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Thu, 10 Sept 2020

India is the second country in the world after the US to have developed the Hypersonic Technology

Bhubaneswar: In a giant leap in indigenous defence technologies and a significant milestone towards Sashakt Bharat and Atmanirbhar Bharat, India successfully flight-tested Hypersonic Technology Demonstration Vehicle (HSTDV) from a defence facility off Odisha coast on Monday.

India is the second country in the world after the US to have developed the hypersonic technology. Powered by scramjet engine it can cruise at Mach 6 and have multiple applications, including the launch of long-range cruise missiles and satellites at low cost.



Defence sources said the indigenously developed hypersonic cruise vehicle was launched from the missile complex- IV of Abdul Kalam Island at about 11.03 am using a proven solid rocket motor (Agni-1 booster), which took it to an altitude of 30 km, where the aerodynamic heat shields were separated at hypersonic speed.

“DRDO has successfully demonstrated the hypersonic air-breathing scramjet technology with the flight test of HSTDV. The scramjet engine performed in a textbook manner,” a defence official told The New Indian Express.

As planned, the cruise vehicle got separated from the launch vehicle subsequently opening the air intake. The hypersonic combustion sustained and the cruise vehicle continued on its desired flight path at a velocity of six times the speed of sound which is nearly 2 km/s for more than 20 seconds.

The critical events like fuel injection and auto ignition of scramjet demonstrated technological maturity. The parameters of launch and cruise vehicle, including the scramjet engine was monitored by multiple tracking radars, electro-optical systems and Telemetry Stations.

A ship was deployed in the Bay of Bengal to monitor the performance during the cruise phase of hypersonic vehicle. All the performance parameters have indicated a resounding success of the mission.

"The scramjet engine worked at high dynamic pressure and at very high temperature. With this successful demonstration, many critical technologies such as aerodynamic configuration for Hypersonic manoeuvres, use of scramjet propulsion for ignition and sustained combustion at

hypersonic flow, thermo-structural characterisation of high-temperature materials, separation mechanism at hypersonic velocity," the official added.

Defence Minister Rajnath Singh congratulated the DRDO on this landmark achievement towards realising PM Narendra Modi's vision of Atmanirbhar Bharat. He spoke to the scientists associated with the project and appreciated their efforts on this great achievement.

"The @DRDO_India has today successfully flight tested the Hypersonic Technology Demonstrator Vehicle using the indigenously developed scramjet propulsion system. With this success, all critical technologies are now established to progress to the next phase," Singh tweeted.

DRDO Chairman Dr G Satheesh Reddy congratulated the scientists, researchers and other defence personnel associated with HSTDV mission for their resolute and unwavering efforts towards strengthening the country's defence capabilities.

"It was a historic mission. With this mission, DRDO has demonstrated capabilities for highly complex technology that will serve as the building block for NextGen hypersonic vehicles in partnership with Indian industry," he said.

The six-metre long vehicle with a launch weight of around one tonne features a flattened octagonal cross-section with wings on mid-body and tail fins. The hydrocarbon-fuelled scramjet engine developed by Indian Space Research Organisation (ISRO) is placed at the mid-body while the portion towards the tail serves as exhaust nozzle. Its first test was conducted on June 12, last year.

<http://www.indiandefensenews.in/2020/09/india-is-second-country-in-world-after.html>

Defence News

Defence Strategic: National/International

THE TIMES OF INDIA

Thu, 10 Sept 2020

CDS favours reform of defence PSUs says some vintage military platforms can be exported

New Delhi: Chief of Defence Staff Gen Bipin Rawat on Wednesday called for revamping India's defence public sector undertakings and ordnance factories with a focus on improving their work culture and enhancing quality control.

Gen Rawat also said that some of India's vintage military platforms, with retrofits, can be exported to countries that lack the desired firepower to defend themselves.

Addressing a seminar on defence exports, the Chief of Defence Staff also pitched for having a "hard look" at the distribution of India's defence expenditure, saying a realistic analysis of the spending must be carried out for proper utilisation of resources.

Gen Rawat said India must move out of constant "threat of sanctions" or dependence on individual nations for its military requirements, in an apparent reference to difficulties involved in the procurement of equipment from countries facing sanctions.



In October 2018, India had signed a USD five-billion deal with Russia to buy five units of the S-400 air defence missile systems, notwithstanding a warning from the Trump administration that going ahead with the contract may invite US sanctions.

The US had imposed sanctions on Russia under the stringent Countering America's Adversaries Through Sanctions Act (CAATSA). The law also provides for punitive action against countries purchasing defence hardware from Russia.

Gen Rawat said the stage is set for the domestic industry to embark on a trajectory of exponential growth, riding on path-breaking reforms rolled out by the government to promote indigenous production of military assets.

"We need to revamp our ordnance factories and other defence public sector undertakings in terms of modernisation, their work culture and quality control.

"Corporatisation including the public listing of some units would be a way forward to ensure a more efficient interface with the designer end-user," he said at the seminar organised by industry chamber FICCI.

India's DPSUs include aerospace major Hindustan Aeronautics Limited (HAL), Bharat Electronics Ltd (BEL), Bharat Dynamics Ltd (BDL), Mazagon Dock Shipbuilders Limited (MDL), Garden Reach Shipbuilders and Engineers Ltd (GRSE), Goa Shipyard Limited (GSL), Bharat Earth Movers Ltd (BEML) and Mishra Dhatu Nigam Ltd (MIDHANI).

The HAL, which produces a range of aircraft and helicopters, is the largest DPSU. Most of the DPSUs have been awarded the prestigious status of 'Navratna' or Mini Ratna because of their consistently high level of performance.

He said the armed forces are committed to win India's wars with indigenous solutions.

Gen Rawat said some of India's vintage military platforms can be exported.

"Our current military fleet comprises of a fair share of vintage platforms which are under modernisation plans in the coming decades. These vintage platforms, with some retrofits or perhaps as it is, could be exported to countries which lack desired firepower to defend themselves," he said.

"We may also consider sharing vintage platforms with domestic industry to assist them in developing cutting edge technology," he said at the seminar.

The Chief of Defence Staff urged the private industry to invest in building long-term capabilities for the application of decisive military power.

In the last three years, he said, India witnessed a staggering 700 per cent growth in defence exports from Rs 1500 crore in 2016-17 to Rs 10,745 crore in 2018-19.

"India is the third-largest defence spender in the world. It is time to have a hard look at the distribution of our defence expenditure. We must carry out a realistic analysis of our expenditures," he added.

"The statement of being third largest spender must give us the capabilities we desire to achieve which is not the case at present," he said.

In the last few months, the government has unveiled a series of reform measures and initiatives to make India a hub of defence manufacturing.

Last month, Defence Minister Rajnath Singh announced that India will stop the import of 101 weapons and military platforms like transport aircraft, light combat helicopters, conventional submarines, cruise missiles and sonar systems by 2024.

In May, the government announced increasing the FDI limit from 49 per cent to 74 per cent under the automatic route in the defence sector.

India is one of the largest importers of arms globally. According to estimates, the Indian armed forces are projected to spend around USD 130 billion in capital procurement in the next five years.

The government now wants to reduce dependence on imported military platforms and has decided to support the domestic defence manufacturing.

The defence ministry has set a goal of a turnover of USD 25 billion (Rs 1.75 lakh crore) in defence manufacturing in the next five years that include an export target of USD 5 billion (Rs 35,000 crore) worth of military hardware.

<https://timesofindia.indiatimes.com/india/cds-favours-reform-of-defence-psus-says-some-vintage-military-platforms-can-be-exported/articleshow/78019419.cms>

TIMESNOWNEWS.COM

Thu, 10 Sept 2020

India's defence exports increase by 700% in two years, ranks 19th among world's defence exporters

Key Highlights

- ***The Defence Production and Export Promotion Policy 2020 aims to achieve exports of Rs 35,000 crores in aerospace and defence goods and services by 2025***
- ***Defence Minister Rajnath Singh had in August announced the imposition of a phase-wise ban on the import of 101 military weapons systems and platforms in order to promote the domestic defence industry***

New Delhi: The central government under Prime Minister Narendra Modi has had the long-standing ambition of making India one of the leading exporter of defence equipment and as per latest information, the Centre has indeed lived up to its promise on that front.

Chief of Defence Staff General Bipin Rawat on Wednesday said that India is currently ranked 19th in the list of top defence exporters in the world, as of 2019 data.

“We witnessed a staggering 700% growth in defence exports from Rs 1521 crores in 2016-17 to Rs 10,745 crores in 2018-19...an all-time high ranking of 19th in the list of defence exporters in 2019,” CDS Rawat said during an e-symposium on 'Catalysing Defence Exports' via video conferencing.

In order to boost PM Modi's clarion call for 'Atmanirbhar Bharat', the Union Ministry of Defence in August formulated a draft Defence Production and Export Promotion Policy 2020 as an overarching guiding document to provide a focused, structured and significant thrust to defence production capabilities of the country for self-reliance and exports.

“The policy aims to achieve a turnover of Rs 1,75,000 crores, including export of Rs 35,000 crores, in aerospace and defence goods and services by 2025,” the Defence Ministry said in a statement on August 3.

Defence Minister Rajnath Singh had in August announced a major policy decision about the imposition of a phase-wise ban on the import of 101 military weapons systems and platforms in order to promote the domestic defence industry.

“We cannot depend on foreign governments, foreign suppliers and foreign defence products to meet our defence needs. It is not compatible with the objectives and feelings of a strong and 'Atmanirbhar Bharat',” he had said back then.

<https://www.timesnownews.com/india/article/india-s-defence-exports-increase-by-700-in-two-years-ranks-19th-among-world-s-defence-exporters/650027>

India's light utility helicopter completes hot and high altitude trials in Himalayas

Synopsis

The LUH took off from Leh and demonstrated its hot and high hover performance at Daulat Beg Oldie (DBO) Advanced Landing Ground (ALG) at 5000 MAMSL, an HAL statement said on Wednesday. The helicopter also demonstrated its payload capability in Siachen glacier high altitude. During the trials, pilots landed the helicopter at the highest helipads of Amar and Sonam, it said.

Bengaluru: HAL's indigenously developed Light Utility Helicopter (LUH) demonstrated high altitude capability in hot and high weather conditions in the Himalayas for about 10 days. A comprehensive test plan was executed at Leh (3300 metres above mean sea level) in temperatures up to ISA (international standard atmosphere)+320C which included envelope expansion, performance and flying qualities, Bengaluru headquartered HAL (Hindustan Aeronautics Limited) said.

The LUH took off from Leh and demonstrated its hot and high hover performance at Daulat Beg Oldie (DBO) Advanced Landing Ground (ALG) at 5000 MAMSL, an HAL statement said on Wednesday.

The helicopter also demonstrated its payload capability in Siachen glacier high altitude. During the trials, pilots landed the helicopter at the highest helipads of Amar and Sonam, it said.

"HAL has once again proved its indigenous capability in design & development", the statement said.

The Army version of LUH is now ready for Initial Operational Clearance, said HAL CMD, R Madhavan.

According to Director (Engineering and R&D), HAL, Arup Chatterjee, the performance of the helicopter and its systems is satisfactory fulfilling the requirements of the users.

All planned tests were successfully demonstrated.

The flights were carried out recently by composite trial team which included pilots from HAL, Wg Cdr (Retd) Unni Pillai, CTP (RW), Wg Cdr (Retd) Anil Bhambani, Gp Capt (Retd) Pupinder Singh and Gp Capt V Panwar along with Gp Capt R Dubey, Sq Ldr Joshi from Indian Air Force and Lt Col R Grewal & Lt Col Pawan from the Indian Army.

Representatives from certification authority witnessed the trials, it was stated.

The Initial Operational Clearance for basic LUH was accorded by CEMILAC (Centre for Military Airworthiness and Certification) for IAF variant on February seven, 2020, HAL said.

<https://economictimes.indiatimes.com/news/defence/indias-light-utility-helicopter-completes-hot-and-high-altitude-trials-in-himalayas/articleshow/78014916.cms>



HAL's indigenously developed Light Utility Helicopter has completed hot & high altitude trial in the Himalayas

French defence minister Florence Parly to visit India for Rafale induction

Parly will make an official visit to India on September 10 to attend the ceremony marking the induction of the first batch of Rafale combat jets into the IAF and to take forward cooperation in key areas such as the Indo-Pacific and joint exercises

New Delhi: French defence minister Florence Parly will make an official visit to India on September 10 to attend the ceremony marking the induction of the first batch of Rafale combat jets into the Indian Air Force (IAF) and to take forward cooperation in key areas such as the Indo-Pacific and joint exercises.

This will be Parly's third official visit to India since 2017, and one of her first trips abroad since the outbreak of the Covid-19 pandemic.

Parly's visit is aimed at strengthening France's "forward-looking defence cooperation with India, its foremost Asian strategic partner", according to a statement issued by the French embassy on Wednesday.

She will meet her Indian counterpart Rajnath Singh and National Security Adviser Ajit Doval.

"Their broad-ranging talks will cover, among others, industrial and technological partnership in line with the Make in India programme, operational defence cooperation, particularly maritime security in the Indo-Pacific, modalities of continuing the armed forces' joint exercises in the context of the Covid-19 pandemic, counter-terrorism cooperation, as well as major regional and international strategic issues," the statement said.

These talks will also take forward the decision by President Emmanuel Macron and Prime Minister Narendra Modi to deepen and expand the bilateral partnership, with strategic autonomy and defence of a multi-polar order as its cornerstones, it said.

In a video message posted on Twitter, French ambassador Emmanuel Lenain described the visit as one of the "next steps" in the bilateral relationship.

During her visit to air force station Ambala for the ceremony to induct the Rafale jets, Parly will be received by defence minister Singh and the IAF Chief, Air Chief Marshall RKS Bhadauria.

The French minister's delegation will include top executives from Dassault Aviation, Thales Group, Safran and MBDA, representing the French defence majors that have partnered with Indian companies as part of the Rafale agreement.

Parly will also pay a floral tribute to India's soldiers at the National War Memorial in Delhi.

France has emerged as one of India's closest partners in the fields of defence and security. Besides backing efforts at world bodies such as the UN and the Financial Action Task Force to crack down on terrorism emanating from Pakistan, France recently provided India 120 ventilators and 50,000 test kits to counter the Covid-19 pandemic. It has also announced it will provide financial aid of up to 200 million euros to support vulnerable sections of society affected by the pandemic.

<https://www.hindustantimes.com/india-news/french-defence-minister-florence-parly-to-visit-india-for-rafale-induction/story-CPKMIA2T5VgIp80Q67CtUM.html>



Rajnath Singh (and Florence Parly at the ceremony marking the delivery of the first of 36 Rafale fighter jets for India, on October 8, 2019 at Dassault Aviation plant in Merignac. (AFP)

5 things you need to know about the induction of Rafale jets into IAF at Ambala

Five of the 36 Rafales ordered by the IAF arrived at the Ambala airbase on July 29

New Delhi: The Indian Air Force is all set to formally induct its latest Rafale fighter jets at the Ambala airbase on Thursday in the presence of defence minister Rajnath Singh, officials said Wednesday. French defence minister Florence Parly and Air Chief Marshal RKS Bhaduria will attend the ceremony, they added. The two ministers are likely to hold a meeting on the sidelines of the event, the officials said.

Here are five things you should know about India's latest warplanes

1. Five of the 36 Rafales ordered by the IAF arrived at the Ambala airbase on July 29. India had ordered the jets from France in a government-to-government deal worth Rs 59,000 crore in September 2016. While the air chief and other IAF officials welcomed the Rafales and the pilots on arrival, a formal induction ceremony is being held on September 10. These Rafale jets are part of the IAF's No. 17 Squadron, also known as the 'Golden Arrows'.
2. The next batch comprising three or four Rafale jets is expected to reach Ambala from France in October, followed by a third batch in December, the officials said. All deliveries will be completed by the end of 2021.
3. India's new Rafale fighters will significantly enhance the offensive capabilities of the air force with their advanced weaponry, high-tech sensors, superior radar for detection and tracking of targets and ability to carry an impressive payload, experts said.
4. The Rafale weaponry includes Meteor, beyond visual range air-to-air missiles, Mica, multi-mission air-to-air missiles, and Scalp, deep-strike cruise missiles—weapons that allow fighter pilots to attack air and ground targets from standoff ranges and fill a significant capability gap.
5. Officials said the IAF could deploy its new Rafale fighters in the Ladakh sector as part of India's overarching plan to strengthen its military posture in the region, where Indian and Chinese forces are locked in a tense border confrontation and military friction has grown in recent weeks.



A Rafale combat aircraft at the Air Force Station in Ambala.(PTI)

<https://www.hindustantimes.com/india-news/5-things-you-need-to-know-about-the-induction-of-rafale-jets-into-iaf-at-ambala/story-Uq9rWS5loRtO9nH4bPWY6I.html>

भारतीय वायुसेना में आज शामिल होंगे राफेल विमान, रक्षा मंत्री राजनाथ सिंह और फ्रांस की रक्षा मंत्री रहेंगी मौजूद

भारत ने फ्रांस से 36 राफेल लड़ाकू विमानों का सौदा किया था। इनमें से पहली खेप में पांच विमान

29 जुलाई को अंबाला एयरबेस पर पहुंच गए हैं। अगले पांच विमान अक्टूबर में भारत पहुंच जाएंगे।

अंबाला: भारतीय वायु सेना आज अंबाला वायुसैनिक अड्डे में विधिवत रूप से राफेल विमानों को अपने बेड़े में शामिल करेगी। ये विमान वायु सेना के 17 वें स्क्वाड्रन, "गोल्डन एरो" का हिस्सा होंगे। पांच राफेल विमानों का पहला जत्था 27 जुलाई को फ्रांस से अंबाला के वायुसैनिक अड्डे पर पहुंचा था। रक्षा मंत्री राजनाथ सिंह और फ्रांस की रक्षा मंत्री फ्लोरेंस पार्ली इस अवसर पर आयोजित कार्यक्रम में मुख्य अतिथि होंगे।

जनरल बिपिन रावत, वायु सेना प्रमुख सहित ये मेहमान कार्यक्रम में होंगे शामिल

प्रमुख रक्षा अध्यक्ष जनरल बिपिन रावत, वायु सेना प्रमुख एयर चीफ मार्शल आर के एस भदौरिया, रक्षा सचिव डॉ। अजय कुमार, रक्षा विभाग के सचिव और डीआरडीओ के अध्यक्ष डॉ। जी सतीश रेड्डी के साथ रक्षा मंत्रालय और सशस्त्र बलों के कई वरिष्ठ अधिकारी भारतीय वायुसेना के इतिहास में दर्ज होने वाली इस बड़ी घटना के अवसर पर उपस्थित रहेंगे।



राफेल (फाइल फोटो)

इस अवसर पर फ्रांसीसी प्रतिनिधिमंडल का प्रतिनिधित्व भारत में फ्रांस के राजदूत इमैनुएल लेनिन, वायु सेना प्रमुख एरिक ऑटेलेट, फ्रांसीसी वायु सेना के उप प्रमुख और अन्य वरिष्ठ अधिकारियों द्वारा किया जाएगा।

फ्रांस की रक्षामंत्री फ्लोरेंस पार्ली को दी जाएगी सलामी

दसाल्ट एविएशन के अध्यक्ष और मुख्य कार्यकारी अधिकारी एरिक ट्रेपीयर और एमबीडीए के मुख्य कार्यकारी अधिकारी एरिक बेरांगर समेत फ्रांसीसी रक्षा उद्योग के कई अधिकारियों का एक बड़ा प्रतिनिधिमंडल भी इस आयोजन के अवसर पर मौजूद रहेगा। फ्रांस की रक्षामंत्री फ्लोरेंस पार्ली को दिल्ली आगमन पर सम्मान स्वरूप सलामी दी जाएगी।

राफेल विमान हवा में दिखाएंगे दम, विमानों को दी जाएगी वाटर कैनन की सलामी

अंबाला नौसैनिक अड्डे में राफेल विमान का औपचारिक अनावरण पारंपरिक रूप से आयोजित सर्व धर्म पूजा के साथ किया जाएगा। इस मौके पर राफेल विमान हवाई करतब दिखाएंगे जिसमें तेजस विमान के साथ सारंग एयरोबेटिक टीम भी शामिल होगी। इसके बाद में, राफेल विमान को पारंपरिक तरीके से वाटर कैनन की सलामी दी जाएगी। समारोह का समापन वायुसेना के 17वें स्क्वाड्रन में राफेल विमान को विधिवत शामिल किए जाने के साथ होगा। आयोजन के बाद भारतीय और फ्रांसीसी प्रतिनिधिमंडल की द्विपक्षीय बैठक होगी।

2021 तक भारत को मिल जाएंगे सभी 36 राफेल विमान

भारत और फ्रांस के बीच 36 लड़ाकू विमानों की खरीद के लिये 59,000 करोड़ रुपये की लागत से हुए समझौते के करीब चार साल बाद 29 जुलाई को पांच राफेल लड़ाकू विमानों का पहला जत्था भारत पहुंचा था। फ्रांसीसी विमानन कंपनी दसाल्ट एविएशन द्वारा उत्पादित इन विमानों को अभी औपचारिक रूप से वायुसेना में शामिल नहीं किया गया है। अब तक भारत को 10 राफेल विमानों की आपूर्ति की जा चुकी है जिनमें से पांच अभी फ्रांस में ही हैं जिन पर भारतीय

वायुसेना के पायलट प्रशिक्षण ले रहे हैं। सभी 36 लड़ाकू विमानों की आपूर्ति 2021 के अंत तक पूरी हो जाने की उम्मीद है।

अत्याधुनिक हथियारों और उन्नत प्रणाली से लैस हैं राफेल विमान

चार राफेल लड़ाकू विमानों के एक अन्य जत्थे के नवंबर तक भारत पहुंच जाने की उम्मीद है। सूत्रों ने कहा कि भारत द्वारा फ्रांस से 36 और लड़ाकू विमानों की संभावित खरीद पर सिंह और पार्ली की बातचीत के दौरान शुरुआती चर्चा हो सकती है। रूस से सुखोई विमानों की खरीद के बाद अपनी सटीक मारक क्षमता और वायु श्रेष्ठता के लिये चर्चित राफेल विमानों की करीब 23 साल बाद खरीद हुई है। राफेल विमान अत्याधुनिक हथियारों और उन्नत प्रणाली से लैस हैं।

<https://www.abplive.com/news/india/rafale-aircraft-to-join-indian-air-force-today-defense-minister-rajnath-singh-and-french-defense-minister-will-be-present-1557704>

NavalTechnology

Thu, 10 Sept 2020

India vs China: A comparison of the Indian and Chinese (PLA) Navies

By Hemanth Kumar

The border dispute between India and China along the Line of Actual Control (LAC) in June 2020 has raised concerns of a possible military confrontation between two of the world's major economies. Here we compare to the countries' naval forces.

Naval Technology compares Indian Navy with the People's Liberation Army Navy (PLA Navy), amid ongoing tensions between the two powers.

Personnel: PLAN outnumbers the Indian Navy

India has more than 67,000 active personnel in the navy, including approximately 10,000 officers and 57,240 sailors, as of June 2019.

The People's Liberation Army Navy has more than 235,000 personnel in active service, including up to 20,000 marines.

Submarines: PLA Navy fleet bigger and more advanced

China's submarine fleet consists of more than 70 submarines, including seven nuclear ballistic missile submarines (SSBN), 12 nuclear attack submarines (SSN), and more than 50 diesel attack submarines.

The fleet size is more than three times the size of the Indian Navy which operates less than 20 submarines.

SSBNs will give PLA Navy the edge

Although both India and China observe 'no first-use' nuclear policy, larger fleet size will give China an advantage in sea-based nuclear domain.

The majority (six) of the SSBNs in active service with the Chinese Navy are Jin-class (Type 094/094A) second-generation nuclear-powered submarines, which are designed to carry up to 12 JL-2 submarine-launched ballistic missiles (SLBMs).

The Indian Navy, on the other hand, has just one nuclear-powered ballistic missile submarine, INS Arihant, in active service.



The Indian Navy's Eastern Fleet during an operational deployment to South China and North West Pacific. Image courtesy of Indian Navy.



China's Jin-class nuclear-powered submarines can fire JL-2 SLBMs that can hit targets 7,200km away.

China's JL-2 missile has a longer range compared to India's K-15 missile giving the former an advantage. Targeting INS Arihant accurately will be difficult given the invulnerability of sea-based nuclear deterrent capability, though.

China has the Type 91 Han-class and the Type 093 Shang-class SSNs in active service, whereas India has just one SSN, INS Chakra (S71) – an 8,140t Akula-class submarine that can accommodate up to 12 Granit submarine-launched cruise missiles.

Conventional submarines: India needs to deploy advanced technologies

India will have to reckon with the PLAN's conventional submarines including Ming diesel attack submarines, as well as Kilo and Song submarine classes.

Yuan, the PLA Navy's most modern conventional submarine, is equipped with air-independent propulsion (AIP) system and quieting technology. The AIP system provides increased underwater endurance, range, and stealth capabilities to Yuan.

Further, the fuel cell technology used in the Yuan submarine reduces noise levels due to fewer moving mechanical components, allowing China to position the submarines within torpedo firing range with minimum risk of being detected.

The Indian Navy operates conventional submarines including two advanced INS Kalvari-class boats, based on the French Scorpène design. Although the INS Kalvari-class provides long range and low acoustic, electromagnetic and infrared (IR) signatures, the absence of AIP system could prove to be a major disadvantage.

Aircraft carriers: PLAN can deploy more sea-based aircraft

China has two aircraft carriers, CNS Liaoning and CNS Shandong, as opposed to India's only aircraft carrier, INS Vikramaditya.

Inducted into the People's Liberation Army Navy in 2012, Liaoning has a range of 7,130km, operates at a speed of 53.7kmph, and can carry up to 24 J-15 fighter aircraft, six Z-8 helicopters, and four Kamov Ka-31 helicopters. CNS Shandong can operate at least 36 J-15s. Both the aircraft carriers have a displacement of 50,000t.

Commissioned in 2013, INS Vikramaditya is a modified Kiev-class aircraft carrier with a range exceeding 7,000nm. The 44,500t short take-off, but assisted recovery (STOBAR) aircraft carrier can carry more than 30 aircraft, including MiG 29K / Sea Harrier, Sea King, Kamov 31, and Kamov 28 helicopters, as well as HAL-built Chetak helicopters.

Liaoning has a longer deck than INS Vikramaditya and weighs up to 17,000t more. Greater deck size means the Chinese aircraft carrier can carry more munitions. More aircraft carriers mean China will be able to more rapidly deploy aircraft in areas without airbases.

Both the navies do not possess catapult launch capabilities and rely on STOBAR technology.

Destroyers, frigates and corvettes: PLAN has the larger fleet

China has a significantly larger fleet of destroyers compared to India.

China's Renhai-class advanced guided-missile destroyer has a range of 5,000nm and can escort carrier strike groups in blue water operations. It is armed with YJ-18A anti-ship cruise missiles (ASCMs), Yu-8 anti-submarine rockets, and YJ-100 long-range ASCMs, in addition to HQ-10 and HHQ-9B surface-to-air-missiles.

The Renhai's 128 vertical launch system (VLS) silos are a significant improvement over the Luyang III class' (Type 052D) 64 vertical launch cells.

In comparison, the Indian Navy's INS Kolkata-class of destroyers can carry fewer missiles (32 Barak-8 missiles in vertical launch cells and 16 BrahMos anti-ship missiles).

The INS Kolkata-class can fire all the 16 BrahMos missiles simultaneously. BrahMos, the world's fastest supersonic cruise missile, however, has a shorter range of 290km compared to the 537km range of the YJ-18 supersonic ASCM used by the Chinese Navy's Luyang III-class (Type 052D) destroyers.

The Indian Navy is set to strengthen its INS Delhi, INS Kolkata, and Rajput-class guided-missile destroyers with the future Visakhapatnam-class (Project 15B) destroyers that are expected to enter service starting 2021.

Frigates and Corvettes

The Chinese Navy operates a range of frigates including Jiangkai-II class (Type 054A), Jiangkai I-class, Jianghu-class, and Jiangwei II-class.

The Jiangkai-II class (Type 054A) can support anti-air, anti-surface, and anti-submarine warfare operations. They can launch the HQ-16 medium-range SAMs up to a range of 50km and the YJ-83 (C-803) sea-skimming anti-ship missile that can hit targets 250km away.

The Indian Navy also has a strong fleet of frigates. Considered the first stealth warships built domestically, the INS Shivalik-class frigates have several radars that perform functions such as air search, weapon control, and fire control. The frigates have structural, thermal, and acoustic stealth features, which reduce the vulnerability of detection and maintain low noise levels.

The land-attacking capability of the INS Shivalik-class is primarily due to its ability to launch BrahMos supersonic and Klub anti-ship cruise missiles.

Other frigate classes of the Indian Navy are Talwar, Brahmaputra, and Godavari, while advanced Talwar-class frigates are being imported from Russia under Project 11356 in order to significantly upgrade operational capabilities against air targets, surface ships, and submarines.

The Talwar-class frigate's single-arm launcher can launch just one missile at a time, whereas the PLA Navy's Type-054A frigate is equipped with a vertical launch system (VLS) that allows for firing multiple missiles simultaneously.

The People's Liberation Army Navy has more corvettes than the Indian Navy and the pace of procurement of the Type 056 ships demonstrates China's intent to further enhance its coastal protection capabilities.

The Chinese military is procuring and commissioning several corvettes of the Jiangdao-class (Type 056A), more than 50 of which have been planned to be inducted since 2013. The Type 056 corvettes are intended to protect China's interests in South China and East China Seas.

Corvettes in the Indian Navy's fleet include Kamorta-class (anti-submarine warfare), Abhay-class, Veer-class, and Kora-class.

India received its fourth Kamorta-class corvette in February 2020 to counter the threat of enemy submarines with torpedoes and rocket launchers.

Naval aviation: India lacks enough fighter aircraft

The aviation branch of the Chinese Navy operates the J-10A Vigorous Dragon and J-11B Flanker fighter aircraft, both of which are armed with PL-8 and PL-12 air-to-air missiles and can perform extended fighter patrols.

Major aircraft and helicopters of the Indian Navy are Dornier 228, Hawk MK 132, Boeing P-8I multi-mission maritime patrol aircraft, Kamov-28, Kamov-31, Sea King 42 (B/C), UH 3H, MiG 29-K fighter jet, UAV Heron, and UAV Searcher.

The PLA Navy's H-6 Badger bomber, known for its maritime strike capabilities, is a long-range strike aircraft that can carry four ASCMs.

The JH-7 Flounder tandem-seat fighter-bomber, with improvements to radar and weapons-carrying capacity, offers increased potency in maritime strike missions. It can carry up to four ASCMs and two PL-5 or PL-8 short-range air-to-air missiles.

Whereas, India's carrier-based fighter MiG-29K is facing maintenance issues and operational deficiencies. Indian Navy plans to acquire 57 more fighters to strengthen its fleet.

Maritime patrol platforms

The Boeing P-8I aircraft, which is one of the most advanced maritime patrol aircraft in the world, allows the Indian navy to track China's movements in the Indian Ocean, while also supporting anti-submarine warfare and anti-surface warfare missions.

China uses Y-8 and Y-9 maritime patrol and anti-submarine warfare aircraft equipped with airborne early warning and electronic warfare mission capabilities.

India lacks enough naval multi-role helicopters and signed a deal to purchase 24 MH-60 Romeo helicopters from Lockheed Martin in February 2020 to replace the ageing Sea Kings. To be equipped with multi-mode radar, precision-kill rockets, and Hellfire missiles, the Romeo helicopters will play a key role in surveillance missions.

China has gained a head start in this capability by completing the demo flight of a newly developed Z-20 helicopter, which is comparable with Sikorsky UH-60 Black Hawk, in 2019.

Indian Ocean: China building bases to counter India

India is expected to leverage its dominant position in the Indian Ocean to counter the threat of aggressive manoeuvres from China.

The Andaman and Nicobar Command, a tri-service command of the Indian Armed Forces, mans a strategically important zone. Indian Navy's strong presence in the Andaman Sea makes China vulnerable in the region since the majority of Chinese imports have to pass through the Malacca Strait, a narrow passage between Malaysia and Indonesia.

China has been embracing multiple strategies including building bases in Djibouti and ports in Pakistan, Sri Lanka, and Myanmar in order to counter India's strength in the Indian Ocean.

https://www.naval-technology.com/features/india-vs-china-indian-and-chinese-pla-navies-compared/?utm_source=Army%20Technology&utm_medium=website&utm_campaign=Must%20Read&utm_content=Image



Thu, 10 Sept 2020

India bulks up amid provocation by China's People's Liberation Army

The Chinese PLA has deployed 5,000 to 6,000 soldiers in the area, and the armed forces are fully prepared to deal with any contingency, they added

By Rahul Singh

New Delhi: The Indian Army has rushed its front-line tanks and infantry combat vehicles (ICVs) to strategic heights held by its soldiers on the southern bank of Pangong Tso in eastern Ladakh, in response to intimidating military moves by the Chinese People's Liberation Army (PLA) in the theatre, where conflict is below the threshold of a shooting war but could take any trajectory, top government officials told HT on Wednesday.

The PLA is parading its tank squadrons, mechanised infantry squads, and thousands of soldiers in the area in a show of strength to threaten the Indian Army after it swiftly occupied key heights to prevent the PLA from grabbing Indian territory on August 29, the officials said, requesting anonymity.

The Chinese PLA has deployed 5,000 to 6,000 soldiers in the area, and the armed forces are fully prepared to deal with any contingency, they added.

"The PLA lines up 20-30 tanks, ICVs and thousands of soldiers almost on a daily basis in the Spanggur area. It's nothing but posturing and we would be concerned if the military elements were not visible and hidden in the undulating folds of the land," a top official said.

China has deployed sizeable military assets in the eastern Ladakh theatre, including 50,000 troops, 150 aircraft, tanks, heavy artillery, missiles and air defence systems, with India matching the neighbour's every move.

The Indian Army has also taken control of key heights overlooking the PLA's deployments on the Finger 4 ridgeline on the northern bank of Pangong Tso, the officials said. "Indian soldiers are barely a few hundred metres from Chinese troops on Finger 4," they said.

"If the military capabilities were to be measured, the combat ratio is 1:1. If China brings in more reinforcements, so will we. The Galwan Valley skirmish showed them that they have to pay a price for their actions. If China wants to start a war, there will be a price to pay on both sides," the officials said.

"A shooting war doesn't erupt overnight. A lot of actions happen before that — war of words, firing, skirmishes, smaller conflicts and other pinpricks. We haven't reached that stage yet. While we don't think China wants to start a war, nowhere are we underprepared," the officials said.

The movements come at a time when Indian foreign minister S Jaishankar is due to meet his Chinese counterpart Wang Yi on the sidelines of the Shanghai Cooperation Organisation (SCO) meeting in Moscow on Thursday to seek a diplomatic resolution for the impasse.

The Indian Army on Tuesday said Chinese troops fired into the air on September 7 to intimidate its soldiers holding dominating heights near a strategic mountain pass in eastern Ladakh during a failed attempt to close in on a forward position controlled by India, with bullets flying at the contested Line of Actual Control (LAC) for the first time in 45 years. The last recorded incident when bullets were fired at the LAC was in October 1975, when the PLA ambushed an Indian patrol in Arunachal Pradesh's Tulung La sector and shot four soldiers dead.

Twenty Indian soldiers and an undisclosed number of PLA troops were killed on June 15 in a seven-hour conflict in Galwan Valley, but no shots were fired in that deadly skirmish.

Experts said the situation along the LAC was volatile and things could go bad.

"The key to how things will go forward from here is whether there is a breakthrough in the talks. While both sides don't want a shooting war, local dynamics on the ground sometimes have a life of their own. That is the real danger when thousands of soldiers are facing off," said former Northern Army commander Lieutenant General DS Hooda (retd).

The Indian Army controls ridgeline positions on the southern bank of Pangong Tso that allow it to completely dominate the sector and keep an eye on Chinese military activity, with the most significant heights being held by India on Rezang La and Requin pass where the PLA is making desperate attempts to regain lost ground.

The army has marked the perimeter of the positions held by it with barbed wire and it would not hesitate to retaliate if the PLA attempts to cross that red line, the officials said. "During talks, the PLA stresses there should be no night movement and mountain manoeuvres but does exactly the opposite on the ground. What is happening in the Ladakh theatre is being controlled by their top leadership and cannot be attributed to the exuberance of local commanders," the officials cited in the first instance said.

In the northern bank of Pangang Tso, before the PLA grabbed positions on Finger 4, the army would patrol right up to Finger 8 that New Delhi considers within Indian territory. The new positions held by the PLA have curtailed the scope of Indian patrols. Fingers 4 and 8 are eight km apart. The Indian claim line in this sector extends to Finger 8, while the Chinese claim is up to Finger 4.

Top Indian and Chinese commanders are likely to hold a meeting soon to reduce military tensions in eastern Ladakh. Both sides are currently working on finalizing the date for the meeting between corps commander-ranked officers who have met several times but failed to break the deadlock.

"We want talks at the military and diplomatic talks to succeed. The sense we got from the recent meeting between the Indian and Chinese defence ministers in Moscow was that the Chinese don't want a war...But why are Chinese opening so many fronts, we don't understand," the officials said.

The latest tensions in eastern Ladakh come days after defence minister Rajnath Singh asked China -- in a face-to-face meeting with his Chinese counterpart Wei Fenghe in Moscow -- to

strictly respect the LAC, not make attempts to unilaterally change the status quo, and work with India for complete disengagement from all friction areas in the sensitive sector.

<https://www.hindustantimes.com/india-news/india-bulks-up-amid-provocation-by-pla/story-cluI9efmjTIErTkUlpNrK.html>

Business Standard

Thu, 10 Sept 2020

Indian Army instructs field commanders to protect territory at any cost

Sources said the Chinese Army has deployed close to 50,000 troops along with heavy tanks and artillery

New Delhi: Engaged in a stand-off with the Chinese Army, the Indian Army has given instructions to field commanders that the Chinese should not be allowed to transgress at any cost and also directed them that troops should maintain utter discipline while protecting Indian territory.

The field commanders have also been told that while patrolling their respective areas of responsibility or accomplishing any task, there should not be any extra display of strength or overuse of force, government sources told ANI.

On the situation along the border, the sources said that the Chinese Army is carrying out firing practice well within territory controlled by them in Tibet but it can be heard on the Indian side at many locations along the Line of Actual Control (LAC) from Ladakh to Arunachal Pradesh.

Sources said that India has strengthened its defences along the positions occupied by the Indian Army near Rezang La and Rechen La heights by putting concertina wires and the Chinese troops have been warned that there would be consequences if they try to breach Indian defence, the sources said.

The Indian side has also taken up the issue of Chinese Army's soldiers carrying stick machetes and spears along with them during the deployment close to the Indian positions during talks at the Brigade Commander level, they added.

Sources said the Chinese Army has deployed close to 50,000 troops along with heavy tanks and artillery.

On the opposite Indian side of Chushul, the Chinese have been lining up their tanks and infantry combat vehicles within their territory near the friction areas as they have brought in a lot of heavy weaponry to the area, they said.

https://www.business-standard.com/article/current-affairs/indian-army-instructs-field-commanders-to-protect-territory-at-any-cost-120090901987_1.html



Sources said that India has strengthened its defences along the positions occupied by the Indian Army near Rezang La and Rechen La heights by putting concertina wires

Thu, 10 Sept 2020

New Space Policy is a momentous step in India's Space Odyssey, says Vivek Kimahune, Executive VP, Saankhya Labs

Space being a capital-intensive, low volume, high-value business, the Indian ecosystem had inadequate access to capital, largely due to limited domestic market opportunities and long gestation cycles

By Huma Siddiqui

Space being a capital-intensive, low volume, high-value business, the Indian ecosystem had inadequate access to capital, largely due to limited domestic market opportunities and long gestation cycles. "With the opening up of the Space sector for private participation, the Indian ecosystem can now leverage on Indian Space Research Organisation's (ISRO) infrastructure and know-how to build globally competitive solutions with lesser investments," says Vivek Kimahune, Executive VP – Sales and Business Development, Saankhya Labs. In his interaction with Huma Siddiqui, he talks about the benefits to private companies, and how it can catapult India as one of the leading space economies in the world.

Following are excerpts:-

How is the private sector going to benefit from the government's recent decision to open up the space sector?

We welcome the decision taken by the Government to open up the space sector for private companies. It is a momentous step in India's Space Odyssey.

The Indian space sector is synonymous with ISRO and opening up the sector will unlock the vast potential of India's space economy. The private sector can now tap into India's market potential to deliver innovative satellite solutions directly to end-users. Given India's market size and capabilities, it will inspire confidence in the investment community to back new entrants with the latest space technologies and disruptive business models.

How is India faring on the space segment and significance of this space policy decision?

India's space program is one of the most comprehensive ones in the world today. With modest beginnings in the 1960s, ISRO has strived hard to propel India to feature amongst the elite league of nations considered as the world's 'Space Superpowers'.

Today, ISRO has world-class capabilities and infrastructure, servicing the strategic, defence and commercial requirements of the nation in key areas such as satellite communication, earth observation and satellite-aided navigation. The proposed collaborative approach with the industry would help India to increase its market share in the global space economy.

Why Change?

The space economy is an important asset of the superpowers in the world today. The technology and business landscape of Satcom is changing at a rapid pace. To harness the enormous potential of



India's Satcom policy must provide a roadmap to AtamanirbharBharat in satellite communication. (Photo source: IE)

space opportunities both domestically and worldwide, the Indian space economy must scale up. Currently, an estimated 2,666 satellites are in orbit. The US is the world leader with over 1300 satellites in orbit, followed by China which has over 350 satellites. In contrast, India ranks sixth in the world with 58 satellites to its credit.

As per a recent market study report by PwC, the Indian space economy is valued at USD 7 billion dollars, which is approximately 2% of the global space economy. All the major space economies have had support from their respective governments. NASA and ESA support and fund new developments extensively and India cannot be an exception if it were to compete with the best in the business. To fulfil its aspirations of global supremacy, India also needs to come up with an active fund to support its domestic ecosystem.

Given the emerging geopolitical situation and security threats to the country, Self-reliance in Satcom is an absolute necessity.

How is Saankhya going to benefit?

The recent space policy announcements are broad-based and the details are still emerging. As of now the policy primarily focuses on enabling the building and launching of satellites and access to remote sensing data by private companies. On similar lines, the government should also release policy framework dealing with ground communication equipment and terminals. This will greatly benefit companies like Saankhya Labs.

The opening up of the space sector will expand the market size and present new opportunities for Saankhya. We have been working with ISRO for over 7 years now and will continue our contribution and are keen to partner with all the satellite service providers who would be interested in indigenous hub-side baseband systems and user-side Satcom terminals.

What are your expectations with regards to Satcom policy?

India's Satcom policy must provide a roadmap to AtamanirbharBharat in satellite communication. The FM in her address had also emphasized that 'Make in India' and self-reliance is an absolute necessity while unveiling India's New Space policy.

Key policy considerations to enable a globally competitive Indian ecosystem and a path to self-reliance: Open & Interoperable Standards policy – To eliminate monopoly and encourage healthy competition.

Preferential Market Access to Designed, Owned and Made in India products.

Import restrictions on foreign equipment if domestic companies have the capability to fulfil the requirements.

Enable an environment for partnership so that more IP's are created, owned, and supplied by Indian owned companies.

Proactively fund import substitution projects to enable Indian companies to compete with the best in business.

Satcom offset policy akin to defence offset requirements will promote Indian ecosystem.

Liberalized Satcom policy on a reciprocal basis, which implies India will extend the same business terms to companies that Indian companies receive in their respective countries/geographies.

What satellite communications solutions Saankhya Labs has developed?

Saankhya Labs offers indigenous ground communication systems all powered by its own award-winning SDR chipsets. And the company's Satcom product portfolio includes Two-way MSS terminals, Hub-side equipment, Simplex and Duplex modems and Satellite to Terrestrial Radio heads for 5G Broadcast.

SAMRAT S-Band Satellite phone

Industry's first S-Band Satphone terminal designed as an add on accessory to Commercial off the shelf Android phone, supporting Voice, Data and Short messaging service. The satellite phone is meant for defence and strategic use.

NAVRAIL Satellite-based Train tracking terminal

Indian Railways first Satellite-based Real-time information System (RTIS) network is powered by Saankhya's two-way MSS Terminals. Over 2600 locomotives are equipped with MSS terminals for real-time tracking & monitoring of trains.

TARANG Multichannel Burst Demodulator

Is the industry's first SDR based multi-channel, multi-standard burst demodulator system deployed as hub-side baseband equipment for operationalizing the Indian Railways RTIS network.

NAVDOOT Satellite-based Vessel Tracking System

Is a Vessel Tracking terminal for Coastal Security. With over 300 shipping vessels equipped with two-way MSS terminals, the government can track, monitor and send weather and potential fishing zone information to fishermen. It enables ship-to-shore and shore-to-ship data communication with SoS functionality for fishermen safety

NAVSETU Satellite IoT Modem

Is a low-power, Satellite IoT modem for two-way satellite communication for mobile, land, maritime, M2M and industrial IoT application. The portable modem is capable to support multiple Satellites in LEO/MEO/GEO constellations operating in L-Band and S-Band. Additionally, it has an in-built GPS for real-time tracking and monitoring of assets.

LEHAR Portable Broadcast Receiver

Is a one-way, USB powered satellite broadcast receiver supporting S-Band multimedia broadcast reception in a handheld form factor.

GYANDOOT Satellite terminal for remote education

Is a Ku/L-Band broadcast receiver designed to operate on the EDUSAT network primarily meant for educational and skill development purposes.

Has Saankhya Labs partnered with any company to deploy the solutions that are developed?

Yes, the company has partnerships with ISRO and Bharat Electronics Ltd(BEL) for Satcom applications. And has supplied Satcom modems and hub-side baseband equipment for Indian Railways'RTIS network. Over 2600 locomotives are already equipped with MSS terminals for real-time tracking of trains. The RTIS network is commissioned and operationalized by BEL in collaboration with Centre for Railway Information Systems (CRIS), ISRO and Saankhya Labs.

Also the company has deployed over 300 vessel tracking terminals on shipping vessels for coastal security. The project was commissioned and operationalized by ISRO.

What about collaboration with ISRO?

Saankhya Labs has been working with ISRO since 2013 and an MoU was signed with SAC, ISRO in 2015 for Mobile Satellite Service (MSS) Technology. Over the years, Saankhya has developed a variety of indigenous Satcom solutions supporting voice, data, location reporting and broadcast services for strategic and defence applications. All our products operate on ISRO's satellites and are co-branded with ISRO.

What are Saankhya's future plans in Satcom?

For strategic and defence applications, we will continue to design, develop and manufacture Satcom solutions with full Intellectual Property Rights (IPR) created and vested in India.

For emerging commercial applications, we are in discussion with multiple national and international satellite service providers to offer globally differentiated Satcom products. And also evaluating the business opportunity for bringing to market a variant of its SDR chipset specifically optimized for Sat-IoT applications. We are also contributing to the NTN initiatives in 3GPP that will drive the next-generation non-terrestrial networks.

With unique chipset-to-systems expertise, Saankhya is well poised to offer market differentiated products and technology proudly Made in India for the world.

<https://www.financialexpress.com/defence/new-space-policy-is-a-momentous-step-in-indias-space-odyssey-says-vivek-kimahune-executive-vp-saankhya-labs/2078620/>

Explained: Zvezda, the Russian firm making suits for India's Gaganyaan astronauts

Established in 1952 as Factory No. 918, Zvezda is a Russian company which primarily designs, develops and produces portable life support systems for aircraft and spacecraft crew

By Amitava Chakraborty

New Delhi: Glavkosmos, a subsidiary of the Roscosmos, the space agency of the Russian federations, announced on September 7 that Zvezda, a research and development enterprise, has started manufacturing space suits for Indian astronauts, who are likely to be part of the Gaganyaan mission. Glavkosmos CEO Dmitry Loskutov said, "On September 3, Indian cosmonauts who have been training for a spaceflight in Russia under the contract of Glavkosmos, visited Zvezda, where their anthropometric parameters were measured for the subsequent production of spacesuits."

What is Zvezda?

Established in 1952 as Factory No. 918, Zvezda is a Russian company which primarily designs, develops and produces portable life support systems for aircraft and spacecraft crew. The systems created by the company are also used in military and civil airplanes in Russia and abroad. Zvezda has also made significant contributions to the development of the International Space Station. Located 26 km southeast of Moscow, in Tomilino, Zvezda is known for having developed most of the Russian spacesuits, including Yuri Gagarin's (the first human to travel to space) in 1961. Gagarin's suit still remains on display at the company's factory in Tomilino. Soviet cosmonaut Alexei Leonov, who became the first human to conduct a spacewalk in 1965, also wore a spacesuit developed by Zvezda. So was the flight jacket worn by Valentina Tereshkova, the first woman to fly in space in June 1963.



Currently, the firm is not only making spacesuits for Indian astronauts who will travel to space as part of the Gaganyaan Mission but also their individual seats and custom-made couch liners.

Other than spacesuits, what else does Zvezda manufacture?

Following its establishment, Factory No. 918, as Zvezda was known then, also designed rocket-powered sledges to send animals to space. In the 1950s, many countries sent animals to space to test the survivability of human spaceflights. Zvezda's work in this field paved the way to send Laika, a Soviet dog and one of the first animals to visit space, on the Sputnik 2 on November 3, 1957, to orbit the earth.

Among other things, space toilets have been designed and developed by the company over the decades. Zvezda is also well known for its ejection seat, which has saved the lives of numerous pilots across the world.

What is Zvezda's role in India's Gaganyaan mission?

Currently, the firm is not only making spacesuits for Indian astronauts who will travel to space as part of the Gaganyaan Mission but also their individual seats and custom-made couch liners.

What is Gaganyaan mission?

India's maiden manned spaceflight, a part of the Gaganyaan mission, is expected to carry three people to space for seven days. The mission was announced in August 2018 and will be completed before the 75th Independence Day in 2022. As part of the mission, there will be three launches — two unmanned followed by a manned one. The launch of the manned spacecraft is likely to take

place in December 2021 or January 2022, after the astronauts complete their training by the first quarter of 2021.

Where are the astronauts being trained?

Four Indian Air Force fighter pilots are undergoing training at the Gagarin Cosmonaut Training Center in Russia. The training programme, which began in February 2020, was put on hold following the outbreak of the novel coronavirus. It was again resumed in May.

What all are they being taught in Russia?

The Indian Space Research Organisation's Human Spaceflight Centre in Bengaluru has signed a contract with Roscosmos in June 2019 for the training of the four pilots. According to a statement issued by Roscosmos in August 2020, the astronaut-elects are attending "courses of the general space training programme and of the systems of the Soyuz MS crewed spacecraft". The statement further added that in June, "the Indian astronauts-elect passed training in short-term weightlessness mode aboard the IL-76MDK special laboratory aircraft, and in July, they were trained to lift aboard a helicopter while evacuating from the descent module landing point."

<https://indianexpress.com/article/explained/india-gaganyaan-mission-russia-zvezda-6589334/>



Thu, 10 Sept 2020

Physicists explain mysterious dark matter deficiency in galaxy pair

A new theory about the nature of dark matter helps explain why a pair of galaxies about 65 million light-years from Earth contains very little of the mysterious matter, according to a study led by a physicist at the University of California, Riverside.

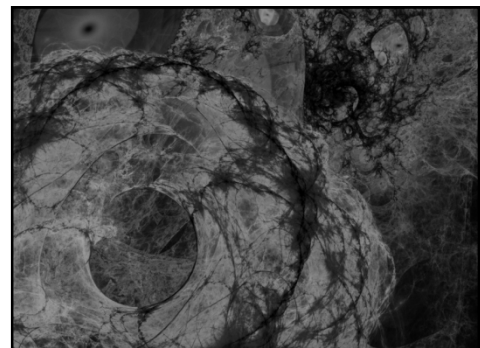
Dark matter is nonluminous and cannot be seen directly. Thought to make up 85% of matter in the universe, its nature is not well understood. Unlike normal matter, it does not absorb, reflect, or emit light, making it difficult to detect.

The prevailing dark matter theory, known as cold dark matter, or CDM, assumes dark matter particles are collisionless, aside from gravity. A newer second theory, called self-interacting dark matter, or SIDM, proposes dark matter particles self-interact through a new dark force.

Both theories explain how the overall structure of the universe emerges, but they predict different dark matter distributions in the inner regions of a galaxy. SIDM suggests dark matter particles strongly collide with one another in a galaxy's inner halo, close to its center.

Typically, a visible galaxy is hosted by an invisible dark matter halo—a concentrated clump of material, shaped like a ball, that surrounds the galaxy and is held together by gravitational forces. Recent observations of two ultra-diffuse galaxies, NGC 1052-DF2 and NGC 1052-DF4, show, however, that this pair of galaxies contains very little, if any, dark matter, challenging physicists' understanding of galaxy formation. Astrophysical observations suggest NGC 1052-DF2 and NGC 1052-DF4 are likely satellite galaxies of NGC1052.

"It is commonly thought that dark matter dominates the overall mass in a galaxy," said Hai-Bo Yu, an associate professor of physics and astronomy at UCR, who led the study. "Observations of NGC 1052-DF2 and -DF4 show, however, that the ratio of their dark matter to their stellar masses is about 1, which is 300 times lower than expected. To resolve the discrepancy, we considered that



Credit: CC0 Public Domain

the DF2 and DF4 halos may be losing the majority of their mass through tidal interactions with the massive NGC 1052 galaxy."

Using sophisticated simulations, the UCR-led team reproduced the properties of NGC 1052-DF2 and NGC 1052-DF4 through tidal stripping—the stripping away of material by galactic tidal forces—by NGC1052. Because the satellite galaxies cannot hold the stripped mass with their own gravitational forces, it effectively gets added to NGC 1052's mass.

The researchers considered both CDM and SIDM scenarios. Their results, published in *Physical Review Letters*, indicate SIDM forms dark-matter-deficient galaxies like NGC 1052-DF2 and -DF4 far more favorably than CDM, as the tidal mass loss of the inner halo is more significant and the stellar distribution is more diffuse in SIDM.

The research paper has been selected as an "editors' suggestion" by the journal, an honor that only a select few papers receive each week to promote reading across fields.

Yu explained tidal mass loss could occur in both CDM and SIDM halos. In CDM, the inner halo structure is "stiff" and resilient to tidal stripping, which makes it difficult for a typical CDM halo to lose sufficient inner mass in the tidal field to accommodate observations of NGC 1052-DF2 and -DF4. In contrast, in SIDM, dark matter self-interactions could push dark matter particles from the inner to the outer regions, making the inner halo "fluffier" and enhancing the tidal mass loss accordingly. Further, the stellar distribution becomes more diffuse.

"A typical CDM halo remains too massive in the inner regions even after tidal evolution," Yu said.

Next, the team will perform a more comprehensive study of the NGC 1052 system and explore newly discovered galaxies with novel properties in an effort to better understand the nature of dark matter.

The title of the research paper is "Self-Interacting Dark Matter and the Origin of Ultradiffuse Galaxies NGC1052-DF2 and -DF4."

More information: Self-Interacting Dark Matter and the Origin of Ultradiffuse Galaxies NGC1052-DF2 and -DF4, *Physical Review Letters* (2020). [journals.aps.org/prl/abstract/ ... ysRevLett.125.111105](https://journals.aps.org/prl/abstract/.../ysRevLett.125.111105)

Journal information: *Physical Review Letters*
<https://phys.org/news/2020-09-physicists-mysterious-dark-deficiency-galaxy.html>

Magnetic whirls crystallize in two dimensions

In a collaboration between experimental physicists and theoretical physicists in the framework of the Dynamics and Topology (TopDyn) excellence project, a system of many small magnetic whirls could be engineered to form a regularly ordered state. Such a transition from a disordered to an ordered phase is analogous to the well-known crystallization, which, however, occurs here in two dimensions. For the research work at Johannes Gutenberg University Mainz (JGU), experimental physicists around Professor Mathias Kläui cooperated with a group of theoretical physicists around Dr. Peter Virnau. The results have been published recently in the journal *Advanced Functional Materials*. The TopDyn research center is funded by the German federal state of Rhineland-Palatinate.

Two-dimensional systems are a topical area of research in theoretical and experimental physics. These systems can attain a number of exotic states and exhibit transitions that do not exist in three dimensions. One such example is the Kosterlitz-Thouless transition, for which the Nobel Prize in Physics was awarded in 2016. Another example is the so-called hexatic phase, which occurs in systems of two-dimensional hard discs in between the disordered liquid and strongly ordered solid phase.

Two-dimensional model system generated from skyrmions

In the work now presented, magnetic whirls, so called skyrmions, were realized in ultra-thin metal multilayer films. The number of skyrmions and their size could be tuned by applied magnetic fields. These are ideal conditions for the experimental realization of dense two-dimensional model systems. In particular, the researchers were able to generate an experimental system that exhibits the signature of an emerging hexatic phase. This demonstrates that the system indeed behaves like a two-dimensional system and can be described by hard discs. Furthermore, the results allowed for the determination of the repulsive interaction between skyrmions, which could be modeled by computer simulations.

"I am very glad that the joint work between the Soft Matter Theory group of Dr. Peter Virnau and our experimental group led to this exciting work. Such new collaborations are exactly the aim of the TopDyn research center," said Professor Mathias Kläui, TopDyn spokesman.

Since the properties of skyrmions can be tuned by external magnetic fields, this is an important first step towards the tailored preparation and analysis of the dynamics of two-dimensional phases and phase transitions. Perspectives of further possibilities of effects to be studied in such systems can be found in a recently published News & Views Article in *Nature Nanotechnology*.

The Dynamics and Topology research center was founded in 2019 as a collaborative center of Johannes Gutenberg University Mainz, TU Kaiserslautern, and the Max Planck Institute for Polymer Research in Mainz. It is funded by the state of Rhineland-Palatinate and pursues a highly interdisciplinary approach.

More information: Jakub Zázvorka et al, Skyrmion Lattice Phases in Thin Film Multilayer, *Advanced Functional Materials* (2020). [DOI: 10.1002/adfm.202004037](https://doi.org/10.1002/adfm.202004037)

Mathias Kläui. Freezing and melting skyrmions in 2D, *Nature Nanotechnology* (2020). [DOI: 10.1038/s41565-020-0726-1](https://doi.org/10.1038/s41565-020-0726-1)

Journal information: *Advanced Functional Materials*, *Nature Nanotechnology*

<https://phys.org/news/2020-09-magnetic-crystallize-dimensions.html>

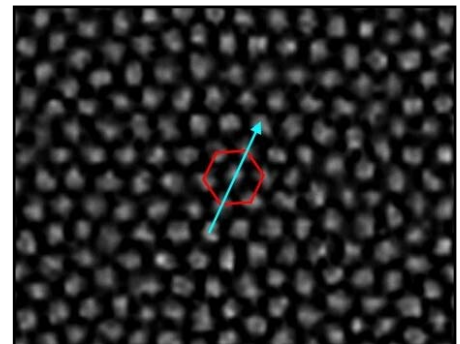


Image of an experimental skyrmion structure: The hexagonal arrangement and orientation are shown as an example. Credit: Jakub Zázvorka, Florian Dittrich

Technique prevents errors in quantum computers

Even quantum computers make mistakes. Their computing ability is extraordinary, exceeding that of classical computers by far. This is because circuits in quantum computers are based on qubits that can represent not only zeroes or ones, but also superpositions of both states by using the principles of quantum mechanics. Despite their great potential, qubits are extremely fragile and prone to errors due to the interactions with the external environment.

To solve this crucial issue, an international research group developed and implemented a new protocol that protects fragile quantum information and corrects errors due to qubit loss. This research group published the results of their study in *Nature*.

"Developing a fully functioning quantum processor still represents a great challenge for scientists across the world," explains Davide Vodola who is one of the authors of the study as well as a researcher at the University of Bologna. "This research allowed us, for the first time, to implement a protocol that can detect and, at the same time, correct errors due to qubit loss. This ability could prove to be essential for the future development of large-scale quantum computers."

We know that quantum processors show a certain tolerance against computational errors. But we know too little about how to prevent and correct errors due to a complete or partial loss of qubits.

When quantum computers elaborate the data, some qubits can be completely lost from the quantum registers or they can transition to unwanted electronic states. The outcome of both these processes is a loss that may render the quantum processor useless.

For this reason, devising theory-based and experimental techniques that can analyze and mitigate the consequences of these errors is extremely important.

"To solve this problem, the first thing our research group did was to develop an effective theoretical approach to the issue," says Vodola. "We managed to show that the information stored in a register with some qubits can be protected and fully retrieved in case one of these qubits gets lost."

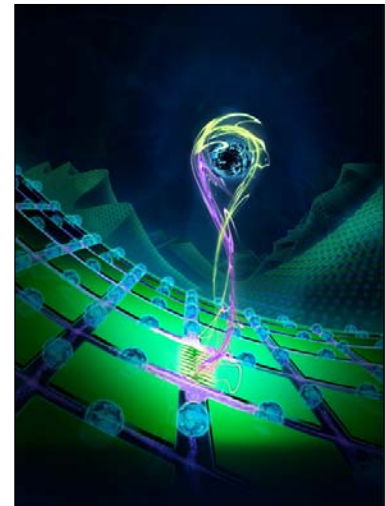
Then, the research group implemented this protocol in a real-life quantum processor. This was not easy, however. Indeed, for assessing whether a qubit is lost, a direct measurement will destroy all the information that is contained in the quantum register.

The research group came up with the solution of using an additional qubit that functions as a probe and can assess the presence or absence of other qubits without altering the computing process. This idea worked, allowing the researchers to successfully test their protocol in real time.

"We are happy with the results of this test on the trapped-ion quantum processor of the University of Innsbruck," confirms Vodola. "The same protocol can be implemented in different quantum computer architectures that are currently under development by other research centers or private institutions."

More information: Experimental deterministic correction of qubit loss, *Nature* (2020). [DOI: 10.1038/s41586-020-2667-0](https://doi.org/10.1038/s41586-020-2667-0), www.nature.com/articles/s41586-020-2667-0

Journal information: [Nature](https://phys.org/news/2020-09-technique-errors-quantum.html)
<https://phys.org/news/2020-09-technique-errors-quantum.html>



The research group developed and implemented a new protocol that allows for the protection and the correction of the fragile quantum information in case of errors due to qubit loss. Credit: Harald Ritsch / IQOQI

Researchers design system to visualize objects through clouds and fog

By Taylor Kubota

Like a comic book come to life, researchers at Stanford University have developed a kind of X-ray vision—only without the X-rays. Working with hardware similar to what enables autonomous cars to "see" the world around them, the researchers enhanced their system with a highly efficient algorithm that can reconstruct three-dimensional hidden scenes based on the movement of individual particles of light, or photons. In tests, detailed in a paper published Sept. 9 in *Nature Communications*, their system successfully reconstructed shapes obscured by 1-inch-thick foam. To the human eye, it's like seeing through walls.

"A lot of imaging techniques make images look a little bit better, a little bit less noisy, but this is really something where we make the invisible visible," said Gordon Wetzstein, assistant professor of electrical engineering at Stanford and senior author of the paper. "This is really pushing the frontier of what may be possible with any kind of sensing system. It's like superhuman vision."

This technique complements other vision systems that can see through barriers on the microscopic scale—for applications in medicine—because it's more focused on large-scale situations, such as navigating self-driving cars in fog or heavy rain and satellite imaging of the surface of Earth and other planets through hazy atmosphere.

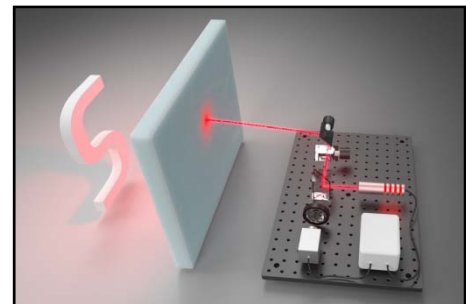
Supersight from scattered light

In order to see through environments that scatter light every-which-way, the system pairs a laser with a super-sensitive photon detector that records every bit of laser light that hits it. As the laser scans an obstruction like a wall of foam, an occasional photon will manage to pass through the foam, hit the objects hidden behind it and pass back through the foam to reach the detector. The algorithm-supported software then uses those few photons—and information about where and when they hit the detector—to reconstruct the hidden objects in 3-D.

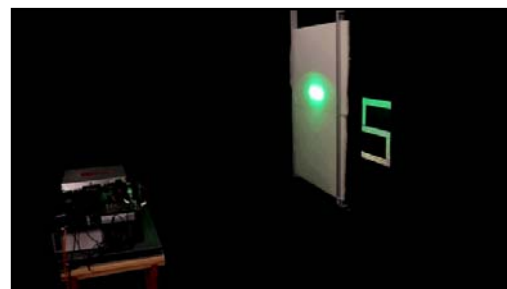
This is not the first system with the ability to reveal hidden objects through scattering environments, but it circumvents limitations associated with other techniques. For example, some require knowledge about how far away the object of interest is. It is also common that these systems only use information from ballistic photons, which are photons that travel to and from the hidden object through the scattering field but without actually scattering along the way.

"We were interested in being able to image through scattering media without these assumptions and to collect all the photons that have been scattered to reconstruct the image," said David Lindell, a graduate student in electrical engineering and lead author of the paper. "This makes our system especially useful for large-scale applications, where there would be very few ballistic photons."

In order to make their algorithm amenable to the complexities of scattering, the researchers had to closely co-design their hardware and software, although the hardware components they used are



A three-dimensional reconstruction of the reflective letter "S," as seen through the 1-inch-thick foam. Credit: Stanford Computational Imaging Lab



The laser scanning process in action. Single photons that travel through the foam, bounce off the "S," and back through the foam to the detector provide information for the algorithm's reconstruction of the hidden object. Credit: Stanford Computational I

only slightly more advanced than what is currently found in autonomous cars. Depending on the brightness of the hidden objects, scanning in their tests took anywhere from one minute to one hour, but the algorithm reconstructed the obscured scene in real-time and could be run on a laptop.

"You couldn't see through the foam with your own eyes, and even just looking at the photon measurements from the detector, you really don't see anything," said Lindell. "But, with just a handful of photons, the reconstruction algorithm can expose these objects—and you can see not only what they look like, but where they are in 3-D space."

Space and fog

Someday, a descendant of this system could be sent through space to other planets and moons to help see through icy clouds to deeper layers and surfaces. In the nearer term, the researchers would like to experiment with different scattering environments to simulate other circumstances where this technology could be useful.

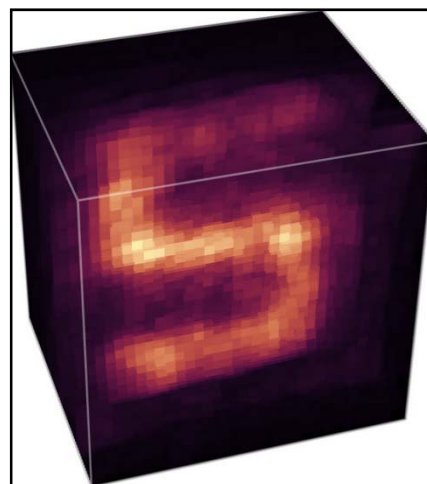
"We're excited to push this further with other types of scattering geometries," said Lindell. "So, not just objects hidden behind a thick slab of material but objects that are embedded in densely scattering material, which would be like seeing an object that's surrounded by fog."

Lindell and Wetzstein are also enthusiastic about how this work represents a deeply interdisciplinary intersection of science and engineering.

"These sensing systems are devices with lasers, detectors and advanced algorithms, which puts them in an interdisciplinary research area between hardware and physics and applied math," said Wetzstein. "All of those are critical, core fields in this work and that's what's the most exciting for me."

More information: Three-dimensional imaging through scattering media based on confocal diffuse tomography. *Nature Communications* (2020). doi.org/10.1038/s41467-020-18346-3

Journal information: [Nature Communications](https://phys.org/news/2020-09-visualize-clouds-fog.html)
<https://phys.org/news/2020-09-visualize-clouds-fog.html>



A three-dimensional reconstruction of the reflective letter "S," as seen through the 1-inch-thick foam. Credit: Stanford Computational Imaging Lab

A gold nanoparticle nearly cloaked by a single molecule

By Bob Yirka

A team of researchers from the Max Planck Institute for the Science of Light and Friedrich-Alexander University Erlangen has found a way to prove a theory suggesting the possibility of cloaking a nanoparticle using a single molecule—by nearly doing it with a gold nanoparticle and a dibenzoterrylene molecule. In their paper published in the journal *Physical Review Letters*, the group describes their experiments with coupled nanoparticles and molecules, and what they learned from them.

For several years, scientists have been experimenting with coupling nanoparticles and molecules. In most such work, the nanoparticle (which is generally larger than the molecule) serves as an antenna of sorts, funneling light to the molecule. The goal has been to boost the emissions from the molecule or to absorb the light they receive—both of which can be used to detect biomolecules under certain circumstances. In other work, researchers have looked into the possibility of controlling the emissions coming from the molecule to match the wavelength of the incoming light. In theory, if they are in phase, the nanoparticle's shadow should dissipate or disappear completely—a form of cloaking. In this new effort, the researchers sought to prove this theory by carrying out experiments with nanoparticles and molecules.



Shadow stealer. The absorption of light by a gold nanoparticle is reduced—and the shadow weakened—when a dye molecule (red) is placed nearby. With experimental improvements, the nanoparticle could become transparent. Credit: J. Zirkelbach/Max Planck Inst. for the Science of Light, via *Physics*, DOI: 10.1103/Physics.13.141

The work involved first getting a 130-nm-wide gold nanoparticle to couple with a dibenzoterrylene molecule. This involved placing several of the gold nanoparticles on a surface and then covering them with a solution containing dibenzoterrylene molecules. The setup was then chilled to the point that the solution solidified. The team then used a laser to look for a test nanoparticle-molecule pairing until they found a pair that had closely coupled. They then focused a near-infrared beam on the pair, from the direction of the molecule.

Notably, the molecule was significantly smaller than the nanoparticle. Still, the close coupling was enough to reduce the shadow of the nanoparticle by 10%. The researchers suggest that better control of the placement of the molecule and nanoparticle would further reduce the shadow, perhaps enough to make it disappear completely. They further suggest that their results open the door to using similar pairs as switches in photon-based circuits.

More information: Johannes Zirkelbach et al. Partial Cloaking of a Gold Particle by a Single Molecule, *Physical Review Letters* (2020). DOI: 10.1103/PhysRevLett.125.103603

Journal information: *Physical Review Letters*

<https://phys.org/news/2020-09-gold-nanoparticle-cloaked-molecule.html>

Metabolite signature of COVID-19 reveals multi-organ effects

Summary:

Researchers compared lipoproteins and metabolites in the blood of COVID-19 patients and healthy subjects, revealing signs of multi-organ damage in patients that could someday help diagnose and treat COVID-19.

SARS-CoV-2, the virus responsible for COVID-19, can cause a wide range of symptoms, from none at all to severe respiratory stress, multi-organ failure and death. The virus notably targets the lungs, but many patients also experience non-respiratory symptoms. Now, researchers reporting in ACS' *Journal of Proteome Research* compared lipoproteins and metabolites in the blood of COVID-19 patients and healthy subjects, revealing signs of multi-organ damage in patients that could someday help diagnose and treat COVID-19.

Current diagnostic tests for COVID-19 rely on the detection of viral RNA or antibodies against the virus. Both types of tests are prone to false-negative results, as well as having other limitations. Another possible way of detecting SARS-CoV-2 infection could involve analyzing metabolic changes the virus causes in an infected person. Jeremy Nicholson, Elaine Holmes and colleagues wanted to analyze the systemic effects of the disease and determine whether there is a general metabolic signature of COVID-19.

The researchers collected blood samples from 17 patients who tested positive for COVID-19 with current assays and from 25 healthy age-, sex- and body mass index-matched controls who were proven negative for current or prior SARS-CoV-2 infection with an antibody test. Then, the team analyzed the plasma lipoprotein, metabolite and amino acid levels in blood plasma with nuclear magnetic resonance spectroscopy and liquid chromatography-mass spectrometry. Through multivariate statistical analyses that detected differences between patients and controls, the researchers revealed a metabolic signature of SARS-CoV-2 infection involving signs of acute inflammation, liver dysfunction, diabetes and cardiovascular disease risk. The team is now validating the data in a much larger group of patients. In addition to possibly being used to develop a metabolite-based diagnostic test, these results suggest that recovered COVID-19 patients should be evaluated for increased risks for other conditions, the researchers say.

The authors acknowledge funding from the Spinnaker Health Research Foundation, the McCusker Charitable Foundation, the Western Australian State Government, the Australian Government Department of Health Medical Research Future Fund, the U.K. Medical Research Council, and the Australian Research Council.

Story Source:

[Materials](#) provided by [American Chemical Society](#). Note: Content may be edited for style and length.

Journal Reference:

1. Torben Kimhofer, Samantha Lodge, Luke Whiley, Nicola Gray, Ruey Leng Loo, Nathan G. Lawler, Philipp Nitschke, Sze-How Bong, David L. Morrison, Sofina Begum, Toby Richards, Bu B. Yeap, Chris Smith, Kenneth C.G. Smith, Elaine Holmes, Jeremy K. Nicholson. **Integrative Modelling of Quantitative Plasma Lipoprotein, Metabolic and Amino Acid Data Reveals a Multi-organ Pathological Signature of SARS-CoV-2 Infection.** *Journal of Proteome Research*, 2020; DOI: [10.1021/acs.jproteome.0c00519](https://doi.org/10.1021/acs.jproteome.0c00519)

<https://www.sciencedaily.com/releases/2020/09/200909114808.htm>

Engineered 'nanobodies' block SARS-CoV-2 from infecting human cells

By Meghan Rosen

Researchers have designed a molecule that sticks tightly to the coronavirus spike protein, preventing the virus from infecting cells. The molecule might someday be used in an aerosolized drug to treat or prevent COVID-19.

In the race to find drugs that halt the novel coronavirus, scientists are finding inspiration in unusual sources—like llamas.

A new lab-engineered molecule inactivates the machinery that the coronavirus, SARS-CoV-2, uses to infect cells. It's modeled after the simple, compact antibodies found in some animals such as llamas, alpacas, and camels.

While the research is still preliminary, the team behind the advance hopes their molecule might someday be the key ingredient in an antiviral drug that could be delivered via nasal spray.

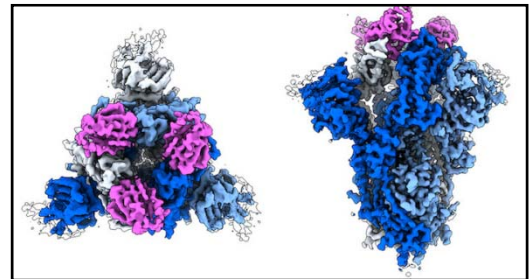
"In just twelve weeks, we've found a molecule that's a clinical lead," says Howard Hughes Medical Institute Investigator Peter Walter, a biochemist at the University of California, San Francisco (UCSF), who co-led the work. The team described the advance August 17, 2020, in a preprint posted to bioRxiv.org.

Alongside vaccines, drugs that target SARS-CoV-2 are important tools for keeping the COVID-19 pandemic in check. Researchers have identified existing drugs that can be repurposed to treat symptoms of the virus and help quell severe infections. But a drug specifically designed to attack SARS-CoV-2 might be more effective at halting the virus in its tracks before it causes severe disease, Walter says. To make such drugs, he and others are designing custom antibodies.

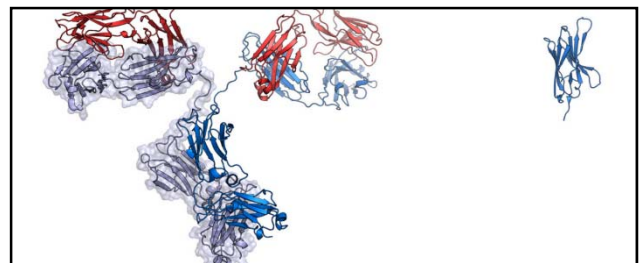
Immune cells produce antibodies in response to infection, but it takes time for that response to develop. Lab-made antibodies could knock a virus out before it gains a foothold.

That's where the llamas come in. Alpacas and llamas have a simpler version of the antibodies found in humans—only a tenth the size, with fewer components. These stripped-down antibodies, called "nanobodies," are potentially powerful drug building blocks, says Aashish Manglik, a protein engineer at UCSF who co-led the study with Walter. "Because of their unique shape they can often fit deep inside the crevices of proteins." They tend to be more stable than regular antibodies, too.

Manglik's lab has developed large collections of these synthetic proteins as a resource for drug discovery. When the COVID-19 pandemic began, these collections were the perfect place to hunt for a molecule that could deactivate SARS-CoV-2, Walter says.



Researchers designed a three-part molecule (pink) that nestles into the coronavirus spike protein (blue), pinning it into a conformation that makes it unable to stick to ACE2, the receptor through which the virus gains entry into human cells. Top view and side view shown. Credit: Walter and Manglik Labs/UCSF/HHMI



A nanobody (right) is smaller, simpler, and more stable than a full-sized antibody (left). Credit: Walter and Manglik Labs/UCSF/HHMI

Michael Schoof, a graduate student in Walter's lab, began mining Manglik's nanobody collections en masse. The aim: Finding any nanobodies that would stick to the coronavirus spike protein, the key on the virus's surface that lets it sneak into cells.

In a series of lab experiments, he and his colleagues winnowed down a pool of billions of different nanobodies to a few dozen that stuck strongly to the spike protein. Then, they engineered the most promising candidate, linking three copies of the same nanobody together into a chain.

That three-piece molecule wedged tightly against the virus spike protein, pinning it into a shape that prevented attachment to human cells. The researchers also discovered that the molecule is particularly sturdy. In test-tube experiments, a single nanobody fell off the spike protein within minutes. The team calculated that the three-piece version would be able to hold on for over a week without budging.

The work hasn't yet been peer-reviewed, but Walter and Manglik are currently looking for partners who can produce and test the molecule for safety and efficacy in clinical trials. They hope the molecule could someday soon work as an aerosolized drug that would get directly to patients' lungs.

Traditional antibody drugs are usually injected into the patient's bloodstream—most antibodies fall apart when aerosolized by a nebulizer or a nasal spray, Walter says. Preliminary tests suggest that the new nanobody-based molecule is far hardier. The nanobodies kept their shape and function when sprayed, and withstood being freeze-dried and heated, too.

Aerosolized delivery of a nanobody drug "is an exciting possibility, but it hasn't been demonstrated yet," says Andrew Kruse, a biochemist at Harvard Medical School who has collaborated with Manglik's team to build nanobody collections but wasn't involved in the current study. "It would be very important to see how long an aerosol-delivered nanobody remains in the respiratory system," he says.

More information: Michael Schoof et al. An ultra-potent synthetic nanobody neutralizes SARS-CoV-2 by locking Spike into an inactive conformation, (2020). [DOI: 10.1101/2020.08.08.238469](https://doi.org/10.1101/2020.08.08.238469)
<https://phys.org/news/2020-09-nanobodies-block-sars-cov-infecting-human.html>



Thu, 10 Sept 2020

How mutating coronavirus poses challenge to Covid-19 vaccine development

A vaccine is inoculated to keep body's immunity ready to produce antibodies for a particular pathogen. In case of SARS-CoV-2, the Covid-19 causing coronavirus, the scientists have found that some mutant viruses might evade such antibodies

By Prabhash K Dutta

HIGHLIGHTS

- *Scientists suspect SARS-CoV-2 may mutate to acquire HIV-like ability*
- *Some 12,000 mutations have been catalogued in SARS-CoV-2*
- *Experiment saw a mutant SARS-CoV-2 evade antibodies taken from Covid-19 patient*

Going by the claims of people and agencies involved in Covid-19 vaccine development, the period of October-November may see a major announcement. Vaccine development is in final phases for a couple of candidates. Government heads, but probably not the scientists, are going to declare some kind of victory over the pandemic-causing coronavirus.

This comes even as virologists studying SARS-CoV-2 -- the coronavirus that has caused the deadly Covid-19 pandemic -- say the virus is yet not fully understood. The researchers have found

that the coronavirus has been changing as it spreads from person to person but the mutations have been slow.

Some virologists suspect that there could be some chance mutations similar to the human immunodeficiency virus in the SARS-CoV-2 giving it an HIV-like ability to evade the immune system.

This ability of the HIV has made developing a vaccine against it almost impossible over the past four decades. Now, there is concern of such a possibility repeating at a time when a Covid-19 vaccine appears around the corner.

12,000 Mutations

Though viruses with RNA-genomes such as SARS-CoV-2, HIV and influenza undergo mutations quickly, this coronavirus has been very slow in picking up mutations compared to HIV or influenza.

Scientists have found a 'proofreading' protein in SARS-CoV-2 that keeps its rate of mutations low. This is good news for vaccine development as this is a sign that the virus is stable in nature and hence can easily be neutralised.

But one particular mutation has stood out for virologists. By the way, scientists have catalogued some 12,000 mutations in SARS-CoV-2 after studying more than 95,000 genomic sequences of the virus.

More Infectious

This mutation relates to the gene that encodes the spike protein of SARS-CoV-2. This spike protein is instrumental in the transmission of the coronavirus from one person to another.

This mutation has been found appearing again and again. The scientists have named it the D614G mutation. This mutation is believed to have given SARS-CoV-2 more transmutability.

This SARS-CoV-2 variant has been found to be prevalent in many countries including the US, Canada and Australia. Whether increased transmutability is helping the coronavirus in evading the immune system is a matter of debate among scientists studying it.

Challenge to Vaccine Development

However, there are other mutations that have caused concern. There is an emerging body of evidence that says a mutated SARS-CoV-2 is developing ability to evade antibodies.

In an experiment conducted at the Rockefeller University in New York City, scientists generated antibody-resistant SARS-CoV-2 variants. These mutant strands were tested against antibodies taken from the blood samples of patients who had recovered from Covid-19. The coronavirus grew in number in the presence of antibodies, showing that this variant was capable of neutralizing them.

This happened in a genetically engineered environment. But simply put, a similar mutation could take place in the real world and this would present a serious challenge to vaccine development.

Current vaccine development has factored in only the most common variant of the coronavirus that was circulating in the initial stages of Covid-19 pandemic. Besides prevention, the fight against Covid-19 pandemic depends a lot on the ability of the vaccine-generated antibodies to neutralise the coronavirus.

Why it Matters

Antibodies are the 'missiles' in the body that kill invaders -- viruses and bacteria. To perform this duty, they need to identify harmful antigens -- foreign particles in the body -- and neutralise them.

The body's immunity develops a memory of the encounter and produces similar antibodies when the same pathogen invades it again. Vaccines and survival from an infectious disease build immunity the same way.

A vaccine is inoculated in a healthy person to create this memory even before the actual virus, bacteria or any other pathogen enters the body. This enables the body's immunity to produce enough number of required antibodies, when time comes, to neutralise the pathogens.

But if a mutant variant of coronavirus develops the ability to evade the antibody, it may pose a fresh -- and possibly more dangerous -- challenge to healthcare. A vaccine may not be as useful.

<https://www.indiatoday.in/news-analysis/story/coronavirus-mutation-covid-19-vaccine-1720180-2020-09-09>



Thu, 10 Sept 2020

Post-Covid-19, damaged lungs can repair themselves | Research

A recent study has suggested that after recovery from coronavirus, damaged lungs can repair themselves

By Prabhash K Dutta

Damaged lungs are among the most serious impacts of Covid-19 on a patient. Scars have been found on the lungs of people who have recovered from Covid-19, thus limiting the person's breathing capacity.

Now, a study conducted in Austria has brought a positive hope for those surviving Covid-19. Doctors have been debating world over whether a patient's lungs can fully regain their strength after recovery from Covid-19.

The study, yet to be peer reviewed, evaluated 82 severe cases of Covid-19 post-recovery. They were evaluated for "the cardio-pulmonary damage in Covid-19 survivors at 6, 12, and 24 weeks after discharge". This study was conducted between April and June.



The study, yet to be peer reviewed, evaluated 82 severe cases of Covid-19 post-recovery. (Photo: PTI)

The researchers noted that a comparison of CT scans of the lungs of Covid-19 survivors, taken at the end of six weeks and 12 weeks after discharge from hospital, showed that on an average, the damage to lungs had reduced significantly.

At six weeks, 88 per cent of patients with severe Covid-19 showed signs of lung damage shown typically in CT scan films as ground glass. At 12 weeks, 56 per cent patients showed such lung damage.

This means, though patients' lungs remained damaged weeks after they recovered from Covid-19, the breathing chambers showed remarkable ability to repair themselves over time. An active pulmonary rehabilitation medical care can help faster repair of the lungs.

This was confirmed in another study that was conducted in France on pulmonary rehabilitation.

"Patients, who spent less time bedridden between ICU and PR [pulmonary rehabilitation], recovered faster. These results show the importance of PR in patients post Covid-19, the sooner and the longer, the better," the researchers concluded.

This study showed that recovered Covid-19 patients showed marked improvements in their lungs capacity, muscle strength, fatigue and anxiety if they underwent pulmonary rehabilitation.

Both the studies raise hope that damage to lungs due to Covid-19 can be managed successfully. This finding is particularly significant as damage to lungs has been found even in asymptomatic patients.

In an interview to India Today TV, Director, All India Institute of Medical Sciences (AIIMS), Dr Randeep Guleria confirmed this as "something that has emerged recently".

He said, "People who carried out CT scans of asymptomatic cases found that in about 20-30 per cent cases there were some patches in the lung when the cases were asymptomatic."

Dr Guleria, however, also said these Covid-19 scars on lungs are repaired by the body's own immunity, except in a few cases. "In most of them, these patches vanished spontaneously without leaving any residual damage. But in some cases, it did cause scarring of lungs," he said.

<https://www.indiatoday.in/india/story/post-coronavirus-damaged-lungs-repair-themselves-research-1719956-2020-09-09>



Thu, 10 Sept 2020

Serum Institute's decision to not halt vaccine trials in India raises concerns after AstraZeneca hits pause

The phase three trials of AstraZeneca were stopped in the UK on Wednesday and the pharma firm said it has halted global trials, including large late-stage trials, of its experimental Covid-19 vaccine

Serum Institute of India (SII) said on Wednesday that trials of AstraZeneca Plc's potential Covid-19 vaccine in the country is in progress even as AstraZeneca paused global trials. "We can't comment much on the UK trials, but they have been paused for further review and they hope to restart soon. As far as Indian trials are concerned, it is continuing and we have faced no issues at all," SII said in a statement.

SII was responding to how the halt in trials globally is going to play out in India given that SII is developing a vaccine against Covid-19 in collaboration with AstraZeneca and Oxford University.

On Wednesday, the phase three trials of AstraZeneca were stopped in the UK and the pharma firm said it has halted global trials, including large late-stage trials, of its experimental coronavirus vaccine due to an unexplained illness in a study participant.

AstraZeneca has not given out details on the nature of the adverse reaction in the patient.

"We voluntarily paused vaccination to allow review of safety data by an independent committee. This is a routine action which has to happen whenever there is a potentially unexplained illness in one of the trials, while it is investigated, ensuring we maintain the integrity of the trials," AstraZeneca said in a statement.

Taking the medical fraternity and other vaccine watchers by surprise, Serum Institute said, "We can't comment much on the UK trials."

"It's the same vaccine candidate, if there is a safety signal, even if just one, and the UK trial has been suspended till a DSMB looks at the event, why not suspend the Indian study too till that decision is made?" wrote Dr Anant Bhan, Researcher in Bioethics in a tweet.

"The ethics committees for the Indian sites should be intervening," he told News18.

The Pune-based vaccine maker earlier shortlisted 17 sites in India for the Phase II clinical trial of COVID-19 vaccine. At least 1,600 candidates aged between 18 to 55, will participate in the trial. The trials started on August 26 in Pune's Vidyapeeth Medical College.

In the UK, the Lancet published data on trials of AstraZeneca that indicated that the vaccine candidate produced a dual immune response in people aged 18 to 55.

On the disruption of trials of Oxford University's vaccine candidate, which has been touted as a front runner, Professor Ashish Jha wrote on Twitter "We have no idea whether this is a big deal or

not. Science is hard. This is why we have to let the trials play out. I remain optimistic we will have a vaccine found to be safe and effective in upcoming months. But optimism isn't evidence."

The government of India, meanwhile, in a press briefing on Tuesday expressed confidence about Serum Institute's manufacturing capacity.

"Manufacturing capacity of Serum Institute is unimaginable - 75 to 100 million doses per month," Dr VK Paul, head of India's National Task Force on Covid-19 said.

<https://www.news18.com/news/india/serum-institutes-decision-to-not-halt-vaccine-trials-in-india-raises-concerns-after-astrazeneca-hits-pause-2863593.html>

