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# समाचार पत्रों से चयित अंश Newspapers Clippings

A Daily service to keep DRDO Fraternity abreast with DRDO Technologies, Defence Technologies, Defence Policies, International Relations and Science & Technology

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*Wed, 29 July 2020*

## **US Air Force and Indian Air Force join to develop drones**

*By Saurav Chordia*

On Tuesday, July 21, during “Ideas for India Summit” hosted by the U.S.-India Business Council, U.S. Deputy Defense Secretary Ellen M. Lord announced the U.S. Air Force Research Laboratory had begun negotiating with the Indian Air Force (IAF), India’s Defense Research and Development Organization (DRDO) and an Indian startup company for the two countries to begin joint Unmanned Aerial Vehicle (UAV) development.

BulgarianMilitary.com reported the U.S. Air Force Research Laboratory’s negotiations with the Indian military. The potential joint UAV development plan comes amid heightened Indian interest in building up its drone fleet, but that has been slowed by lengthy procurement times.

“I would like to emphasize a very interesting project that we are currently negotiating – the joint development of a UAV launched from the air with the research laboratories of the US Air Force, Indian Air Force, Defense Research and Development Organization of India and an Indian startup company,” Lord said during the summit.

The reported joint drone development plan comes amid IAF plans to buy American MQ-9 Reaper/Predator-B” drones, designed for reconnaissance and airstrikes. The Indian Army previously expressed interest in purchasing the armed U.S. drones in 2019, but has yet to go through with the purchase.



An MQ-9 Reaper drone remotely piloted aircraft performs aerial maneuvers over Creech Air Force Base, Nev., June 25, 2015. (U.S. Air Force photo by Senior Airman Cory D. Payne)

Ongoing tension with Chinese forces in the eastern Ladakh border region has raised India’s interest in obtaining combat-capable drones and India has again begun to look to the U.S.

In addition to armed Predator-B variant drones, the U.S. has also offered a 30 Sea Guardian UAVs at a cost of \$4 billion. The Sea Guardian is an unarmed variant of the MQ-9 Reaper. There is some reported U.S. concern about providing combat-capable UAVs to other countries, like China, as Russia is another of India’s strategic allies and there are concerns about classified drone technology being leaked.

The IAF was also interested in acquiring 100 of General Atomics Avenger drones, a stealth capable drone variant still under development.

A plan for joint drone development by the U.S. and India may help to overcome some of the concerns about shared technology, while expanding the strategic partnership between the U.S. and India. UAVs are a key area of interest to the Indian armed forces and expanded drone capabilities may help its military maintain real-time data from the ground while minimizing manpower costs. Beyond military applications, the drones may also be used in humanitarian operations.

<https://americanmilitarynews.com/2020/07/usaf-and-india-air-force-join-to-develop-drones/>

Fri, 31 July 2020

## India's Rafale fighter jets: Here is everything from speed to weapon capabilities

*India's Rafale fighter jets: When all the 36 Rafale jets are delivered by 2022, we will have 32 squadrons, still well below the 42 squadrons of the sanctioned strength*

*By Krishn Kaushik*

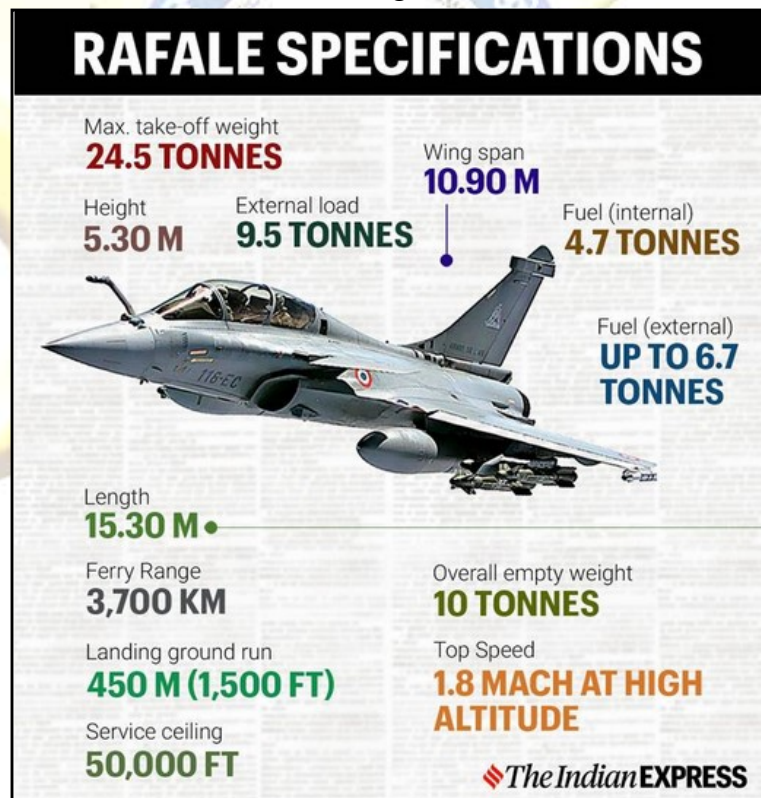
New Delhi: The five Rafale fighter jets that land in Ambala on Wednesday morning will resurrect the Number 17 Golden Arrows squadron of the Indian Air Force. It will take the IAF's squadron strength to 31. When all the 36 Rafale jets are delivered by 2022, it will take it to 32 squadrons, still well below the 42 squadrons of the sanctioned strength.

The state-of-the-art 4.5 Generation Rafale jet can reach almost double the speed of sound, with a top speed of 1.8 Mach. With its multi-role capabilities, including electronic warfare, air defence, ground support and in-depth strikes, the Rafale lends air superiority to the Indian Air Force.

While China's J20 Chengdu jets are called fifth generation combat jets, compared to 4.5 generation Rafale, the J20 have no actual combat experience. Whereas the Rafale is combat proven, having been used by the French Air Force for its missions in Afghanistan, Libya and Mali. It has also been used for missions in Central African Republic, Iraq and Syria. Rafale can also carry more fuel and weapons than the J20.

Each aircraft has 14 storage stations for weapons. The jets come with one of the most advanced Meteor air-to-air missiles. The 190-kg missile has a Beyond Visual Range (BVR) of over 100 km, traveling at a top speed of Mach 4. The F16 jets, used by Pakistan, carry the AMRAAM missile, which has a BVR of 75 km. Rafale can also outperform F16 in dogfights.

The Rafale jets also come with SCALP, the air-to-ground cruise missile with a range over 300 km. It is a long-range deep strike missile.



Rafale specifications

The MICA air-to-air missile on Rafale is for both, close-quarter dogfights, and for BVR. At the last-minute, India has also asked for HAMMER (Highly Agile and Manoeuvrable Munition Extended Range), which is an air-to-ground precision guided missile produced by French conglomerate Safran, and can be used against bunker-type hardened targets within the range of 70 km.

#### **Basic Rafale Specifications:**

- Wing span: 10.90 m
- Length: 15.30 m
- Height: 5.30 m
- Overall empty weight: 10 tonnes
- External load: 9.5 tonnes
- Max. take-off weight: 24.5 tonnes
- Fuel (internal): 4.7 tonnes
- Fuel (external): up to 6.7 tonnes
- Ferry Range: 3,700 km
- Top Speed: 1.8 Mach at high altitude
- Landing ground run: 450 m (1,500 ft)
- Service ceiling: 50,000 ft

<https://indianexpress.com/article/explained/explained-rafale-fighter-jets-india-specs-speed-range-6528893/>

**TIMESNOWNEWS.COM**

*Fri, 31 July 2020*

## **Not just Rafales: The blockbuster acquisitions that are driving India's military modernisation**

*Here, we take a look at some of the most advanced military technology that New Delhi has, in recent years, loosened its purse strings to acquire*

#### **Key Highlights**

- **India inked a deal with the United States worth \$750 million in November 2016 for the procurement of 145 ultra-light howitzers (M777), to be manufactured by BAE Systems**
- **India had struck a deal worth \$3.1 billion in 2015 for the procurement of 22 Boeing AH-64E Apache Longbow attack helicopters along with 15 Chinook heavy-lift choppers**
- **In early 2019, India entered into a contract with Israel Aerospace Industries (IAI) worth \$93 million for the provision of Naval MSRAMs, including maintenance services**

On Wednesday, the first batch of Dassault Rafale aircraft completed their 7,000km journey across the world to their new home in the Indian sub-continent, marking a new era of modernisation in the IAF's history. The induction of the five Rafale jets, and the 31 more to arrive in the next few years, is part of a larger drive toward military modernisation that India has embarked upon.

Here, we take a look at some of the most advanced military technology that New Delhi has, in recent years, loosened its purse strings to acquire.

#### **M777 ultra-light howitzers**

India inked a deal with the United States worth \$750 million in November 2016 for the procurement of 145 ultra-light howitzers (M777), to be manufactured by BAE Systems. The deal signified the first attempt to modernise the nation's artillery since the debacle of the Bofors scam in the late 1980s. The first of these guns arrived in May 2017. While 25 of these howitzers were set to

be imported, the additional 120 were assembled in the homeland by BAE Systems and Mahindra Defence.

### **Israeli Spike Anti-tank guided missiles (ATGM)**

In November 2019, the Indian Army successfully conducted test firing of the Israeli Spike LR anti-tank guided missile (ATGM) capable of homing in on and destroying enemy tanks and vehicles at ranges up to 4km. The Spike missiles are, in fact, a temporary solution to fulfil the Indian Army's ATGM requirements while the DRDO develops its own indigenous missile, expected to be ready for operation in 2022. However, the Spike Missile's maker, Rafael Advanced Defense Systems, has argued that its missile still exceeds the capabilities of the one that the DRDO is developing. In 2011, India had floated a tender for 321 ATGM launchers and 8,356 missiles in a deal estimated at \$500 million.



Boeing's Apache Guardian attack helicopter. (Image Credit: Boeing website)

### **Attack and heavy-lift choppers**

India had struck a deal worth \$3.1 billion in 2015 for the procurement of 22 Boeing AH-64E Apache Longbow attack helicopters along with 15 Chinook heavy-lift choppers. The final batch of Apache helicopters was delivered by the United States to India earlier this month. The complete delivery of the US' Chinook heavy-lift helicopter fleet purchased by India ended in March this year. The Apache helicopters have joined India's SU-30MKI, Mig-29 and Mirage 2000 aircraft at the frontline airbases near the border in Eastern Ladakh.

### **SU-30MKI**

The Russian made Sukhoi jet was inducted into the Indian Air Force in 2002, and has since become a mainstay of the IAF's aerial arsenal. It is a twin seater, twin engine multirole fighter capable of carrying a variety of medium-range missiles. India had initially signed a deal in 2000 with Russia for the procurement of 140 Sukhoi jets. The first indigenously manufactured Sukhoi entered service in 2004.

### **Medium-Range Surface-to-Air Missiles (MRSAM)**

In early 2019, India entered into a contract with Israel Aerospace Industries (IAI) worth \$93 million for the provision of Naval MSRAMs, including maintenance services. The Israeli made weapon was first inducted into the IAF in August 2019. It is, reportedly, designed to provide India's armed forces with air defence capability against a whole host of aerial threats at medium range. IAI had received a contract worth \$2 billion for the development of advanced MRSAMs for the Indian Army in April 2017.

<https://www.timesnownews.com/india/article/not-just-rafales-the-blockbuster-acquisitions-that-are-driving-india-s-military-modernisation/629474>

## Rafale a game changer, now IAF challenge is to boost jet strength

*The strength of 29 squadrons by 2023 includes two Rafale squadrons, one additional MiG-29 squadron and one additional squadron of indigenous Light Combat Aircraft (LCA) Tejas jets, into the IAF fleet as per schedule*

*By Sushant Singh*

New Delhi: The Induction of five French Rafale aircraft at Ambala on Wednesday will be a game changer in many ways, but may not make up for the shortfall faced by the Indian Air Force, according to senior officers of IAF.

The Rafale aircraft's arrival brought attention to the biggest challenge confronting the IAF: its depleting strength of fighter jets. Against an authorisation of 42 squadrons, it will have 29 squadrons in 2023. At present, its fleet comprises 30 squadrons of fighter jets.

"Is getting two squadrons of Rafale significant? Yes, it is a game changer in many ways. But does this induction make up for all the other shortfalls faced by the IAF? No, those challenges remain and will have to be tackled," a senior IAF officer told *The Indian Express*.



A Rafale aircraft lands at the IAF base in Ambala on Wednesday. (Source: @DefenceMinIndia Twitter)

The strength of 29 squadrons by 2023 includes two Rafale squadrons, one additional MiG-29 squadron and one additional squadron of indigenous Light Combat Aircraft (LCA) Tejas jets, into the IAF fleet as per schedule. By then, the Pakistan Air Force will have 27 fighter squadrons while China's PLA Air Force is assessed to have the capacity to bear at least 42 squadrons against India.

The shortfall in the current strength is expected to be made up over the next two decades by the proposal for acquisition of 114 foreign fighter jets under the Make in India scheme, along with the acquisition of indigenous LCA Tejas fighters.

"The squadron strength is a force structure issue and depends on a host of factors. We cannot lose sight of the developments in the North and West; with both our adversaries continuously increasing and upgrading their inventories," IAF Chief Air Chief Marshal RKS Bhadauria told *The Indian Express* in May.

Even though the IAF desires a strength of 45 fighter squadrons for a two-front challenge, the last time it had its authorised complement of 42 squadrons was in 2002, just after India had mobilised its forces against Pakistan following the terror attack on Parliament.

Since then, the numbers have steadily fallen, and the trend will continue with five squadrons of old Russian MiG aircraft getting decommissioned in the next couple of years while IAF adds four additional squadrons. The IAF has long been cognisant of the challenge of its depleting fighter squadron strength. In June 2017, the then IAF Chief Air Chief Marshal BS Dhanoa had told this newspaper that "one of our main focus areas is to build up to the authorised strength of fighter squadrons at the earliest".

The IAF's authorised strength of 42 fighter squadrons "is the minimum strength necessary to dominate a two-front conflict," Dhanoa who saw the Balakot airstrikes as IAF Chief last year had said.

The IAF plans to procure 83 LCA Mk IAs and more than 100 LCA Mk II from Hindustan Aeronautics Limited (HAL), and has already raised the second squadron of Tejas against its initial order of 40 aircraft. However, the supplies from HAL are behind the scheduled induction plan, leading to discomfort within the IAF.

IAF issued a request for information for 114 multirole fighters in June 2018 to foreign manufacturers: Boeing, Lockheed Martin, Dassault Aviation, Saab AB, Airbus Defence and Space, Russian Aircraft Corporation and Sukhoi Company. It plans to induct the aircraft within 12 years of the contract. A request for proposal is awaited.

Meanwhile, the government has decided to procure 21 MiG-29 aircraft from Russia which would be inducted into service as an additional squadron. The 12 Su-30MKIs, lost in accidents, are also being replenished by HAL through a contract with Russia, which has been approved by the government. However, the Russian connect is also limited as the IAF had earlier pulled out of the collaborative venture with Sukhoi to develop the Fifth Generation Fighter Aircraft (FGFA) after 11 years, citing disagreements over cost sharing plans, technology transfers and the test aircraft's technological capabilities.

France has already handed over 10 Rafale jets to India, of which five have flown to Ambala. All the 36 Rafale fighter jets from France are expected to be in India by end-2021. The fitting of additional India-specific enhancements is likely to take a few more months.

<https://indianexpress.com/article/india/rafale-a-game-changer-now-iaf-challenge-is-to-boost-jet-strength-6529980/>

## NAVAL TECHNOLOGY

*Fri, 31 July 2020*

# Indian Navy expands deployment of ships in Indian Ocean

The Indian Navy has expanded its deployment of frontline warships and submarines in the Indian Ocean Region (IOR).

India had deployed its warships in the IOR amid border clashes with China in the Galwan Valley in June that led to the death of 20 Indian Army personnel.

With the aim of sending out a strong message to China, the government has taken a multi-pronged approach involving three defence forces, reported PTI, citing defence sources.



An undisclosed defence source was quoted by the news agency as saying: "Yes, our message has been registered by China."

It was further reported that there was no visible increase in forays by Chinese vessels in the IOR.

According to a PTI report, this could be because of an increase in the deployment of ships by the People's Liberation Army (PLA) Navy in the South China Sea following tensions with the US over territorial disputes.

The Indian Navy recently conducted exercises with naval forces of the Japan Maritime Self Defense Force and French Navy in the IOR to enhance regional security.

The CSG was deployed to the Indian Ocean in support of an open Indo-Pacific free from influence.

After the Galwan Valley clashes, the IAF deployed fighter jets, including Sukhoi 30 MKI, Jaguar and Mirage 2000 aircraft in Ladakh airbases.

<https://www.naval-technology.com/news/indian-navy-expands-deployment-of-ships-in-indian-ocean/>



## Navy steps up Indian Ocean operations, strategic Malacca strait under close watch

### Synopsis

*The navy has heightened presence along the strategic Malacca strait from where a bulk of China's energy supplies pass through, with sources saying warships as well as aircraft have been deployed. Sources said that while steps were taken to check on the PLA Navy's intentions in the region after the clash, the Chinese side has been occupied in the South China Sea with current assets.*

New Delhi: A strong message has been sent to China with deployment of Indian Navy in strength in the Indian Ocean Region, with top sources saying there is no reason for concern as far as PLA presence is concerned and the strategic Malacca strait is being kept under strict observation.



As reported by ET, the navy and air force was pressed into action immediately after the Galwan clash on June 15, with sources saying operational warships have been at sea to consolidate presence in the Indian Ocean Region (IOR).

Sources said that coordinated action has been taken up by the three forces given the situation on the Line of Actual Control (LAC) and daily joint meetings are being conducted to monitor the China situation. The navy has heightened presence along the strategic Malacca strait from where a bulk of China's energy supplies pass through, with sources saying warships as well as aircraft have been deployed.

“These operations will continue, we do not know for how long but we will remain alert. This is not a passive response. The Chinese Navy has ships in the Gulf of Aden but there is nothing alarming about their deployment in the IOR,” a source said.

Sources said that while steps were taken to check on the PLA Navy's intentions in the region after the clash, the Chinese side has been occupied in the South China Sea with current assets. “The two US aircraft carrier strike groups and the frictions with Japan and Taiwan has kept them contained to the South China Sea,” a source said.

India is also embarking on a major plan to strengthen military infrastructure in the Andaman Nicobar islands. Without going into details, sources said that the islands will be of utmost importance in coming years to project power as China extends its reach into the Indian Ocean.

“China sees itself as a global power. They don’t want to be limited by land disputes. Their ambition is the seas – and they requires resources and markets that are available in places like Africa. This means that they will significantly increase their presence in the oceans and will move westwards. We need to be ready to counter or match them,” another source said.

India is also gearing up for an extensive exercise with the US and Japan in the Bay of Bengal under the Malabar series later this year, though the participation of the fourth member of the so called quad – Australia – is yet to be decided on. The Malabar series and similar exercises with Indonesia, Vietnam, Singapore and Australia are part of the larger plan to check the growing Chinese influence and maritime activity in the region.

<https://economictimes.indiatimes.com/news/defence/navy-steps-up-indian-ocean-ops-malacca-strait-under-close-watch/articleshow/77227221.cms>



**DEFENCE AVIATION POST**  
Your Connect To The World Of Defence And Aviation

*Fri, 31 July 2020*

## **Project 75I race to build six new conventional submarines for Indian Navy**

After the Rafale fighter jets arrived in India, the full attention of the Ministry of Defense has been focused on the Scorpene class attack submarine project stuck for years now. In view of the growing threat of Sino-Pak in the Indian Ocean, the Indian Navy has stepped up preparations to increase its firepower. The construction of 6 state-of-the-art submarines will be expedited under Project 75I for the Navy.

**These submarines will be equipped with stealth technology**

The Indian Defense Ministry on 20 June 2019 issued an Expression of Interest to the Indian strategic partners for the construction of 6 submarines powered by diesel electric power under Project-75I. These submarines will be equipped with radar-less technology (stealth technology).



**The project has been stuck for four years**

This project has been stuck for the last four years. Negotiations were first started in 2017. Which are planned to be made under the Make in India category. Whichever foreign partner will have an agreement to build these submarines, they will have to make them in the country together with the Indian partner. The cost of the project to build these 6 submarines is about 45 thousand crores.

**These foreign companies are in line**

When the tender for this project was issued in 2017, four top foreign companies of the world came out. These include France’s Navan Group, Russia’s Rosoboron Exporters Rubin Design Bureau, Germany’s Thiesenkrupp Marine Systems and Sweden’s Saab Group. It is believed that one of these companies can be given this tender.

<https://www.defenceaviationpost.com/2020/07/project-75i-race-to-build-six-new-conventional-submarines-for-indian-navy/>

## Success for Make in India! Hindustan Shipyard boasts a healthy order book, says the outgoing CMD

*“The shipyard has also recently won a contract for constructing semi-submersible pontoon for the Indian Navy costing about Rs 450 crores,” RAdm Sarat Babu said*

*By Huma Siddiqui*

Hindustan Shipyard Ltd, which has been focusing on ‘Make in India’ a big success has undergone a significant financial turnaround and in the last four financial years has posted profits. These profits came after a gap of almost four decades. Talking about the order book of the yard, the outgoing CMD of the Shipyard, RAdm LV Sarat Babu, in a conversation with Financial Express Online said “The order book is good. The yard is presently building for the Indian Navy two Diving support vessels costing about Rs 2500 crores, as well as four 50 tonne bollard pull tugs costing about Rs 250 crores.”

“The shipyard has also recently won a contract for constructing semi-submersible pontoon for the Indian Navy costing about Rs 450 crores,” RAdm Sarat Babu said.

The shipyard has set a record by recently completing a major refit of EKM class submarine ahead of schedule apart from delivering ships post refit and repair ahead of schedule. Besides this, “There are two Indian Navy ships undergoing refitting, and there are other vessels too,” he added.

The yard is also working on ships and vessels for the Indian Coast Guard, DCI, the Fisheries department and for other private companies.

In an earlier interaction, the CMD of the yard had stated that the Indian Navy’s Maritime Capability Perspective Plan (MCP) will give enough opportunities to all the shipyards for competing for different types of vessels.

Since the yard has been undertaking short and long refits of the submarines, the focus has been to make the dream of ‘Make in India’ initiative a huge success.

“Compared to other yards PSUs or private, the yard has managed to get orders on a competitive basis, which has made their order book health,” observed an industry source.

Being a PSU, the shipyard has been competing with the private sector on equal footing and has been complying with the policies as laid down by the government.

“The HSL has the four Cs ‘Confidence, Commitment, Capability and Capacity’. We can undertake most types of ship construction, as well as repair and submarine retrofit projects,” the outgoing CMD concluded.

The yard has also last year won the prestigious ‘SKOCH Awards 2019’ in the category of “Corporate Excellence” which was received by RAdm LV Sarat Babu, C& MD HSL along with his team received this award. This was, in fact, the 7th award the yard had received between 2018-19 under him.

<https://www.financialexpress.com/defence/success-for-make-in-india-hindustan-shipyard-boasts-a-healthy-order-book-says-the-outgoing-cmd/2039874/>



The yard is also working on ships and vessels for the Indian Coast Guard, DCI, the Fisheries department and for other private companies. (Photo source: PTI)

## आकाश मिसाइल: क्या बीडीएल और बीईएल जैसे पीएसयू के खेल की कीमत चुकाएगी वायुसेना?

सार

- मिसाइल, मिसाइल कंटेनर और भारतीय वायु सेना
- प्रेशराइज्ड मिसाइल कंटेनर में उलझी है बीडीएल और बीईएल
- बीईएल ने कराई गुणवत्ता पर सवाल उठाने वाले कंटेनर की इंट्री
- वायुसेना को चाहिए बीडीएल का प्रेशराइज्ड मिसाइल कंटेनर

विस्तार

देश के सैन्यबल रक्षा साजो-सामान के लिए देश की पीएसयू पर निर्भर हैं और देश की पीएसयू मिसाइल कंटेनर के खेल में उलझी हैं। ताजा मामला वायुसेना का है। वायुसेना आकाश मिसाइल को युद्धक स्थान पर ले जाने के लिए प्रेशराइज्ड मिसाइल गैस कंटेनर चाहती है। वायुसेना की इच्छा भारत डायनामिक्स (बीडीएल) द्वारा तैयार गुणवत्ता वाले कंटेनर को पाने की है। वायुसेना से रिटायर एक वरिष्ठ अधिकारी के अनुसार बीडीएल का कंटेनर बीईएल के कंटेनर की तुलना में काफी उम्दा है। लेकिन बीडीएल सूत्रों के मुताबिक भारत इलेक्ट्रानिक्स लिमिटेड (बीईएल) के खेल ने वायुसेना के सपने पर पानी फेर दिया।

**बीईएल के प्रमुख ने माना कि नहीं बनाएंगे प्रेशराइज्ड मिसाइल कंटेनर**

डिफेंस एक्सपो-2020, लखनऊ... बीईएल के चेयरमैन और मैनेजिंग डायरेक्टर एमवी गौतमा। गौतमा ने आकाश प्रेशराइज्ड मिसाइल कंटेनर को वायुसेना की जरूरत के अनुरूप बना पाने में बीईएल की कमजोरी को स्वीकार कर लिया था। गौतमा ने कहा कि कंटेनर बनाकर सैन्य बलों को मिसाइल देने का काम बीडीएल का है। बीडीएल नहीं विकसित कर पाई, तब बीईएल ने यह बीड़ा उठाया था। गौतमा के अनुसार बीईएल ने कंटेनर को विकसित किया है। इसमें 50 साल तक लीकेज की समस्या नहीं आएगी।

यह हीलियम लीक टेस्टिंग में सफल है। हालांकि बीईएल चेयरमैन ने माना कि बीईएल का कंटेनर वजन में बीडीएल के कंटेनर से करीब 100 किग्रा भारी है। यूजर फ्रेंडली के मामले में भी बीईएल का कंटेनर कमजोर है और ट्रांसपोर्टेशन में भी थोड़ी समस्या आ सकती है। बीईएल के सीएमडी ने कहा कि यह कोई रॉकेट साइंस नहीं है और बीईएल कंटेनर नहीं बनाएगा। बीडीएल ने अब एक निजी कंपनी के सहयोग से कंटेनर तैयार करा लिया है। वायुसेना यदि उसको चाहती है तो आपूर्ति करे। बीईएल इसे नहीं बनाएगी।

**बीडीएल के सीएमडी सिद्धार्थ मिश्रा की सुनिए**

बीडीएल के सीएमडी ने भी डेफ एक्सपो में बताया कि बीडीएल ने प्रेशराइज्ड मिसाइल कंटेनर बनाने में कामयाबी पाई है। हम इसे इंड यूजर (सेना) को दे रहे हैं। सेना से कंटेनर को लेकर कोई शिकायत नहीं आई है। बीडीएल जल्द ही सेना को अगले लॉट की आपूर्ति करेगी। बीडीएल के एक अन्य अधिकारी ने माना कि टेस्टिंग के दौरान बीडीएल का प्रेशराइज्ड कंटेनर बीईएल के मुकाबले बहुत अच्छा है। इसमें गैस को भरना, होल्ड करना, आवश्यकता अनुसार डिफ्यूज करना आसान है। बीडीएल का कंटेनर लेह-लद्दाख के माइनस तापमान से लेकर पोखरण, लाठी, महाजन रेंज में भी फिट है।

## तो बीईएल ने ही कौन सा खुद कंटेनर बनाया?

बीडीएल के सूत्रों के मुताबिक बीईएल ने भी खुद कंटेनर विकसित नहीं किया है। उसने भी एक निजी कंपनी के सहयोग से ही विकसित कराया है। लेकिन बीईएल का कंटेनर भारी है। उसमें गैस को भरने, होल्ड करने और आवश्यकता अनुसार डिफ्यूज करने की प्रक्रिया जटिल है। बीडीएल के अधिकारियों की मानें तो वायुसेना ने बीईएल द्वारा पेश किए गए प्रेशराइज्ड गैस कंटेनर के मॉडल को रिजेक्ट कर दिया था। वायुसेना ने उसमें कई सुधार की जरूरत बताई थी और बीईएल उसे दूर नहीं कर पा रही थी। इसके लिए वायुसेना ने कई बार वायुसेना को अपने कंटेनर को सुधारने का समय दिया, लेकिन बीईएल उसे पूरा नहीं कर पाई।

## क्या है दोनों के प्रेशराइज्ड गैस कंटेनर में अंतर

सूत्रों से प्राप्त जानकारी के अनुसार वायुसेना के एयर वाइस मार्शल की अध्यक्षता में बीडीएल और बीईएल के कंटेनर की गुणवत्ता के लिए जांच कमेटी का गठन किया था। इस कमेटी ने पाया कि बीडीएल की तुलना में बीईएल का कंटेनर वजन में भारी, ट्रांसपोर्टेशन के लिहाज थोड़ी परेशानी वाला, युद्धकाल के समय में उपयोग में लाने में थोड़ा कठिनाई पैदा करता है। इससे काफी अधिक टोगल क्लैंप की सहायता से तैयार किया गया है। इसलिए इसके आपरेशन में समय भी ज्यादा लगेगा। वायुसेना के अधिकारी ने अपनी रिपोर्ट में लिखा है कि बीडीएल के कंटेनर के उपयोग के लिए एक वायुसैनिक पर्याप्त है। जबकि बीईएल के कंटेनर के लिए कम से कम दो वायुसैनिकों की आवश्यकता पड़ेगी।

रिपोर्ट में कहा गया है कि एयरक्राफ्ट के लैंडिंग के समय वायुमंडलीय दाब की बढ़ती आवस्था के बीच बीईएल के कंटेनर में विस्फोट संभव है। इसमें गैस का भरना और निकालना थोड़ा जटिल प्रक्रिया है। वायुसैनिक अधिकारी की रिपोर्ट के अनुसार एक एमटीवी में बीईएल के छह कंटेनर ही बमुश्किल ले जाए जा सकेंगे। जबकि बीडीएल के छह से अधिक कंटेनर आसानी से ले जाए जा सकते हैं। बीडीएल का कंटेनर, बीईएल के कंटेनर से कम वजनी है। यह एक बड़ी खासियत है और बीईएल को भी अपने कंटेनर को हल्का, इसी स्तर का विकसित करना चाहिए।

## अब देखिए नया खेल, बीडीएल के अधिकारी भी चुप हैं?

भारत डायनामिक्स लिमिटेड सेना, वायुसेना को मिसाइल की आपूर्ति करनी है। वायुसेना बीईएल से रक्षा साजो-सामान लेती है। आकाश मिसाइल प्रणाली में रडार और अन्य उपकरणों को विकसित करने में बीईएल का बड़ा योगदान है। इस तरह से वायुसेना बीईएल की उपभोक्ता है। बीडीएल के अधिकारी बताते हैं आकाश मिसाइल गैस कंटेनर उपलब्ध कराने में बीईएल ने यहां खेल कर दिया है। वह सीधे कंटेनर देने की जिम्मेदारी से पीछे हट गई, लेकिन जिस निजी कंपनी से कंटेनर विकसित कराया था, उसे आगे कर दिया है।

बीडीएल के अधिकारियों के अनुसार वायुसेना ने अभी भी बीईएल के कंटेनर को परीक्षण करके अनुमति नहीं दी है। बीईएल ने कंटेनर के लिए अनुमति लेने की खानापूर्ति भर की है। वरिष्ठ सूत्र का कहना है कि बीईएल के प्रेशर में वायुसेना के कंटेनर के लिए पुरानी शर्त पर 2020 में निविदा आमंत्रित की गई। इसमें बीडीएल और बीईएल द्वारा विकसित कराए गए कंटेनर ने प्रतिस्पर्धा में हिस्सा लिया और बीईएल का कंटेनर एल-1 आ गया है। इस तरह से भारतीय वायुसेना तुलना में खराब प्रेशराइज्ड मिसाइल कंटेनर लेने के लिए मजबूर हो गई है।

## क्यों चाहिए प्रेशराइज्ड मिसाइल गैस कंटेनर

मिसाइल को अनुकूल वातावरण देने के लिए प्रेशराइज्ड मिसाइल कंटेनर की जरूरत पड़ती है। कंटेनर में मिसाइल को नाइट्रोजन गैस के प्रेशर में अनुकूल तापमान देकर रखा जाता है। ताकि किसी तरह की नमी आदि के दुष्प्रभाव से मिसाइल को बचाया जा सके। रक्षा वैज्ञानिकों का कहना है कि इससे मिसाइल अधिक समय तक सुरक्षित और प्रयोग में लाने के योग्य रहता है। दुनिया के विकसित देश प्रेशराइज्ड मिसाइल गैस कंटेनर में ही अपनी मिसाइल का ट्रांसपोर्टेशन करते हैं। भारत में इससे पहले आकाश मिसाइल को सामान्य लोहे के कंटेनर में रखा जा रहा था, लेकिन सैन्य बलों की मांग, पूर्व रक्षा मंत्री मनोहर पारिकर के प्रयास ने इसे देश में अमली जामा पहनाया।

<https://www.amarujala.com/india-news/will-indian-air-force-pay-for-the-deeds-of-bdl-and-bel-psus-for-pressurized-missile-container?pageId=4>

## Pangong and Gogra not yet resolved, Army awaits talks

*The standoff at Pangong Tso and Patrolling Point 17A at Gogra, Army sources said, is still to be resolved and is likely to be the focus of the fifth round of talks at the level of the Corps Commander*

*By Krishn Kaushik*

Within hours of the Chinese Defence Ministry claiming that troops on both sides were gradually disengaging and the situation was moving towards de-escalation along the Line of Actual Control in Ladakh, sources in the Indian Army said there has been no positive movement on the ground for more than two weeks now.

The standoff at Pangong Tso and Patrolling Point 17A at Gogra, Army sources said, is still to be resolved and is likely to be the focus of the fifth round of talks at the level of the Corps Commander. The fifth round of talks since June 6 is expected in the next few days. The talks were expected Friday or over the weekend but there was no official word until Thursday evening.

Senior Colonel Ren Guoqiang, spokesperson for China's Ministry of National Defense, Thursday said China and India "have conducted effective communication and coordination through both diplomatic and military channels since the clash at the Galwan Valley region" and "at present, the situation in this region tends toward de-escalation, and the disengagement between the border troops of the two countries is gradually carried forward."

"We expect the Indian side will proceed from the overall situation of maintaining China-India relations and regional peace and stability, focus on cooperation, properly address differences, and earnestly promote the continuous development of the relations between the two countries and the two militaries along the correct direction of friendly cooperation," he said.

Responding to the remarks, Indian Army sources said there has been no further disengagement at Pangong Tso and PP 17A, two of four friction points. Nor has there been any change in the situation at Depsang Plains where Chinese troops have blocked Indians from accessing traditional patrolling limits.

There has been a stalemate since the last round of Corps Commander talks at Chushul on July 14.

Sources said there was mutual pullback of troops, after the third round of talks on June 30, at all four friction points—PP 14 in Galwan Valley, PP15 in Hot Springs sector, PP 17A in Gogra Post area, and Finger 4 on the north bank of Pangong Tso. At PP 17A and Pangong Tso, sources said, the disengagement has not been completed.

Around 50 troops on each side continue to remain within a kilometre of each other at PP 17A.

In Pangong Tso, the Chinese, after coming 8 km west of Finger 8 which India says marks the LAC, vacated the Finger 4 base area and stepped back towards Finger 5. They continue to occupy the ridgeline at Finger 4.

<https://indianexpress.com/article/india/india-china-border-dispute-pangong-gogra-army-6531667/>



A scenic view of Pangong lake in Ladakh can be seen through a small tower of stones collected by tourists on the banks of pangong lake. (Express photo by Shuaib Masoodi)

## If India wants to tire China out on LAC, it must build fortresses at these pressure points

*It would be prudent to formally inform the nation about the essentials of our strategy rather than let unnamed officials run riot with their imagination*

*By Lt Gen H S Panag (Retd)*

Keeping in view the differential in technological military capabilities between the Indian Army and China's People's Liberation Army, and the positional terrain advantage secured by the latter through its preemptive manoeuvre, it is a prudent strategy for India to persist with military and diplomatic engagement through an indefinite face-off to achieve the political aim — restoration of status quo ante April 2020. Even a strategy to achieve a compromised political aim — status quo ante with buffer zones where no patrolling, deployment or development of infrastructure will be carried out — would be pragmatic.

The logic of this strategy is simple — tire the Chinese out because it is difficult to sustain an indefinite large-scale deployment in this difficult terrain with extreme weather in winter. However, the danger is that if the Chinese come to sense India's strategy, they may raise the ante and attempt to seize Daulat Beg Oldi Sector and areas to the north-east and east of Pangong Tso.



File image of Indian soldiers in Ladakh (representational image) | By special arrangement

### Coercive military pressure

This strategy can only succeed by maintaining coercive military pressure, and not without “exerting any military pressure” as spelt out by the de facto official spokesperson quoted in a recent report in *The Indian Express*. I am sure this relatively junior government/military official has let his imagination run wild. This is almost signalling defeat and accepting fait accompli. I sincerely hope that this is not the view of the Narendra Modi government and the military hierarchy.

As per *The Indian Express* report on the situation at LAC, a government official was quoted as saying, “New Delhi has decided to stick to its strategy of ‘incremental change despite slow progress’ while pressing for the end-goal, the restoration of status quo ante as of April. It has also ruled out application of any kind of military pressure against China as an option, so as to avoid any inadvertent escalation.”

### The disturbing silence

It is unusual and disturbing that an anonymous “government official” is holding forth on national security strategy in a casual manner while the Prime Minister, Defence Minister, National Security Advisor, Chief of Defence Staff and the service chiefs remain silent. The only charitable explanation could be that these statements are part of strategic deception. But if that is the intent, such statements must be made formally at the Defence Minister/NSA/CDS level.

At the Friday meeting of the Working Mechanism for Consultation & Coordination on India-China Border Affairs, both sides agreed to hold further talks at the level of Corps Commander. Status quo continues to prevail at Depsang and north of Pangong Tso with no progress on disengagement. At Hot Springs and Gogra, the disengagement is not as per the agreement reached during earlier talks. It is only in the Galwan Valley that the troops have disengaged and a buffer zone of 4 km has been created.

On Tuesday, Chinese Foreign Ministry spokesperson Wang Wenbin highlighted the four rounds of Corps Commander-level talks and three meetings under the Working Mechanism for Consultation and Coordination on China-India Border Affairs. Wenbin said, “As border troops

have disengaged in most localities, the situation on the ground is deescalating and the temperature is coming down.” The statement indicates that China does not visualise any further disengagement.

### **Strategic and tactical significance of areas of intrusion**

The terrain of Eastern Ladakh is unique. Up to Leh and 150 km to the east, the terrain is extremely rugged with narrow valleys and surrounding hill ranges, varying in height from 15,000 to 23,000 feet. This topography also prevails up to 130 km north of Pangong Tso along the Shyok River up to Depsang plains and east of this line for 60-80 km. Beyond these areas is the extension of the Tibetan plateau. The valleys become broader, the base height rises to 14,000-15,000 feet, and surrounding hill ranges are a mix of rugged and relatively gradual terrain. The latter terrain is only 2,000-3,000 feet higher than the valleys and after reconnaissance, it can be negotiated by tracked and high-mobility vehicles.

Since peace prevailed along the LAC, it was not defended like the Line of Control (LoC), but only policed by the Indo-Tibetan Border Police (ITBP). The main defences of 3 Infantry Division were based on the Ladakh Range and Pangong Range in the Indus Valley and Chushul bowl, respectively. The DBO Sector being a plateau, the defences are based on relatively higher features. The Galwan Valley was only policed by the ITBP.

The main defences are based on the sound principle of dominating heights and convergence of avenues of approach. This left a forward zone of 10-80 km to the east, which was policed by the ITBP and kept under surveillance.

In the event of a war, this area was to be dominated by selective defensive/delaying positions and mechanised forces. While the bases of the formations are well to the rear, sufficient force was maintained near main defences for preemptive tasks on and across the LAC, particularly in areas of differing perceptions. However, we failed to exercise this option.

The LAC was based on the positions held by the rival forces at the time of the 1993 agreement. China's 7 November 1959 assertion (also known as 1960 claim line) north of Pangong Tso and in Depsang Plains was further west of the LAC by 10 and 20 km, respectively. The alignment of the 1959 claim line had been carefully planned by the Chinese. It is tactical in nature. It allows the PLA to cut off our forward deployment in all sectors and completely isolate all sectors from each other, particularly DBO Sector.

The preemptive intrusions and concentration of troops at Depsang, Galwan river, Hot Springs-Gogra-Kongka La and north of Pangong Tso places India at a disadvantage in a war. The DBO Sector is likely to be completely isolated by an offensive in Galwan River valley and the bottleneck area at Burtse. Hot Springs-Gogra-Kongka La area can be cut off at Phobrang by an offensive from Finger 4 and Ane La. This places us at the risk of losing our entire territory east and north-east of Pangong Tso along with the DBO Sector. Also, our major riposte options get restricted to Chushul Sector, Indus River Valley Sector and Chumar Sector.

### **Recommended operational strategy**

The strategy should be to strive for status quo ante with or without buffer zones with an indefinite “face-off” while simultaneously remaining poised with “fortress defence” of the areas likely to be isolated and attacked, and by maintaining a potent counter-offensive capability.

In execution, it implies fortifying the DBO-Galwan Sector, Hot Springs-Gogra-Kongka La-Tsogtsalu Sector and Marsimik La-Ane La-Phobrang- Fingers 1-3 Sector with overwhelming resources that must have an inbuilt tactical counter-offensive capability. The defences and habitat should be of a permanent nature. These sectors should be prepared to fight even when isolated. Main defences on Ladakh and Pangong Ranges must continue to be manned. Our reserves must be arrayed for an operational-level counter-offensive in Chushul/Indus River Valley/Chumar Sectors.

India's armed forces have the capability to execute the above strategy, which, apart from tiring the PLA out, caters to its escalation while maintaining a responsive or self-initiated capability for an operational-level offensive. It would be prudent to formally inform the nation about the essentials of our strategy rather than let unnamed officials run riot with their imagination.



(Lt Gen H S Panag PVSM, AVSM (R) served in the Indian Army for 40 years. He was GOC in C Northern Command and Central Command. Post-retirement, he was Member of Armed Forces Tribunal. Views are personal.)

<https://theprint.in/opinion/if-india-wants-to-tire-china-out-on-lac-it-must-build-fortresses-at-these-pressure-points/470795/>



Fri, 31 July 2020

## India-China border tensions | Indian Army to deploy 35,000 additional soldiers along LAC: Report

*The Indian Army has already sent thousands of troops to forward locations along the Line of Actual Control. The additional deployment comes amid slow withdrawal from the Chinese forces*

Amid delay in disengagement at the Line of Actual Control (LAC) with China, the Indian Army is preparing to deploy 35,000 additional soldiers in eastern Ladakh, according to a Bloomberg report.

After nearly three months of border tensions, both sides have said that troops are disengaging in most of the friction points. However, defence experts have expressed concern over the slow Chinese withdrawal from locations such as Pangong Tso. This disengagement followed several rounds of high level military talks.

Moneycontrol could not independently verify the report.

Tensions escalated to another level after 20 Indian Army soldiers, including an officer, had been killed in a violent face-off in Ladakh's Galwan Valley on June 15-16. There were casualties on the Chinese side too. However, that number is not clear.

Since then, the Indian Army has already sent thousands of additional troops to forward locations along the border.

The Indian Air Force (IAF) has also moved a sizeable number of its frontline Sukhoi 30-MKI, Jaguar, Mirage 2000 aircraft and Apache attack helicopters to several key air bases including Leh and Srinagar following the clashes.

Earlier this week, it was reported that the Indian Army had deployed a squadron of T-90 battle tanks and a full troop brigade at Daulat Beg Oldi (DBO) base.

This is to prevent possible Chinese aggression close to the Shaksgam-Karakoram pass axis, the report suggests. The troop brigade comprises 4,000 personnel.

The Chinese People's Liberation Army (PLA) has also reportedly deployed around 50,000 troops in Aksai Chin across the LAC.

<https://www.moneycontrol.com/news/trends/current-affairs-trends/big-story-centre-raises-excise-duty-on-petrol-and-diesel-5236001.html>

Fri, 31 July 2020

## The maritime implications of growing China-Iran strategic ties

By *Abhijit Singh*

Iran's recent decision to drop India from the Chabahar-Zahidan railway line project has been the subject of some consternation in Indian strategic circles. The development has generated disquiet in New Delhi, where some have questioned the timing of the move by Iran. As Indian observers see it, the railway line was part of a strategic endeavour: the development of Chabahar port and an associated rail-links to circumvent Pakistan and its traditional obstruction of India's overland routes into Central Asia and Afghanistan. Amidst US sanctions, as Delhi searched for suppliers and funding, Tehran suddenly (and unilaterally) decided to go it alone. Oddly, this comes at a time when China has made itself available to assist in the project.

More worrying for Indian watchers is the prospect of a comprehensive military and trade partnership between Iran and China. Beijing, ostensibly, has undertaken to invest \$400 billion in key sectors of Iran's economy, in return for an assured supply of Iranian fuel for the next 25 years. The proposed investment is the biggest China has ever pledged to any country as a part of its Belt and Road Initiative (BRI), and envisages huge expenditure in building Iran's oil and gas and infrastructure sector (\$280 billion and \$120 billion respectively). Beijing also plans to station over 5,000 Chinese security personnel to protect the investments in Iran.

The implications of a China-Iran strategic partnership are particularly stark in the maritime arena. According to a leaked 18 page draft agreement, parts of which were published by the *New York Times* last week, Chinese construction companies are set to initiate multiple infrastructure projects along Iran's Gulf coastline, including free-trade zones in Abadan, a city on the eastern bank of the Shatt Al-Arab River, and on the island of Qeshm, where Tehran is planning a major hub for oil production and storage. China will also build infrastructure at Jask, a port city just outside of the Strait of Hormuz, only 150 miles away from Gwadar, where a Chinese company has already developed and operating a port. Observers say a rudimentary Chinese naval presence at Jask could lead to greater joint military training and exercises between Iran, China and Pakistan, enhancing China's regional security profile.

To be sure, there is no cause for alarm yet. It is worth noting that the Iranian Revolutionary Guards navy (IRGCN), that is responsible for the waters of the Gulf, is opposed to any foreign naval presence at Iranian ports. The IRGCN controls the Imam Ali naval base in Chabahar, and also has a presence in Bandar-e-Jask and the island of Qeshm. An armed force of radicalized cadres loyal to Iranian Supreme Leader, Ayatollah Khomeini, the Republican Guards' Corps has a two point agenda: to protect the revolution and counter the United States. The IRGCN, that uses asymmetric tactics to harass the USN in the Straits of Hormuz, has been instrumental in keeping foreign military activity in Iranian ports to a minimum, and there have been no foreign bases on Iranian soil since 1979. As much as the Iran-China pact creates possibilities for greater Chinese influence in Gulf region, analysts say the IRGC leadership is unlikely to allow a substantial PLA presence in Iranian ports.

In the wider context of Western Indian Ocean region, however, the China-Iran agreement has greater significance. The PLA, which already possesses base in Djibouti, has been gradually expanding its military footprint on Africa's Eastern seaboard, and in the Northern Indian Ocean. A comprehensive strategic pact with Iran, analysts posit, could allow China to establish military presence along the Iran-Pakistan coastline; the PLA could even assist in the creation of a surveillance network to monitor US and Indian naval activity in the region. With the benefit of

Chinese support, and an oil terminal outside the Hormuz, Iran could also be emboldened into adopting a more aggressive stance inside the Persian Gulf.

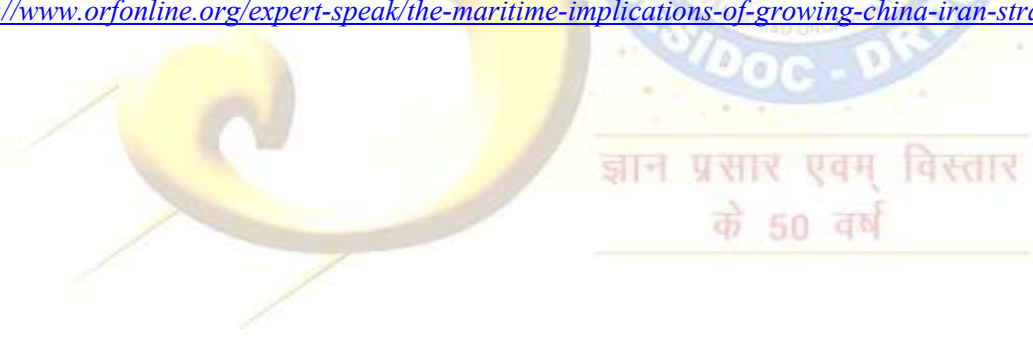
Notwithstanding the abundant caution the PLAN has displayed in the Gulf region so far, there has been an uptick in Chinese naval engagements with Iran and other regional states. Last year, the PLAN held a trilateral exercise with Iran and Russia, signaled a desire for greater presence in the Northern Indian Ocean. If Iran builds a permanent base in the Indian Ocean, as announced by the head of the IRGCN last year, analysts say Chinese warships could well be frequent visitors at the facility. A proposed tie-up between Gwadar and Chabahar, could exacerbate India's predicament. For the Indian navy, already troubled by the China – Pakistan maritime nexus, the development of China-Iran naval ties isn't good news

Expectedly, many in New Delhi are blaming the United States for the dip in Indian fortunes in Chabahar. The crisis of faith in India-Iran relations, they aver, could well have been avoided had Washington not systematically alienated Tehran. As US sanctions have forced India to reduce its oil imports from Iran, Tehran has lost faith in New Delhi as a reliable partner. What is more, pressure from the Trump Administration has forced the Iranian government's hand in ways that have hurt Indian interests.

This also highlights a contradiction in India's maritime relationship with the US: it's a relationship that works well in the Eastern Indian Ocean, where Indian and American interests neatly align, but is somewhat constrained in the Western Indian Ocean, where there is a divergence of perspectives. Importantly though, New Delhi's strategic interests are "weighted west": the oil flows are from west, the bulk of trade is west, as is the diaspora, and India major investments. Not only are India and the US badly coordinated in the Western Indian Ocean, observers say Washington's Iran policy actively impinges on Indian interests.

Policymakers in Washington and New Delhi must, then, recognize the need for better coordination on Iran. Greater Chinese naval presence in the Northern Indian Ocean in coming years raises the prospects of greater instability and elevated tensions in the Gulf region. The USN and IN have every reason to work together in the Western Indian Ocean, synergizing operations to preserve peace, even as they strive to exert strategic influence in the littorals.

<https://www.orfonline.org/expert-speak/the-maritime-implications-of-growing-china-iran-strategic-ties/>



ज्ञान प्रसार एवम् विस्तार  
के 50 वर्ष

### Scientists make quantum technology smaller

**Summary:**

*A way of shrinking the devices used in quantum sensing systems has now been developed.*

The UK government on Wednesday announced an early access agreement with GlaxoSmithKline (GSK) and Sanofi Pasteur for an estimated 60 million doses of an experimental new vaccine being tested to combat COVID-19.

A way of shrinking the devices used in quantum sensing systems has been developed by researchers at the UK Quantum Technology Hub Sensors and Timing, which is led by the University of Birmingham.

Sensing devices have a huge number of industrial uses, from carrying out ground surveys to monitoring volcanoes. Scientists working on ways to improve the capabilities of these sensors are now using quantum technologies, based on cold atoms, to improve their sensitivity.

Machines developed in laboratories using quantum technology, however, are cumbersome and difficult to transport, making current designs unsuitable for most industrial uses.

The team of researchers has used a new approach that will enable quantum sensors to shrink to a fraction of their current size. The research was conducted by an international team led by University of Birmingham and SUSTech in China in collaboration with Paderborn University in Germany. Their results are published in *Science Advances*.

The quantum technology currently used in sensing devices works by finely controlling laser beams to engineer and manipulate atoms at super-cold temperatures. To manage this, the atoms have to be contained within a vacuum-sealed chamber where they can be cooled to the desired temperatures.

A key challenge in miniaturising the instruments is in reducing the space required by the laser beams, which typically need to be arranged in three pairs, set at angles. The lasers cool the atoms by firing photons against the moving atom, lowering its momentum and therefore cooling it down.

The new findings show how a new technique can be used to reduce the space needed for the laser delivery system. The method uses devices called optical metasurfaces -- manufactured structures that can be used to control light.

A metasurface optical chip can be designed to diffract a single beam into five separate, well-balanced and uniform beams that are used to supercool the atoms. This single chip can replace the complex optical devices that currently make up the cooling system.

Metasurface photonic devices have inspired a range of novel research activities in the past few years and this is the first time researchers have been able to demonstrate its potential in cold atom quantum devices.

Dr Yu-Hung Lien, lead author of the study, says: "The mission of the UK Quantum Technology Hub is to deliver technologies that can be adopted and used by industry. Designing devices that are small enough to be portable or which can fit into industrial processes and practices is vital. This new approach represents a significant step forward in this approach."

The team have succeeded in producing an optical chip that measures just 0.5mm across, resulting in a platform for future sensing devices measuring about 30cm cubed. The next step will

be to optimise the size and the performance of the platform to produce the maximum sensitivity for each application.

**Story Source:**

[Materials](#) provided by [University of Birmingham](#). Note: Content may be edited for style and length.

**Journal Reference:**

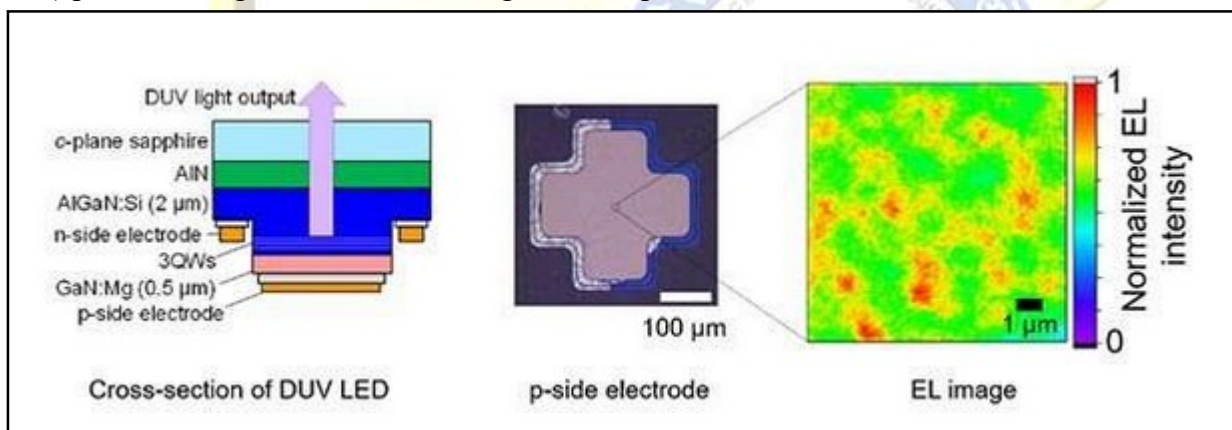
1. Lingxiao Zhu, Xuan Liu, Basudeb Sain, Mengyao Wang, Christian Schliekriede, Yutao Tang, Junhong Deng, Kingfai Li, Jun Yang, Michael Holynski, Shuang Zhang, Thomas Zentgraf, Kai Bongs, Yu-Hung Lien, Guixin Li. **A dielectric metasurface optical chip for the generation of cold atoms.** *Science Advances*, 2020; 6 (31): eabb6667 DOI: [10.1126/sciadv.abb6667](https://doi.org/10.1126/sciadv.abb6667)  
<https://www.sciencedaily.com/releases/2020/07/200729141420.htm>



Fri, 31 July 2020

## Faster LEDs for wireless communications from invisible light

Researchers have solved a major problem for optical wireless communications—the process by which light carries information between cell phones and other devices. Light-emitting diodes (LEDs) pulse their light in a coded message that recipient devices can understand.



Now, a team of researchers based in Japan has married the two options into the ideal combination of long lasting and fast LEDs. They published their results on July 22 in *Applied Physics Letters*.

"A key technology for faster modulation is to decrease the device size," says Kazunobu Kojima, Associate Professor, Institute of Multidisciplinary Research for Advanced Materials. "However, this tactic creates a dilemma: although smaller LEDs can be modulated faster, they have lower power."

Another issue is that both visible and infrared optical wireless communications can have significant solar interference, according to Kojima. To avoid confusion with visible and infrared solar light, the researchers aimed to improve LEDs that specifically communicate via deep ultraviolet light, which can be detected without solar interference.

"Deep ultraviolet LEDs are currently mass produced in factories for applications related to COVID-19," Kojima said, noting that deep ultraviolet light is used for sterilization processes as well as in solar-blind optical wireless communications. "So, they're cheap and practical to use."

The researchers fabricated the deep ultraviolet LEDs on sapphire templates, which are considered an inexpensive substrate, and measured their transmission speed. They found that the

deep ultraviolet LEDs were smaller and much quicker in their communications than traditional LEDs at that speed.

Researchers aimed to improve LEDs that specifically communicate via deep ultraviolet light, which isn't visible to the human eye.

"The mechanism underlying this speed is in how a lot of tiny LEDs self-organize in a single deep ultraviolet LED," Kojima said. "The tiny LED ensemble helps with both power and speed."

The researchers want to use the deep ultraviolet LEDs in 5G wireless networks. Many technologies are currently under testing to contribute 5G, and Li-Fi, or light fidelity, is one of the candidate technologies.

"Li-Fi's critical weakness is its solar dependency," Kojima said. "Our deep ultraviolet LED-based optical wireless technology can compensate for this problem and contribute to society, I hope."

**More information:** K. Kojima et al. Self-organized micro-light-emitting diode structure for high-speed solar-blind optical wireless communications, *Applied Physics Letters* (2020). DOI: [10.1063/5.0013112](https://doi.org/10.1063/5.0013112)

**Journal information:** [Applied Physics Letters](https://phys.org/news/2020-07-faster-wireless-invisible.html)  
<https://phys.org/news/2020-07-faster-wireless-invisible.html>

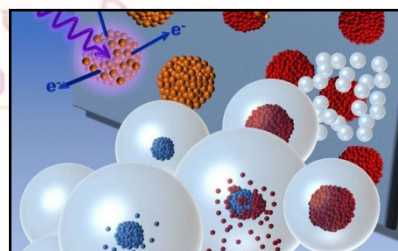


Fri, 31 July 2020

## Researchers synthesize nanoparticles tailored for special applications

Whether in innovative high-tech materials, more powerful computer chips, pharmaceuticals or in the field of renewable energies, nanoparticles form the basis for a whole range of new technological developments. Due to the laws of quantum mechanics, such particles measuring only a few millionths of a millimeter can behave completely differently in terms of conductivity, optics or robustness than the same material on a macroscopic scale. In addition, nanoparticles or nanoclusters have a very large catalytically effective surface area compared to their volume. For many applications this allows material savings while maintaining the same performance.

Researchers at the Institute of Experimental Physics (IEP) at Graz University of Technology have developed a method for assembling nanomaterials as desired. They let superfluid helium droplets of an internal temperature of 0.4 Kelvin (i.e. minus 273 degrees Celsius) fly through a vacuum chamber and selectively introduce individual atoms or molecules into these droplets. "There, they coalesce into a new aggregate and can be deposited on different substrates," explains experimental physicist Wolfgang Ernst from TU Graz. He has been working on this so-called helium-droplet synthesis for twenty-five years now, has successively developed it further during this time, and has produced continuous research at the highest international level, mostly performed in "Cluster Lab 3," which has been set up specifically for this purpose at the IEP.



The graph illustrates the stepwise synthesis of silver-zinc oxide core-shell clusters. Credit: IEP – TU Graz

### Reinforcement of catalytic properties

In *Nano Research*, Ernst and his team now report on the targeted formation of so-called core-shell clusters using helium-droplet synthesis. The clusters have a 3-nanometer core of silver and a 1.5-nanometer-thick shell of zinc oxide. Zinc oxide is a semiconductor that is used, for example, in radiation detectors for measuring electromagnetic radiation or in photocatalysts for breaking down organic pollutants. The special thing about the material combination is that the silver core provides

a plasmonic resonance, i.e. it absorbs light and thus causes a high light field amplification. This puts electrons in an excited state in the surrounding zinc oxide, thereby forming electron-hole pairs—small portions of energy that can be used elsewhere for chemical reactions, such as catalysis processes directly on the cluster surface. "The combination of the two material properties increases the efficiency of photocatalysts immensely. In addition, it would be conceivable to use such a material in water splitting for hydrogen production," says Ernst, naming a field of application.

### **Nanoparticles for laser and magnetic sensors**

In addition to the silver-zinc oxide combination, the researchers produced other interesting core-shell clusters with a magnetic core of the elements iron, cobalt or nickel and a shell of gold. Gold also has a plasmonic effect and also protects the magnetic core from unwanted oxidation. These nanoclusters can be influenced and controlled both by lasers and by external magnetic fields and are suitable for sensor technologies, for example. For these material combinations, temperature-dependent stability measurements as well as theoretical calculations were carried out in collaboration with the IEP theory group led by Andreas Hauser and the team of Maria Pilar de Lara Castells (Institute of Fundamental Physics at the Spanish National Research Council CSIC, Madrid) and can explain the behavior at phase transitions such as alloy formation that deviates from macroscopic material samples. The results were published in the *Journal of Physical Chemistry*.

Ernst now hopes that the findings from the experiments will be rapidly transferred into new catalysts "as soon as possible.

**More information:** Helium droplet assisted synthesis of plasmonic Ag@ZnO core@shell nanoparticles. *Nano Research* DOI: [10.1007/s12274-020-2961-z](https://doi.org/10.1007/s12274-020-2961-z)

Martin Schnedlitz et al. Thermally Induced Diffusion and Restructuring of Iron Triade (Fe, Co, Ni) Nanoparticles Passivated by Several Layers of Gold, *The Journal of Physical Chemistry C* (2020). DOI: [10.1021/acs.jpcc.0c04561](https://doi.org/10.1021/acs.jpcc.0c04561)

**Journal information:** [Nano Research](https://doi.org/10.1007/s12274-020-2961-z) , [Journal of Physical Chemistry A](https://doi.org/10.1021/acs.jpcc.0c04561) , [Journal of Physical Chemistry C](https://doi.org/10.1021/acs.jpcc.0c04561)  
<https://phys.org/news/2020-07-nanoparticles-tailored-special-applications.html>



ज्ञान प्रसार एवम् विस्तारम् *Fri, 31 July 2020*

## **First gene knockout in cephalopod achieved**

A team at the Marine Biological Laboratory (MBL) has achieved the first gene knockout in a cephalopod using the squid *Doryteuthis pealeii*, an exceptionally important research organism in biology for nearly a century. The milestone study, led by MBL Senior Scientist Joshua Rosenthal and MBL Whitman Scientist Karen Crawford, is reported in the July 30 issue of *Current Biology*.

The team used CRISPR-Cas9 genome editing to knock out a pigmentation gene in squid embryos, which eliminated pigmentation in the eye and in skin cells (chromatophores) with high efficiency.

"This is a critical first step toward the ability to knock out—and knock in—genes in cephalopods to address a host of biological questions," Rosenthal says.

Cephalopods (squid, octopus and cuttlefish) have the largest brain of all invertebrates, a distributed nervous system capable of instantaneous camouflage and sophisticated behaviors, a unique body plan, and the ability to extensively recode their own genetic information within messenger RNA, along with other distinctive features. These open many avenues for study and have applications in a wide range of fields, from evolution and development, to medicine, robotics, materials science, and artificial intelligence.

The ability to knock out a gene to test its function is an important step in developing cephalopods as genetically tractable organisms for biological research, augmenting the handful of species that currently dominate genetic studies, such as fruit flies, zebrafish, and mice.

It is also a necessary step toward having the capacity to knock in genes that facilitate research, such as genes that encode fluorescent proteins that can be imaged to track neural activity or other dynamic processes.

"CRISPR-Cas9 worked really well in *Doryteuthis*; it was surprisingly efficient," Rosenthal says. Much more challenging was delivering the CRISPR-Cas system into the one-celled squid embryo, which is surrounded by an exceedingly tough outer layer, and then raising the embryo through hatching. The team developed micro-scissors to clip the egg's surface and a beveled quartz needle to deliver the CRISPR-Cas9 reagents through the clip.

Studies with *Doryteuthis pealeii* have led to foundational advances in neurobiology, beginning with description of the action potential (nerve impulse) in the 1950s, a discovery for which Alan Hodgkin and Andrew Huxley became Nobel Prize laureates in 1963. For decades *D. pealeii* has drawn neurobiologists from all over the world to the MBL, which collects the squid from local waters.

Recently, Rosenthal and colleagues discovered extensive recoding of mRNA in the nervous system of *Doryteuthis* and other cephalopods. This research is under development for potential biomedical applications, such as pain management therapy.

*D. pealeii* is not, however, an ideal species to develop as a genetic research organism. It's big and takes up a lot of tank space plus, more importantly, no one has been able to culture it through multiple generations in the lab.

For these reasons, the MBL Cephalopod Program's next goal is to transfer the new knockout technology to a smaller cephalopod species, *Euprymna berryi* (the hummingbird bobtail squid), which is relatively easy to culture to make genetic strains.

**More information:** *Current Biology* (2020). DOI: [10.1016/j.cub.2020.06.099](https://doi.org/10.1016/j.cub.2020.06.099)

**Journal information:** *Current Biology*

<https://phys.org/news/2020-07-gene-knockout-cephalopod.html>



Fri, 31 July 2020

## Researchers discover a new and unique class of carbohydrate receptors

By Lisbeth Heilesen

An international team of researchers led by Aarhus University are the first to determine the crystal structure of an exopolysaccharide receptor. The results give insight into how plants and microbes communicate, and this knowledge can hopefully be used for more sustainable agriculture where microbes play an important role.

Exopolysaccharides (EPS) are surface-exposed carbohydrates that surround and protect bacteria and are involved in biofilm formation, cell-to-cell interactions, immune evasion, and pathogenesis. The structures and compositions of EPS synthesized by different bacteria are highly diverse and therefore a molecular fingerprint.

EPS also plays an important role for bacterial colonization and symbiosis with plants. Nitrogen-fixing soil bacteria (rhizobia) are recognized on the basis of their EPS when colonizing plant roots, judged compatible or incompatible by their legume host and allowed or denied access accordingly. The single-pass transmembrane Exopolysaccharide receptor 3 (EPR3) is responsible for monitoring EPS.



"To gain a deeper understanding of the function of this receptor, we needed to know what it looks like," says Jaslyn Wong, who conducted this research at Aarhus University. Unfortunately, attempts to determine the structure of the ligand-binding portion of EPR3 remained unsuccessful for years, but a breakthrough was finally achieved by using llama-derived nanobodies to obtain a crystal of the receptor.

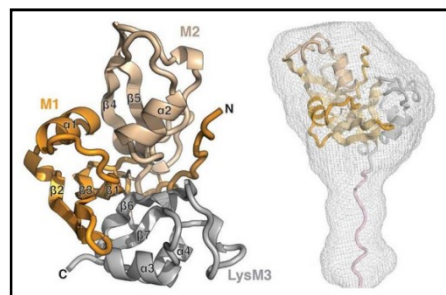
The structure revealed that EPR3 stands out from other members of the so-called LysM receptor kinases. EPR3 deviates in its ligand-binding domain from the canonical members of this receptor family and has a fold that is unique and novel for carbohydrate binding proteins.

"This is a good example of how a structure changes our view on the biology," says Kasper Røjkjær Andersen. "We are now able to demonstrate the existence of a completely new and structurally unique class of carbohydrate receptors and find that this class is conserved in the entire plant kingdom. We did not know this before we obtained the structure and this opens for a lot of exciting biology to understand the role of the receptor."

Jaslyn Wong adds, "Research on EPS receptors is still in its infancy, and I am excited about how this knowledge could be used and its potential implications on shaping microbiota for more sustainable agriculture."

**More information:** Jaslyn E. M. M. Wong et al, Structural signatures in EPR3 define a unique class of plant carbohydrate receptors, *Nature Communications* (2020). [DOI: 10.1038/s41467-020-17568-9](https://doi.org/10.1038/s41467-020-17568-9)

**Journal information:** [Nature Communications](https://phys.org/news/2020-07-unique-class-carbohydrate-receptors.html)  
<https://phys.org/news/2020-07-unique-class-carbohydrate-receptors.html>



The determination of the crystal structure of an exopolysaccharide receptor gives insight into how plants and microbes communicate and this knowledge can hopefully be used for more sustainable agriculture where microbes have an important role. Credit: Kasper Røjkjær Andersen



### ‘Two Indian companies in clinical trial phase for Covid-19 vaccine’: Health minister

*Health minister Dr Harsh Vardhan’s remarks came during the launch of the Compendium on ‘CSIR Technologies for Covid-19 Mitigation’ on Thursday Edited By Sparshita Saxena*

New Delhi: India has put up a strong fight against Covid-19 and continues to battle the pandemic with determination, Union health minister Dr Harsh Vardhan said during the launch of the Compendium on ‘CSIR Technologies for Covid-19 Mitigation’ on Thursday.

Dr Vardhan hailed the technological advancements and innovations by the Council of Scientific and Industrial Research (CSIR) against Covid-19 and lauded the hard work put in by the country’s scientists and experts.

“The Compendium covers a wide range of technologies and products for fighting Covid-19, spanning diagnostics, drugs, ventilators and PPEs using more than 100 technologies and 93 industry partners. Over 60 of these technologies have been transferred for commercial production,” he said.

Talking about the Covid-19 situation in the country, he said India is not behind in fighting the virus. “We have fought the pandemic in full force. Two Indian companies have reached the clinical trial phase for Covid-19 vaccine. It is a matter of pride,” the minister said. He also said that India is among five such nations that could isolate the Covid-19 virus.

Dr Vardhan lauded healthcare professionals, doctors, paramedics, among other ‘corona warriors’ of the country for their selfless fight against Covid-19.

The minister said that as a result of the country’s collective fight against the virus, India has one of the best Covid-19 recovery rates, around 64%, in the world while the fatality rate is also quite low. The health minister emphasised the improving rate of Covid-19 recovery in the country and said that over 10 lakh patients have beaten the virus across India. “Others are on a road to recovery as well,” Vardhan stated.

Dr Vardhan said that India has been supplying hydroxychloroquine to around 150 nations. “The virus is unpredictable, but we have been making strong effort to battle it,” he said.

The minister said that in the coming months, India plans to ramp-up the number of Covid-19 tests to 10 lakh daily. “In April, we were conducting just 6,000 tests on a daily basis, today, the figure has gone up to 5 lakh tests daily,” the minister noted.

<https://www.hindustantimes.com/india-news/two-companies-in-clinical-trial-phase-for-covid-19-vaccine-health-minister-lauds-india-s-effort-in-fighting-covid-19/story-7koR67m6hOzErtduKqfqNP.html>



Union Minister of Health Dr Harsh Vardhan. (ANI)

## Dr Reddy's to launch Covid drugs remdesivir and favipiravir in August

*Trying to boost acquired Wockhardt portfolio which saw sharp decline in sales during pandemic*

*By Sohini Das*

Mumbai: Hyderabad-based Dr Reddy's Laboratories (DRL) is gearing up for two major launches next month - injectable drug remdesivir for hospitalised Covid-19 patients, and oral drug favipiravir that is given to mild to moderate patients.

While the company admitted that its India revenues were hit due to lower prescription generation and a sluggish growth in the acquired Wockhardt portfolio, it is bullish on its Covid-19 portfolio nonetheless.

Apart from favipiravir and remdesivir, its key Covid-19 products, DRL has already launched nutraceutical products and hand sanitisers during the pandemic. Products like azithromycin (common antibiotic used in Covid) have also seen traction, DRL said.

Erez Israeli, Chief Executive Officer of DRL felt that these products are launched with a longer horizon in mind, not just targeted for the pandemic. Israeli, however, also felt that the Covid-19 health crisis was here to stay for at least another year or so which meant the Covid targeted products would continue to do well. "Unless a vaccine surprises us, the pandemic is here to stay at least for a year or so. Our data on favipiravir is showing it is a good product," Israeli said.

DRL is going to launch the innovator brand Avigan of favipiravir as part of a tie up it has with Japan's Fujifilm Toyama Chemical Co and Global Response Aid (GRA). Under the tripartite agreement signed on June 30, Fujifilm grants DRL the exclusive rights of manufacturing and also grants both DRL and GRA the rights to develop, sell and distribute Avigan in all countries other than Japan, China and Russia. In India DRL will have exclusive rights over Avigan, the innovator brand.

While Israeli did not wish to comment on the pricing of Avigan in India, he said that since they would have access to the clinical data from the innovator, they have the opportunity to market it to other countries. DRL has the rights to sell the drug overseas other than Japan, China and Russia.

As for remdesivir, the company is yet to get approval from the country's drug regulator. It, however, is preparing so that it can launch soon after it gets the nod.

Trying to boost acquired Wockhardt biz:

After DRL and Wockhardt agreed to a deal in February for 62 brands along with related sales and marketing teams and one manufacturing plant at Baddi, the pandemic forced the companies to renegotiate the deal. In the first quarter of FY21, DRL's India business fell 10 per cent on a YoY basis and by 8 per cent on a sequential basis.

Saumen Chakraborty, president and CFO of DRL admitted that the along with the Wockhardt portfolio, the decline is higher. He added that on a moving annual turnover basis, DRL would have done better than the industry but for the Wockhardt portfolio.

Chakraborty said that the sales of Wockhardt brands were considerably down in April. "For last financial year, the sales of these brands were Rs 480 crore. Since April sales was below even Rs 20 crore, we felt that it would not be prudent for us to go ahead with the acquisition at the earlier negotiated price of Rs 1850 crore," he said. The companies spoke mutually and came to consensus.

DRL agreed to pay Rs 1,483 crore on the closing date under the business transfer agreement. And DRL will hold Rs 300 crore on the closing date and will release it if revenue from the sales of these products during the 12month period (post closing) exceeds Rs 480 crore. DRL will have to pay twice the amount by which the revenue will exceed, Chakraborty said.

"The integration has been very fast and smooth despite the Covid situation. We feel these brands are ones we can revive and grow," he added. DRL is trying to grow the business fast and has no specific plans of rationalising the team that came from Wockhardt as of now.

"The primary goal is to sell more. We have better ability to invest in those brands. The team that came from Wockhardt is very good. We are always doing efficiency and productivity activities, but not specific to any group," Israeli said.

[https://www.business-standard.com/article/companies/dr-reddy-s-to-launch-covid-drugs-remdesivir-and-favipiravir-in-august-120072901691\\_1.html](https://www.business-standard.com/article/companies/dr-reddy-s-to-launch-covid-drugs-remdesivir-and-favipiravir-in-august-120072901691_1.html)



Fri, 31 July 2020

## **Covid-19 vaccine tracker, July 30: Russian vaccine to be ready by August 12**

***Coronavirus (COVID-19) vaccine tracker update: A Bloomberg report said the Gamaleya vaccine was likely to get “conditional registration” in August, meaning it would be approved for use, even as phase-III trials are carried out***

Pune: The Russian candidate vaccine for novel Coronavirus is back in the news again. According to report by *Bloomberg*, Russia was planning to ‘register’ its novel Coronavirus vaccine by August 10-12.

The vaccine, developed by Moscow’s Gamaleya Research Institute of Epidemiology and Microbiology, was likely to be approved for public use “within three to seven days of registration by regulators”, said the report.

This is the same vaccine that was, earlier this month, reported to have successfully completed human trials. Actually, at that time, in the second week of July, this candidate vaccine had only completed phase-I human trials. Its phase-II trials began on July 13, according to a report in TASS news agency at that time.

A vaccine is usually not approved for public use till it completes three phases of human trials, each of which, in normal circumstances, can run for several months.

It appears, however, that Russia was planning to finish phase-II trials early, and approve the vaccine for use, without phase-III trials.

The *Bloomberg* report said the Gamaleya vaccine was likely to get “conditional registration” in August, meaning it would be approved for use, even as phase-III trials are carried out. The production of the vaccine was expected to begin in September, the report said. Till the clinical trials are completed, the vaccine is likely to be administered only to health professionals, it said.

Phase-I trials assess the safety of the vaccine in human beings. It usually is carried out on small number of people, in the range of a few dozen, and runs from a few weeks to a few months. In phase-II, the vaccine’s ability to trigger immune response against the disease is assessed. In this phase, the vaccine is tested on a few hundred volunteers.

The third and final phase is usually conducted on several thousand volunteers. One group of volunteers are injected with the vaccine while another group is given a dummy vaccine. The volunteers go about their normal lives, and assessed a few weeks later to see whether the group that had been injected with the vaccine had shown any particular resistance to the infection. This phase can take several months.

Scientists and health experts warn against releasing a vaccine in haste, insisting that all safety and efficacy tests must be carried out before it is approved for use.

## **Serum's plans to start testing Oxford vaccine on Indians by August halted**

The plans of Pune-based Serum Institute of India to start testing the Oxford vaccine on Indian participants by August has hit a hurdle. An expert committee studying the firm's proposal for trials has asked it to make revisions. This means that the committee's approval for the trials has been deferred and it is unclear how long Serum would have to wait before it can begin testing the vaccine on Indian participants.

### ***What is this vaccine?***

Being developed by the Oxford University and AstraZeneca, this candidate vaccine is one of the front-runners in the global race to develop a vaccine against novel Coronavirus. Named ChAdOx1, this vaccine tries to use a weakened chimpanzee virus (adenovirus) to carry instructions to the cells in human bodies to recreate the spiky surface of the Covid-19 virus. Once this is done, the body's immune system is expected to recognise these foreign particles as a threat, and create antibodies so that attempts by the real Coronavirus to infect are thwarted.

This vaccine candidate is currently undergoing late stage human trials in the UK, Brazil and South Africa. Serum has an agreement with AstraZeneca to manufacture it for low and middle income countries.

### ***What is this expert committee, and why has it held back its approval?***

India's top drug regulatory body, the Central Drugs Standard Control Organisation (CDSCO), makes decisions related to clinical trials based on recommendations of subject expert committees (SECs). Serum's proposal was being studied by one such SEC.

In its application, Serum had proposed phase-II and phase-III trials on about 1,600 participants. The SEC has sought a demarcation between the two phases. While it is not yet clear whether the Pune-based firm was considering testing sites only in Pune and Mumbai, as it had indicated earlier, the SEC is learnt to have insisted that the test sites should be spread out all over the country.

The SEC is learnt to have recommended about eight amendments to Serum's application. This includes suggestions related to methods adopted to assess the ability of the candidate vaccine to invoke an immune response, and the firm's calculations to determine the number of volunteers the tests would be carried out on.

### ***What happens now***

Serum would have to make changes to its proposal and come back to the committee. If the SEC is satisfied it can then recommend the trials. Only after the SEC makes its recommendation, can the Drug Controller General of India, who heads CDSCO, would grant approval for conducting the trials in India.

## **Moderna vaccine induced "robust immune response" on animals, says study**

Moderna Therapeutics, a US biotech company considered one of the front-runners to produce a vaccine against novel Coronavirus, has published data from pre-clinical trials of its candidate vaccine in a peer-reviewed journal. The publication in *New England Journal of Medicine* says the candidate vaccine had elicited "robust immune response and protection" against the virus in the subjects.

Pre-clinical trials are conducted on animals. If successful, the vaccine is then tested on humans in three phases.

Moderna's candidate vaccine, named mRNA-1273 for the time being, has just entered the third and final phase of human trials. It has published findings of phase-I human trials as well, but these were based on preliminary data. The subjects on whom the vaccine is tried are followed up for several weeks to assess their condition.

Moderna's candidate was the first to get approval for pre-clinical trials, way back in February itself. The animals were given two doses of the candidate vaccine during the trial.

"After two vaccinations, the immune response observed in this non-human primate study was consistent with the recent Phase 1 human study of mRNA-1273, also published in *The New England Journal of Medicine*," the company said in a statement.

“This important preclinical study shows that mRNA-1273 protected against a high dose SARS-CoV-2 infection in non-human primates and prevented pulmonary disease in all animals, further supporting the clinical advancement of mRNA-1273,” the company said.

The interim analysis of phase-I human trials had found that the vaccine had triggered immune response in all the participants.

#### **The Story So Far**

- 25 candidate vaccines in human trials
- Five in Stage-III trials
- 139 candidates in pre-clinical trial stage
- Two Indian candidates in Stage-I trials

<https://indianexpress.com/article/explained/covid-19-vaccine-tracker-russia-oxford-moderna-6530179/>

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## **COVID-19 vaccine updates: delay on cards? Serum Institute asked to revise trial protocols**

*"The company on Tuesday was asked to clearly define phase 2 and phase 3 part of the protocol and resubmit their application for evaluation by the SEC," an official source said to PTI*

*Edited By Poulomi Ghosh*

**COVID-19 Vaccine Updates:** An expert committee, which was looking into Pune-based Serum Institute's proposal to start phase 2 and 3 trial of the Oxford vaccine, has now asked the firm to revise its protocols. Reports said the committee has suggested eight amendments to the firm's proposal.

Serum Institute sought to conduct a trial on 1,600 participants. The committee has sought additional information on this. It has also asked for more pan-India trials.

The firm has already submitted its revised protocols to avoid any delay.

“The company on Tuesday was asked to clearly define phase 2 and phase 3 part of the protocol and resubmit their application for evaluation by the SEC,” an official source said.

Serum Institute has partnered with AstraZeneca for manufacturing the Oxford vaccine candidate for COVID-19 had submitted its application to the DCGI on Friday, seeking permission for conducting the phase 2 and 3 trials of the potential vaccine ‘Covidshield’.

“According to the application, it would conduct an observer-blind, randomised controlled study to determine the safety and immunogenicity of ‘Covishield’ in healthy Indian adults. The firm said that around 1,600 participants of more than 18 years would be enrolled in the study,” a PTI report said.

Initial results of the first two-phase trials of the vaccine conducted in five trial sites in the UK showed it has an acceptable safety profile and homologous boosting increased antibody responses, a PTI report said. These vaccines will be for India and middle and low-income countries across the world (GAVI countries). The firm plans to start phase 2 and 3 human trials in India in August.

Oxford University recently had announced satisfactory progress with the vaccine, making it one of the leading ones among the dozens of vaccine candidates being developed around the world.

<https://www.india.com/news/india/covid-19-vaccine-updates-delay-on-cards-serum-institute-asked-to-revise-trial-protocols-4097914/>

## Single-shot COVID-19 vaccine protects non-human primates

*Findings lay groundwork for clinical development program*

### **Summary:**

***A leading COVID-19 vaccine candidate raised neutralizing antibodies and robustly protected non-human primates (NHPs) against SARS-CoV-2, the virus that causes COVID-19.***

The development of a safe and effective vaccine will likely be required to end the COVID-19 pandemic. A group of scientists, led by Beth Israel Deaconess Medical Center (BIDMC) immunologist Dan H. Barouch, MD, PhD, now report that a leading candidate COVID-19 vaccine developed at BIDMC in collaboration with Johnson & Johnson raised neutralizing antibodies and robustly protected non-human primates (NHPs) against SARS-CoV-2, the virus that causes COVID-19. This study builds on the team's previous results and is published in the journal *Nature*.

"This vaccine led to robust protection against SARS-CoV-2 in rhesus macaques and is now being evaluated in humans," said Barouch, who is Director of BIDMC's Center for Virology and Vaccine Research.

The vaccine uses a common cold virus, called adenovirus serotype 26 (Ad26), to deliver the SARS-CoV-2 spike protein into host cells, where it stimulates the body to raise immune responses against the coronavirus. Barouch has been working on the development of a COVID-19 vaccine since January, when Chinese scientists released the SARS-CoV-2 genome. Barouch's group, in collaboration with Johnson & Johnson, developed a series of vaccine candidates designed to express different variants of the SARS-CoV-2 spike protein, which is the major target for neutralizing antibodies.

Barouch and colleagues conducted a study in 52 NHPs, immunizing 32 adult rhesus macaques with a single dose of one of seven different versions of the Ad26-based vaccine, and giving 20 animals sham vaccines as placebo controls. All vaccinated animals developed neutralizing antibodies following immunization. Six weeks after the immunization, all animals were exposed to SARS-CoV-2. All 20 animals that received the sham vaccine became infected and showed high levels of virus in their lungs and nasal swabs. Of the six animals that received the optimal vaccine candidate, Ad26.COVS, none showed virus in their lungs, and only one animal showed low levels of virus in nasal swabs.

Moreover, neutralizing antibody responses correlated with protection, suggesting that this biomarker will be useful in the clinical development of COVID-19 vaccines for use in humans.

"Our data show that a single immunization with Ad26.COVS robustly protected rhesus macaques against SARS-CoV-2 challenge," said Barouch, who is also the William Bosworth Castle Professor of Medicine at Harvard Medical School, a member of the Ragon Institute of MGH, MIT, and Harvard, and a co-leader of the vaccine working group of the Massachusetts Consortium on Pathogen Readiness. "A single-shot immunization has practical and logistical advantages over a two-shot regimen for global deployment and pandemic control, but a two-shot vaccine will likely be more immunogenic, and thus both regimens are being evaluated in clinical trials. We look forward to the results of the clinical trials that will determine the safety and immunogenicity, and ultimately the efficacy, of the Ad26.COVS vaccine in humans."

Investigators at Beth Israel Deaconess Medical Center (BIDMC) and other institutions have initiated a first-in-human Phase 1/2 clinical trial of the Ad26.COVS vaccine in healthy volunteers. Kathryn E. Stephenson, MD, MPH, is the principal investigator for the trial at BIDMC, which is funded by Janssen Vaccines & Prevention, B.V., a pharmaceutical research arm of Johnson & Johnson.

Pending clinical trial outcomes, the Ad26.COVID.S vaccine is on track to start a phase 3 efficacy trial in 30,000 participants in September.

Co-authors included Noe D. Mercado, Abishek Chandrashekar, Jingyou Yu, Jinyan Liu, Lauren Peter, Katherine McMahan, Lisa H. Tostanoski, Esther A. Bondzie, Gabriel Dagotto, Makda S. Gebre, Xuan He, Emily Hoffman, Catherine Jacob-Dolan, Marinela Kirilova, Zhenfen Li, Zijin Lin, Shant H. Mahrokhian, Lori F. Maxfield, Felix Nampanya, Ramya Mityanandam, Joseph P. Nkolola, Shivanai Patel, John D. Ventura, Kaylee Verrington and Huahua Wan of BIDMC; Lucy Rutten, Rinke Bos, Danielle van Manan, Jort Vellinga, Jerome Custers, Johannes P. Langedijk, Ted Kwaks, Paul Stoffels, Mathai Mammen, Johan Van Hoof and Hanneke Schuitemaker of Janssen Vaccines & Prevention BV; Carolin Loos, Caroline Atyeo, Stephanie Fischinger, John S. Burke, Jared Feldman, Blake M. Hauser, Timothy M. Caradonna, Aaron G. Schmidt and Galit Alter of the Ragon Institute of MGH, MIT, and Harvard; Douglas A. Lauffenburger of Massachusetts Institute of Technology; David Martinez and Ralph S. Baric of University of North Carolina at Chapel Hill; Laurent Pessaint, Alex Van Ry, Kelvin Blade, Amanda Strasbaugh, Mehtap Cabus, Renita Brown, Anthony Cook, Serge Zouantchangadou, Elyse Teow, Hanne Anderson, and Mark G. Lewis of Bioqual; and Yongfei Cai and Bing Chen of Children's Hospital.

The authors declare no competing financial interests. Barouch, Zahn, Wegman, Rutten, Bos, Manan, Vellinga, Custers, Langedijk, Kwaks, and Schuitemaker are co-inventors on related vaccine patents. Zahn, Wegman, Rutten, Bos, Manan, Vellinga, Custers, Langedijk, Kwaks, Stoffels, Mammen, Van Hoof, and Schuitemaker are employees of Janssen Vaccines & Prevention BV and hold stock in Johnson & Johnson.

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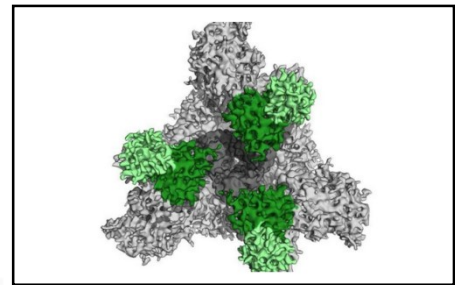


# Images of antibodies as they neutralize the COVID-19 virus

By Lori Dajose

As the COVID-19 pandemic spread across the globe in the first half of 2020, researchers worldwide worked around-the-clock to understand and combat it.

Caltech postdoctoral scholar Christopher Barnes is one of these researchers. In the laboratory of Pamela Björkman, the David Baltimore Professor of Biology and Biological Engineering, Barnes usually studies how the human body produces immune cells and specialized proteins called antibodies that can fight against the countless different strains of HIV. For the last few months, however, he has led the laboratory's COVID-19 research team and refocused the techniques used to study HIV on the novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).



A SARS-CoV-2 S trimer bound by a neutralizing antibody. Credit: C. Barnes / Björkman laboratory

Now, Barnes and his team have captured the first-ever images of antibodies, purified from the blood plasma of people who have recovered from COVID-19, latching onto a key protein on the SARS-CoV-2 virus. In addition, visualization of one exemplary antibody interacting with this protein has allowed the team to identify sites on the virus's surface that are particularly vulnerable to attacks from the immune system. A paper describing this research will be published in the journal *Cell* and is now available online.

## A Detailed Portrait of Antibodies and Virus

The human body can make countless types of antibodies, specialized proteins that target and neutralize viruses or other pathogens. In the same way that a soccer player can use numerous tactics to defend against an opposing player, an antibody can attempt to block a virus in many different ways. Some, however, are more effective than others. When an antibody effectively renders a virus unable to infect cells, it is called "neutralizing."

Barnes and Björkman search for variations of antibodies that can be "broadly neutralizing." In other words, they seek out antibodies that are effective against many variations of a kind of virus—or in the case of SARS-CoV-2, which does not vary as much as HIV, very potent neutralizing antibodies.

The team worked with longtime collaborators at Rockefeller University in New York City, which has been a major site of the COVID-19 outbreak in the United States. The laboratory of Michel Nussenzweig, led by research associate Davide Robbiani, took blood samples from people who had recovered from COVID-19. Upon receipt of these plasmas, Barnes and his colleagues aimed to isolate the unique mixture of antibodies in the samples from each person to discover which antibodies were best at fighting off SARS-CoV-2.

To understand where the coronavirus might be vulnerable, it helps to understand what the virus looks like and how it initiates infections. Each individual SARS-CoV-2 virus has large, spiky protein structures on its surface that give it a crown-like appearance, hence the name "coronavirus" ("corona" being the Latin word for crown). A virus uses its so-called spike (S) protein like a grappling hook, to grab onto a human cell and begin its invasion of that cell. An antibody that can block the S protein would thus be highly effective at preventing the virus from infecting cells.

Antibodies can attach to many different regions, or epitopes, of the S protein, leading to greater or lesser neutralization of the virus. As an analogy, if you want to prevent a poisonous snake from

biting, you might hold onto it by the tail, which would still allow the snake to strike you, or you might grab it near the head, reducing your chance of being bitten.

To discover which epitopes were the predominant targets for antibody reactions, Barnes and his team took detailed images of the purified patient antibodies as they interacted with the SARS-CoV-2 S protein. The researchers found that the patient antibodies bound to two distinct regions of the S protein, including one region, the so-called receptor binding domain (RBD), that is critical to the protein's ability to connect with the host cell.

"To our knowledge, this is the first time a team has imaged a mixture of antibodies purified from human blood after a viral infection to visualize the targets of those antibodies circulating in the recovered individual," says Barnes.

Barnes then focused on one particular type of antibody that showed a strong ability to neutralize the virus. He first purified a complex composed of the bound-together viral S protein and antibody, and then used a technique called single-particle cryo-electron microscopy to take images of the tangled entities—a process akin to imaging an entire beach while still being able to determine the exact locations of each grain of sand.

The RBD of the S protein can adopt two different orientations, called the "up" and "down" conformations. Barnes and his colleagues obtained the first-ever high-resolution images of a SARS-CoV-2 neutralizing antibody bound to the RBD in its "up" conformation.

Barnes found that the neutralizing antibody grabs onto the S protein's RBD at a position that overlaps with the part of the RBD that would latch onto a host cell; in this way, the antibody effectively blocks the S protein from infecting cells, and neutralizes the virus.

"Vaccines work by giving a person a piece of a pathogen and thereby inducing the body to make antibodies to that pathogen, so that any future infections cannot take hold. So a vaccine needs to be designed in a precise way to induce the human body to produce the most effective types of antibodies possible," explains Barnes. "Knowing which regions on the SARS-CoV-2 virus are particularly vulnerable to antibodies is really important for designing vaccines. And knowing which classes of antibodies are the most effective can help us design better antibody therapies."

"One thing that's particularly interesting about Christopher's structure is that it shows that the antibody, although strongly neutralizing, did not evolve for optimal binding to the SARS-CoV-2 S protein," says Björkman. "This suggests that these types of antibodies might not be hard to induce in a person's body by a vaccine. In addition, it suggests that it should be possible to use protein-engineering techniques to improve such antibodies for use as therapeutics."

### **The Intersection of Science and Scientists**

The COVID-19 pandemic has lent an urgency to this research, but the work, like all scientific endeavors, does not occur in a vacuum, isolated from other events occurring in the world; nor can scientists completely separate themselves from their experiences, good and bad, in and outside of the lab. Indeed, just as the team's paper was accepted for publication, another serious issue was on the minds of many researchers, including Barnes and his colleagues. On May 25, the death of George Floyd at the hands of Minneapolis police officers sparked national protests against police brutality and systemic racism. For Barnes, it was a difficult reminder of his own struggles with the racism he has faced in the world and in academia.

"I'll tweet about my work someday," Barnes wrote on his Twitter account, a few days after Floyd's death. "But today I choose to tweet about George Floyd, Ahmaud Arbery [a Black man shot and killed in February] and all the other brothers we've lost for no reason at all. #BlackLivesMatter."

"I am a scientist. I am a Black scientist. I've been on university campuses since 2004, and often, I've been the only African-American scientist in my whole building. Until I arrived at Caltech, I never had a Black male mentor that I could go to, to talk about both science and race and culture," Barnes says. "It's a difficult space to navigate when you have to compartmentalize yourself as a person, compartmentalize your emotions. We can't just hire people of color and then tell them to leave their culture, experiences, and humanity at the door. These current events are a perfect

illustration of this duality: Having to show joy and excitement to my colleagues over the posting of our paper, while aching with pain and sorrow on the inside from the constant reminder of the racist society in which we as Black people must exist."

"Academia, like all of America, is tainted by the racist structure that underlies everything in our society. As Black scientists, all of our experiences are affected by this and we bear this burden along with the responsibilities expected in our positions. To perform at this high level as a Black scientist requires one to be exceptional, exemplified by the work of Dr. Barnes," says Bil Clemons, professor of biochemistry at Caltech and, like Barnes, also a structural biologist. Clemons was Barnes's mentor upon his arrival to Caltech. In addition to leading his own group, Clemons serves as the chair of the President's Diversity Council at Caltech. "Dr. Barnes' research on HIV was already enough to demonstrate that he is ready for a faculty position. The rapid progress he has made on COVID-19 research, in the face of all our societal troubles, proves that he will be a leader of the next generation of academics."

A few days after Floyd's death, the Caltech Center for Inclusion & Diversity (CCID) hosted a virtual panel during which members of Caltech's African-American and Black community—students, faculty, and staff—shared some of their various experiences with an audience of nearly 1,000 members of the wider Caltech community. Clemons and Barnes both participated. The event was the first in a series of programs and conversations through which the Caltech community will discuss and assess the climate of inclusion.

"Sharing my story was an important first step for starting conversations with my peers, difficult conversations that I hope will continue throughout the years," says Barnes.

Caltech's Chief Diversity Officer, Cindy Weinstein, states: "Belonging is the essential foundation for happiness, creativity, and productivity. With this foundation, individuals and communities can reach their full potential; without it, they cannot. Caltech commits itself to equity, inclusion, and diversity and recognizes that these are the pillars upon which belonging is experienced, built, and sustained."

Indeed, in a memo to the Caltech community on July 6, Caltech's president and academic leadership provided an update on new steps the Institute will take "to ensure that we continuously create and reaffirm a campus in which it is evident, in all that we do, that Black lives matter, that Black minds matter," including increasing funding and programs for building the pipeline of students, postdocs, and faculty of color.

"We strive to become an example of how a diverse and inclusive community, committed to equity, permits individuals to thrive in fulfilling the Institute's mission of forefront research and education," the memo said.

A paper describing Barnes' research is titled "Structures of human antibodies bound to SARS-CoV-2 spike reveal common epitopes and recurrent features of antibodies."

**More information:** Christopher O. Barnes et al. Structures of Human Antibodies Bound to SARS-CoV-2 Spike Reveal Common Epitopes and Recurrent Features of Antibodies, *Cell* (2020). DOI: [10.1016/j.cell.2020.06.025](https://doi.org/10.1016/j.cell.2020.06.025)

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## Why in this race to Covid-19 vaccine the world will need more than one winner

*Even if an effective Covid vaccine is licensed, the manufacturing of doses for administration to world's population will need collaboration among manufactures*

*By Chandrakant Lahariya*

It has become clear that we have to learn to live with Covid-19, till an effective vaccine is available, and possibly after that as well. The upside amid this gloom is that the scientific community was never this enthusiastic about developing any other vaccine as it is today for Covid-19. In less than six months, nearly 180 vaccine candidates have been registered and nearly three dozen of these have entered the human trial stage. There are two vaccines in this race from India as well that have entered human clinical trial stage. Six vaccines have entered the phase III of clinical trials to assess their efficacy and two of these — one from University of Oxford in the UK and the other under development by Moderna in the United States — are being considered as front runners. The results from early-stage clinical trials of these vaccines have shown promising outcomes on safety and immunogenicity parameters. They have also generated both antibodies and T-cell responses.

### The stages

Vaccine research and development is a meticulous process, where pre-clinical studies in laboratories and on animals are followed by three phases of trials on human beings. The first phase of trial is focused on knowing whether the vaccine material is safe for administration in humans and if it is leading to the immune reactions it intends to (termed immunogenicity). The next two phases of clinical trials focus on safety, immune reaction or immunogenicity, and whether the vaccine content is generating sufficient levels of antibodies to protect the vaccinated individual from the disease — the efficacy.



(Representational image) A lab worker boxes up test tubes of patient samples in a virology research labs | Geert Vanden Wijngaert | Bloomberg File Photo

The key difference between phase II and phase III trials is that while the former is conducted on a smaller number of healthy people, the latter involves a larger group of people belonging to different age brackets. The number of people involved in Phase II trials are a few hundred while in phase III trials it can go up to a few thousand. The phase III trial of one of the candidate vaccine is being planned on 30,000 participants. At every stage, data is reviewed by an independent data safety monitoring board. The data and information from the each stage of trial is reviewed by independent data safety & monitoring board (DSMB) or an equivalent mechanism. The next stage of trials is started only after it meets certain predefined criteria such as safety and efficacy.

At every stage, there is a close watch. Very few vaccine candidates reach the next stage. Only one in every five to 10 vaccine candidates reach the next stage. The average time taken in vaccine development is around 10 years. It took India nearly 3 decades to develop the first indigenous rotavirus vaccine since the identification of the virus strain. Scientists across the world are still working to find an effective vaccine against HIV/AIDS since the virus was first identified around 4 decades ago.

### But Covid needs speed

What is happening in the case of Covid-19 vaccine development is indeed an accelerated attempt. The scientific community has stepped up to the challenge. The vaccine candidates were

identified within a few weeks of the full genome of the virus being made public on 11 January 2020. A number of vaccines are being attempted in ways that have never been deployed before. The scientists can be compared to the 15<sup>th</sup> century sea explorers who went on a voyage to find the 'new world'. All the routes were tried at and whoever was lucky found a new place. Vasco da Gama arrived in Goa and Christopher Columbus ended up on the shores of what we call today the US, thinking he had reached India. The scientific community is following a similar approach to find a vaccine for Covid-19. All of us hope that more than one of them succeeds.

Completion of all phases of trials, even an accelerated one, would take at least 6-9 months. The successful outcomes in trials are followed by approval of the licensing authorities in the countries where the vaccine will be used. The licensing authorities scrutinise and examine all the relevant data, before any vaccine is allowed to be marketed. Understandably, the processes take another 6-8 months. Although the processes have been accelerated in the case of Covid-19 vaccines, there is a limit to the development speed because licensing would mean mass-scale vaccination of millions of people, and hence, would require minimising the probability of error, which should be kept close to zero.

It is because of these limitations and requirements that many experts say the earliest a vaccine could be available for public use would be towards the mid of 2021. Furthermore, even if a safe and effective vaccine is licensed, the manufacturing of sufficient doses for administration to 800 crore people would require global collaboration among manufactures, and of course a lot of time. The governments have already started planning as to how the vaccine will be used. It is likely that the vaccine will not be available for everyone initially, and will only be offered to high-risk individuals such as health workers, elderly and people with co-morbidities.

A vaccine for public use and open access to wider public at affordable prices is unlikely to be available before 2023 or even later. So, it is important that while we hope for an early development, we continue to take preventive measures such as wearing face masks in public, regularly washing our hands with soap (or sanitise with alcohol-based disinfectant), following cough etiquettes and maintaining social distancing, which would continue to be key weapons in our fight against the Covid-19 disease.

The people of the country where the vaccine is developed are likely to have higher access. However, as a matter of solidarity, it has to be shared with other countries as well. This is a big reason why India needs to step up its efforts to develop the vaccine indigenously. Some of the efforts by Indian vaccine manufactures are promising and commendable.

### **Need to embrace vaccines**

Vaccine research, development and licensing is a meticulous process in India and all countries of the world. Vaccines are amongst the safest and effective public health interventions. Yet, unfounded doubts are raised against vaccines and these are not sufficiently used. In 2015-16, of every 10 children in India, around 4 did not receive licensed, available and safe vaccines offered completely free under government's Universal Immunisation Program. It is time we start putting our faith in existing and licensed vaccines, which remain grossly under-utilised. The use of vaccines among adults and other high-risk population also needs to be encouraged.

The Covid-19 vaccine will go through rigorous safety processes. This underscores that all existing vaccines, including those which were not developed with similar urgency had been licensed and made available after thorough review when found both safe and efficacious. As we wait for a Covid-19 vaccine so desperately, we also need to repose our faith in all licensed vaccines and encourage their use for a healthier society.

*(Chandrakant Lahariya is a New Delhi based epidemiologist, vaccine expert and public health specialist. Views are personal.)*

<https://theprint.in/opinion/why-in-this-race-to-covid-19-vaccine-the-world-will-need-more-than-one-winner/470772/>

