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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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*Tue, 24 Nov 2020*

## **Academic institutes to play major role in making Indian defence tech self-reliant: Satheesh Reddy**

Mangaluru: Academic institutes, R&D organisations and industry need to work together on the advanced and futuristic technologies to make India self-reliant in defence sector, according to Satheesh Reddy, Chairman, Defence Research and Development Organisation (DRDO).

Addressing the 18th convocation of National Institute of Technology Karnataka (NITK), virtually, he said academic institutions should be able to concentrate more on basic and applied research.

Research and development (R&D) organisations such as DRDO should concentrate on applied research and translational research and then make prototypes from the applied research. Taking inputs from the academic institutes' research, R&D institutes should carry it forward and then make a prototype, Reddy said.

He said, the industry should be in a position to adopt these technologies and have necessary infrastructure, and scale these up to market with sustained quality

If these three are able to play their role, then the country will be able to flourish and self-reliant, he said.

There is also need to focus on the areas of materials technology and advanced manufacturing technology to be self-reliant, he said.

DRDO is working with 295 academic institutes in the country. The centres of excellence in many of these institutes are working on the futuristic areas. He said that DRDO has invested around ₹1,000 crore in academic institutes to do the research in these areas.

DRDO, which has tied up with Union Education Ministry, has selected around 500 students from various academic institutes to work in its laboratories on defence related research problems, he said.

Ramesh Pokhriyal 'Nishank', Union Education Minister, spoke on the occasion.

K Umamaheshwara Rao, Director of NITK, welcomed the gathering and highlighted the achievements of NITK. K Balaveera Reddy, Chairman of the Board of Governors of NITK, presided over the convocation ceremony.

<https://www.thehindubusinessline.com/news/academic-institutes-to-play-major-role-in-making-indian-defence-tech-self-reliant-satheesh-reddy/article33162830.ece#>



Satheesh Reddy, Chairman, Defence Research and Development Organisation - The Hindu

## After Su-30 MKI, India to equip its LCA Tejas with indigenous, DRDO developed BVR ‘Astra Missile’

India is soon going to test its indigenously-developed BVR air-to-air missile ‘Astra’ from the Light Combat Aircraft ‘Tejas’, the Indian publication Times Of India reported. The missile has already seen successful integration with the Su-30MKI aircraft.

The step is seen as an important move inching closer towards the full operational capability of the missile with IAF’s fighter fleet and would replace the existing Russian, French, and Israeli BVR missiles in service.

The 21st-century aerial battles have shown the importance of beyond visual range engagements, a major capability gap for the Indian Air Force’s backbone fighter fleet operating the Su-30MKI.

The aircraft, however, does sport the Russian-made R-77 and R-27 medium/long-range BVR missiles, which are deemed to be insufficient and too expensive to meet the IAF requirements.

In 2019, it was reported that the service is considering to replace these Russian-origin missiles with Israeli I-Derby ER missile. To bridge the gap, the Indian Government had again ordered 400 latest-generation R-77 missiles last year.

In August 2020, the service also successfully test-fired a French-made MICA missile from the Su-30.

However, this time the star of the show is the Indian home-grown LCA Tejas, which is said to be developed with a ‘western approach’ to aircraft armament and avionics.

The aircraft itself was built specifically for the IAF requirements to replace the MiG-21 Bisons and would sport an array of advanced arsenal which includes Russian R-73 and R-77, Israeli Python-5 and I-Derby ER, the British ASRAAM, and last but not the least, the indigenous Astra family.

Similar in characteristics to the AIM-120 AMRAAM, the Astra has been one of the most high-priority projects with DRDO. The experience gained in its development has also facilitated other air-launched missile projects, like the NGARM (or now called, ‘Rudram-1’).

The missile, much like its carrier Tejas, had also seen many delays in its development when work started on it in 1990. According to the report, the missile has completed its ground tests and will begin flight testing with the LCA in the coming months.

The Astra, upon being integrated with other fighters as well, would be the IAF and IN’s standard BVR missile carried by the MiG-29UPG/MiG-29K, the Su-30MKI, the LCA Tejas, the Mirage-2000, and the future 5th-generation AMCA.

“Once the flight trials on Tejas are completed, large-scale orders will follow,” a source told TOI. The news comes at a time when orders for 83 Tejas Mk-1A is also on the verge of getting approval by the Government of India.

<https://eurasianimes.com/after-su-30-mki-india-to-equip-its-lca-tejas-with-indigenous-drdo-developed-bvr-astra-missile/>



## दुश्मन के लिए बचना होगा मुश्किल, तेजस से होगी अस्त्र मिसाइल की टेस्टिंग, जानें खासियत

भारत की पहली स्वदेशी हवा से हवा में मार करने वाली मिसाइल अस्त्र का परीक्षण जल्द ही स्वदेशी लड़ाकू विमान तेजस से किया जाएगा। हथियारों के मामले में यह मिसाइल देश के लड़ाकू बेड़े का मुख्य आधार बनेगा। ध्वनि की गति से भी ज्यादा तेज 4.5 मैक की रफ्तार से यह मिसाइल चार गुना ऊपर उड़ने वाली दृश्य श्रेणी की हवा से हवा में मार करने वाली मिसाइल (बीवीआरएएम) है। इसके टेस्टिंग की तैयारी की जा रही है। गुरुवार को वायुसेना के एक सूत्र ने कहा, " अगले कुछ महीनों में स्वदेशी लड़ाकू विमान तेजस पर इस मिसाइल का परीक्षण शुरू किया जाएगा।

इस मिसाइल की सबसे बड़ी खासियत है इसका सभी मौसम में हमला करने की सटीक क्षमता। यह मिसाइल दिन या रात किसी भी समय में लगभग 100 किमी की स्ट्राइक रेंज में दुश्मन के परखच्चे उड़ा सकता है। हालांकि इसकी रेंज को बढ़ाने की भी तैयारी चल रही है। इस मिसाइल के वायुसेना में शामिल हो जाने के बाद बेहद महंगी रूसी, फ्रांसीसी और इजरायल के BVRAAM की जगह लेगी जो वर्तमान में भारतीय वायुसेना के लड़ाकू विमानों के लिए आयात की जाती हैं।



DRDO की योजना अगले साल की पहली छमाही में 160 किमी की रेंज के साथ अस्त्र के मार्क -2 संस्करण का परीक्षण शुरू करने की भी है। सूत्रों के मुताबिक 350 किलोमीटर की सीमा के साथ-साथ अस्त्र मार्क-3 को बनाने की योजना पर भी काम चल रहा है। रूसी मूल के सुखोई-30 एमकेआई लड़ाकू विमानों पर पहले ही अस्त्र मार्क -1 का सफल परीक्षण किया जा चुका है। रक्षा मंत्री राजनाथ सिंह के नेतृत्व वाली रक्षा अधिग्रहण परिषद ने जुलाई में 288 मिसाइलों की खरीद के प्रारंभिक आदेश के लिए "जरूरी स्वीकृति" दे दी थी।

सुरक्षा विभाग से जुड़े एक सूत्र ने बताया कि "एक बार तेजस फाइटर जेट से सफल टेस्टिंग हो जाने पर वायुसेना बड़े पैमाने पर मिसाइल का ऑर्डर देगी। रक्षा PSU भारत डायनेमिक्स को लगभग 715 करोड़ रुपये प्रति मिसाइल के हिसाब से इन मिसाइलों का उत्पादन करना होगा। इस मिसाइल की टेस्टिंग ऐसे समय में हो रही है जब रक्षा क्षेत्र की बड़ी PSU कंपनी Hindustan Aeronautics Ltd को 83 तेजस मार्क-1 ए फाइटर जेट्स के लिए 37,000 करोड़ रुपये से अधिक का ऑर्डर भी मंजूरी के अंतिम कगार पर है। स्वदेशी फाइटर जेट के मामले में यह अब तक का सबसे बड़ा सौदा होगा।

वायुसेना अध्यक्ष एयर चीफ मार्शल आरकेएस भदौरिया ने पिछले महीने कहा था कि 31 मार्च को चालू वित्त वर्ष समाप्त होने से पहले 83 तेजस का सौदा हो जाएगा। आईएफ को फिलहाल 40,802 करोड़ रुपये के दो अनुबंधों वाले पहले 40 तेजस मार्क-1 जेट की डिलीवरी धीरे-धीरे मिल रही है।

भारत ने परमाणु-सक्षम अग्नि जैसी अंतरमहाद्वीपीय बैलिस्टिक मिसाइलों का विकास बहुत पहले ही कर लिया है जो 5,000 किलोमीटर से अधिक दूरी तक के लक्ष्यों को निशाना बना सकती हैं लेकिन अस्त्र को

विकसित करने के तकनीकी संघर्ष में वैज्ञानिकों को 16 साल लग गए। इसलिए यह देश की बड़ी उपलब्धि है।

भारत अब आखिरकार ऐसी जटिल बीवीआरएएम तकनीक को विकसित करने के बाद अमेरिका, रूस, फ्रांस और इजरायल जैसे देशों की श्रेणी में शामिल हो गया है। यह मिसाइल लंबे समय तक "काउंटर अटैक के साथ ही बेहद तेजी से दुश्मनों के सुपरसोनिक लड़ाकू विमानों का पता लगाने, उन पर नज़र रखने और उसे नष्ट करने में सक्षम हैं।

डीआरडीओ ने इस मिसाइल को लेकर कहा है कि अस्त्र के पास "उत्कृष्ट" ईसीसीएम (इलेक्ट्रॉनिक काउंटर) तकनीक है जो दुश्मनों के विमान, सक्रिय रडार हेड-ऑन और टेल-चेस" दोनों मोड में दुश्मनों पर भारी पड़ेगा। शॉट टू किल की उच्च क्षमता से लैस इस मिसाइल में दुश्मन के जैमर से भी निपटने की शक्ति है। इन्हीं खासियतों के बाद भारतीय वायुसेना ने अब इसे बेड़े में शामिल करने का मन बनाया है।

<https://www.aajtak.in/trending/photo/drdo-astra-air-combat-missile-to-be-soon-tested-from-tejas-fighter-jet-indian-air-force-tstk-1166179-2020-11-23-8>

## Airforce Technology

Tue, 24 Nov 2020

### India to begin flight trials of Astra BVRAAM on Tejas

India is set to begin flight trials of its Astra beyond visual range air-to-air missile (BVRAAM) on fighter aircraft Tejas.

A source was cited by The Times of India as saying that Astra missile on Tejas has virtually completed 'initial ground trials'.

The source was quoted as saying: "The flight trials of the indigenous missile on the indigenous fighter will begin within the next few months."

Astra is an all-weather, day and night missile capable of flying at Mach 4.5, which is more than four times the speed of sound.



It has a strike range of approximately 100km and will replace Russian, French and Israeli BVRAAMs equipped on the Indian Air Force (IAF) fighter jets.

In 2017, Astra completed development trials over the Bay of Bengal, off the coast of Chandipur in Odisha, India.

The sources added that the Defence Research and Development Organisation (DRDO) has planned to commence testing of the Mark-2 version of Astra next year.

Simultaneously, plans for an Astra Mark-3 with a range of 350km are also underway.

In 2016, light combat aircraft (LCA) Tejas reportedly conducted the first test-firing of a BVRAAM.

In a separate development, Chief of Air Staff Air Chief Marshal Rakesh Kumar Singh Bhadauria has flown the Light Combat Helicopter (LCH) in Bengaluru.

In 2017, HAL commenced the production of a LCH for the Indian military.

<https://www.airforce-technology.com/news/india-to-begin-flight-trials-of-astra-bvraam-on-tejas/>

## आजादी के बाद पहली बार भारत में बनेगा डिफेंस फैब्रिक

सूरत। मिलिट्री के लिए डिफेंस फैब्रिक अब तक चीन, ताइवान और कोरिया से मंगाया जाता था लेकिन आजादी के बाद पहली बार अब यह कपड़ा सूरत में तैयार होगा।

सूरत की टेक्सटाइल मिल को सेना से 10 लाख मीटर डिफेंस फैब्रिक तैयार करने का पहला ऑर्डर मिला है। डिफेंस रिसर्च एंड डेवलपमेंट ऑर्गनाइजेशन (DRDO) की गाइडलाइन पर यह कपड़ा तैयार हो रहा है। हालांकि पुलिस फोर्स, मिलिट्री के 50 लाख से अधिक जवानों के लिए हर साल 5 करोड़ मीटर फैब्रिक्स लगता है। लक्ष्मीपति समूह के एमडी संजय सरावगी के अनुसार DRDO, CII के दक्षिण गुजरात संगठन के पदाधिकारी और सूरत के कपड़ा उद्यमियों की सितंबर में वर्चुअल बैठक हुई थी। इसमें सूरत की टेक्सटाइल इंडस्ट्री से अनुरोध किया गया था कि वह देश की तीनों सेनाओं सहित विभिन्न सैन्य दलों की जरूरत का कपड़ा तैयार करे।



### दो महीने में तैयार होगा

दीपावली से पहले ही डिफेंस फैब्रिक का सैंपल टेस्टिंग के लिए भेज दिया गया था। अप्रूवल मिलने के बाद 5-7 बड़े उत्पादकों की मदद से यह कपड़ा तैयार किया जा रहा है। यह अगले दो महीनों में तैयार करना है। सरावगी के मुताबिक डीआरडीओ की गाइडलाइन के हिसाब से लैब और जरूरी दक्षता वाले श्रमिकों की व्यवस्था की। इसके बाद विशेष निगरानी में यह फैब्रिक तैयार किया गया।

हमारे लिए सबसे बड़ी चुनौती थी इसकी हाई टिनेसिटी (उच्च दृढ़ता) से कोई समझौता न हो इसलिए इसे हाई टिनेसिटी यार्न से ही तैयार किया जा रहा है। इसके बाद इसे पंजाब-हरियाणा की गारमेंट यूनिट को भेज दिया जाएगा। यहां प्रोसेसिंग के जरिये कपड़े की गुणवत्ता बढ़ाई जाएगी। इसके बाद इससे जूते, पैराशूट, यूनिफॉर्म और बुलेटप्रूफ जैकेट, बैग तैयार किए जाएंगे। मालूम हो, सूरत में देश की जरूरत का 65% कपड़ा तैयार होता है।

### डिफेंस फैब्रिक को हाथ से फाड़ना संभव नहीं

सुरक्षा क्षेत्र के लिए कपड़ा बनाने वाले उद्योग संचालकों का कहना है कि यह कपड़ा हाई टिनेसिटी यार्न से तैयार होता है। यह इतना मजबूत होता है कि इसे हाथ से नहीं फाड़ा जा सकता। DRDO के अंतर्गत आने वाली इंडस्ट्री इंटरफेस एंड टेक्नोलॉजी मैनेजमेंट के डायरेक्टर डॉ. मयंक द्विवेदी के अनुसार अब तक डिफेंस फैब्रिक विदेश से मंगवाते थे। समय की मांग को देखते हुए DRDO भी आत्मनिर्भर मंत्र को अपना रहा है।

<http://legendnews.in/defense-fabric-to-be-made-in-india-for-the-first-time-after-independence/>

## DRDO flags off first Varunastra HWT production unit for Indian Navy

*India's Defence Research and Development (DRDO) chairman and Department of Defence R&D secretary G Satheesh Reddy has flagged off the first Varunastra heavy weight torpedo (HWT) production unit*

India's Defence Research and Development (DRDO) Chairman and Department of Defence R&D secretary G Satheesh Reddy has flagged off the first Varunastra heavy weight torpedo (HWT) production unit.

The torpedo was flagged off during a ceremony conducted at the Bharat Dynamics Limited (BDL) unit in the Indian city of Visakhapatnam.

DRDO said in a tweet: "First Production unit of Heavy Weight Torpedo, (HWT), Varunastra, being produced by BDL Vishakhapatnam for Indian Navy is flagged off on 21 November 2020.

"The HWT is designed by the Naval Science and Technological Laboratory, DRDO. A major boost to #AtmaNirbharBharat."

Varunastra is a ship launched, heavyweight, electrically propelled anti-submarine torpedo.

It can be launched from ships that can fire heavy weight torpedoes to engage quiet submarines in deep and shallow waters.

The Indian Navy inducted the torpedo in 2016.

DRDO's Naval Science & Technological Laboratory (NSTL) has designed and developed Varunastra while BDL manufactured the torpedo for the Indian Navy.

BDL is also the production agency for quick reaction surface-to-air missile (QRSAM) and Astra air-to-air missile system.

Earlier this month, the Indian Navy's Kora-class guided missile corvette INS Kora (P61) fired an anti-ship missile (AShM) in the Bay of Bengal.

Last month, the Indian Ministry of Defence announced that the DRDO successfully flight tested the anti-submarine warfare system Supersonic Missile Assisted Release of Torpedo (SMART).

<https://www.naval-technology.com/news/drdo-flags-off-first-varunastra-hwt-production-unit-for-indian-navy/>



Admiral Sunil Lanba and Manohar Parrikar look at Varunastra during its handing off ceremony to the Indian Navy in 2016. Credit: Ministry of Defence/ Government of India.



## **MHA adopts multi-fold strategy to boost up Covid Fight**

New Delhi: The Ministry of Home Affairs (MHA) on Monday said that it has adopted a multi-fold strategy to combat Covid situation in the national Capital as the Defence Research and Development Organisation (DRDO) has started installation of 250 ventilators delivered by the Centre as part of its promise to help the Delhi government in its fight against the deadly virus.

The MHA, the nodal central agency to help the Delhi government during the coronavirus crisis, said these ventilators will be installed at the DRDO hospital near the Delhi airport.

The Bharat Electronics Limited had dispatched these 250 ventilators from Bengaluru three days ago and arrived here early on Sunday, said another official.

In order to boost the fight against Covid-19, Delhi's All India Institute of Medical Sciences (AIIMS) has also started the process to recruit 207 more Junior Resident (JR) doctors, the MHA said on Sunday.

The AIIMS is recruiting these additional doctors after filling up 194 vacancies of Junior Residents through online registration and recruitment in August.

More than 3.70 lakh people were surveyed on the first day of house-to-house Covid-19 survey in the capital. The survey is being done to find out the real picture vis-a-vis the prevalence of the deadly disease, official sources said on Sunday.

<https://www.daijiworld.com/news/newsDisplay.aspx?newsID=774325>



Tue, 24 Nov 2020

## At IAM, Bhadauria reiterates IAF's commitment to put doctors back into cockpit

*By Anantha Krishnan M*

Bengaluru: The much-awaited move to get Indian Air Force (IAF) doctors back in the cockpit is inching closer to reality. At the Institute of Aerospace Medicine (IAM) here, Chief of Air Staff Air Chief Marshal RKS Bhadauria reiterated IAF's commitment to resurrect the 'flying doctor' concept, part of the PilotPhysician Programme (PPP).

Addressing the 59th annual conference of the Indian Society of Aerospace Medicine (ISAM) at IAM recently, Air Chief Marshal Bhadauria spoke about the need to get medical professionals of the IAF back into the cockpit.

The practice discontinued in 1971, will now probably be back, with experts voicing the need to have flying doctors to meet the needs of the changing times.



Air Chief Marshal Bhadauria felt that when medical officers get into the cockpit, they will understand the changed scenario in modern military flying. The IAF Chief also had a sortie on the Light Combat Helicopter while in Bengaluru. Photo: IAF

“Very soon, hopefully we will have this programme going, where medical officers will be taken in for full training on fighters, transport fleet and helicopters. This will provide you a big opportunity,” Air Chief Marshal Bhadauria said.

This year's ISAM event, held under Covid-19 protocols, saw experts deliberating upon a range of topics including aerospace physiology, clinical and operational aerospace medicine, manned space mission and civil aviation medicine, to name a few.

The IAF Chief said that when medical officers get into the cockpit, they will understand the changed scenario and the needs of modern military flying.

Emphasizing on the need to bring the concept of flying doctors back, he said: “We used to have it a couple of decades back and it was very useful. For some reason maybe we thought we had probably learnt enough. Today when you undertake long combat missions, the situation is totally different. From 45 minutes to a one-hour mission two decades back, we have moved into regular 2-3 hour combat missions and training. That is how wars will be fought today,” Air Chief Marshal Bhadauria said.

With long duration missions becoming more common, with some even going beyond 10 hours, the IAF top brass want to put in place measures to address the needs of pilots, through inputs from the medical fraternity.

“There is a need to interact and there is a need to understand the cockpit. Our shift in philosophy would happen only when you (medical officers) see it upfront and see it yourself. This teamwork I think will go a long way in not only revising our methodology, but coming out with new processes and new ways of tackling situations,” he said.

The IAF Chief opined that doctors would soon get in-depth operational experience when they start flying on IAF assets on a regular basis.

“When you join this team, you are in not only as a pilot in this field but you will be in as a full operational pilot for all tasks that are conducted and you will be a part of the team that will fly across,” he added.

Keeping in mind India’s Human Space Programme (HSP) Gaganyaan, the IAF Chief urged his colleagues at IAM to lock on to future space programmes along with the Aircraft and Systems Testing Establishment (ASTE).

“A lot of things were done in a hurry this time because we were running out of time. For the future this is one area that needs to be kind of institutionalized for design and development and for follow-up,” he said.

The IAF Chief said that the four astronauts-select currently undergoing training in Russia were doing extremely well.

He also added that aviation medical specialists, flight test crew and support crew from IAM and ASTE will be playing critical roles in all future space programmes.

On the much-discussed topic of sleep deprivation among aircrew at ISAM events every year, the IAF Chief felt that the more the issue is debated, the better the solutions that would emerge.

“Last year we ensured that we posted aviation medicine doctors to every single combat squadron and thereafter we have taken up other important flying squadrons too. These are measures that will change the game. We have to be open about how we are going to handle these issues,” he said.

Air Chief Marshal Bhadauria said that with fast-changing technology, the support system in the aircraft, the cockpit, and the understanding of aviation medicine too has undergone rapid changes.

“A lot can be done in terms of medicine and flying. In the years ahead, we need to get the crew back not only as early as possible, but find ways and means of administering medicine and continuing to fly, especially when there are twin cockpit operations,” he added.

The concept of flying doctors goes back a long time. Aviation history points towards John Jeffries, an American physician who had his first voyage in a hot-air balloon with his balloonist friend in November 1784. Later, in 1911, Lt Luigi Falchi, an Italian medical officer, was the first acclaimed military pilotphysician to have own a heavier-than-air aircraft.

A senior IAF official told Onmanorama that the ‘flying doctor’ will be able to give solutions to aeromedical safety concerns with both new aircraft and old aircraft.

“The US Navy was resorting to incorrect usage of oxygen systems in F-18s, which was leading to fainting spells in the air. They suspected a tech problem. But it took extensive flying by a flying

doctor to realize that it was faulty usage of the oxygen system that was creating the problem,” the official said.

*(The writer is an independent aerospace and defence journalist, who blogs at Tarmak007 and tweets@writetake.)*

<https://www.onmanorama.com/news/nation/2020/11/23/iaf-chief-bhadauria-commitment-to-put-doctors-back-into-cockpit.html>



Tue, 24 Nov 2020

## HAL kicks off crucial testing of jet trainer that may have missed IAF bus

*The spin flight testing of the much-delayed jet trainer is being seen as a developmental milestone even though there is no indication from the IAF about a possible order*

*By Rahul Singh*

New Delhi: State-owned plane maker Hindustan Aeronautics Limited (HAL) on Monday announced that it has kicked off a crucial developmental test of a jet trainer that was planned as a replacement for the Indian Air Force’s ageing Kiran aircraft fleet.

The spin flight testing of the much-delayed Sitara intermediate jet trainer (IJT) --- or the HJT-36 single-engine aircraft --- is being seen as a developmental milestone even though there is no indication from the IAF about a possible order. The IJT project is running late by several years.



The delay in the IJT programme, conceived more than two decades ago, has upset the IAF’s calculations, officials said (Courtesy- HAL)

“The spin testing of an aircraft is the most crucial phase of its flight testing. The testing will be gradually progressed to assess the behaviour of the aircraft till six turn spins to either side to meet the targeted requirement,” the HAL said in a statement. HAL test pilots Group Captain HV Thakur (retd) and Wing Commander P Avasti (retd) conducted the tests on Monday.

Spin is a manoeuvre an aircraft gets into on its own when its controls are mishandled. Spin testing seeks to prove that the IJT can do a spin and recover safely from it, experts said. During the first flight test, the aircraft was taken through one turn spin to the left and right to test the spin characteristics, HAL said.

Rookie pilots in IAF go through a three-stage training involving the Pilatus PC-7 MkII planes, Kiran trainers and finally the Hawk advanced jet trainers before they can fly fighter jets. As the Kirans are approaching the end of their service life, some amount of stage-2 training is already being done on the PC-7.

Experts doubted if the IAF would order the IJT as it was a case of “too little, too late.”

The delay in the IJT programme, conceived more than two decades ago, has upset the IAF’s calculations, officials said. The project was sanctioned in July 1999 with a grant of Rs 180 crore. The IJT, first powered by a French engine and now a Russian one, was expected to get initial operational clearance by 2006 with deliveries to the IAF planned a year later.

HAL said the IJT has been redesigned for the spin test “by moving the vertical tail aft and extending the rudder surface.” “These changes (made) for ensuring satisfactory spin behaviour required extensive redesign of the rear fuselage and the rudder. The changes have been incorporated in two aircraft with the involvement and clearance from certification agencies at every stage,” the statement said.

After being modified, the two aircraft underwent significant flight tests to assess the general handling with the new configuration of fin and rudder, and the jets have been incorporated with the necessary safety devices (anti-spin parachute systems), it said.

Meanwhile, the IAF plans to buy the basic trainer aircraft from HAL to train rookie pilots. The defence ministry, in August, gave its go-ahead to the purchase of 106 Hindustan Turbo Trainer-40 (HTT-40) aircraft from HAL to provide a push to the government's Atmanirbhar Bharat Abhiyan' (self-reliant India movement).

<https://www.hindustantimes.com/india-news/hal-kicks-off-crucial-testing-of-jet-trainer-that-may-have-missed-iaf-bus/story-3OQe4Ac1KrgsBm0FsBc2K.html>

INDIA  
TODAY

Tue, 24 Nov 2020

## Amid Ladakh standoff, Indian Army Chief Gen Naravane kicks off 3-day trip to Eastern Command formations

*Indian Army chief Gen MM Naravane will review operational preparedness of troops in forward areas under the Eastern Command formation which guards India's borders with China*  
By Manjeet Singh Negi

New Delhi: Indian Army chief General MM Naravane kicked off his three-day visit to Eastern Command formations on Monday. With its headquarters in Kolkata, the Eastern Command of the Indian Army is responsible for guarding India's borders with China in Arunachal Pradesh as well as the Sikkim sectors besides several other areas.

During his visit, Gen Naravane will review the operational preparedness of troops deployed in forward areas. The Army chief's Eastern Command visit comes at a time when the India-China military standoff along the Line of Actual Control (LAC) in eastern Ladakh is on the verge of entering month-eight.

"General MM Naravane #COAS proceeded on a three-day visit to Army formations of #EasternCommand to review the security situation and operational preparedness," Indian Army said in a tweet on Monday.

Earlier this month, Chief of Army Staff Gen MM Naravane undertook an aerial survey of India's border outposts (BOPs) in the Tawaghat sector near the India-China border in Uttarakhand. The aerial survey was initiated from Mana, the last Indian village near the India-China border in Uttarakhand's Chamoli district.

Responding to questions about the India-China standoff earlier this month, External Affairs Ministry (EAM) spokesperson Anurag Srivastava said that communication through military and diplomatic channels is underway to resolve the situation.

India and China have, through the course of the past few months, held multiple diplomatic and military talks to attain disengagement and de-escalation in eastern Ladakh. A violent clash between Chinese People's Liberation Army (PLA) troops and Indian Army soldiers led to casualties on both sides in Galwan Valley earlier this year.

<https://www.indiatoday.in/india/story/amid-ladakh-standoff-indian-army-chief-gen-naravane-kicks-off-3-day-trip-to-eastern-command-formations-1743491-2020-11-24>



File photo of Chief of Army Staff Gen MM Naravane (Photo Credits: PTI)

# Chushul heights and why India must dispel thoughts of a disengagement tradeoff with China

*Any thought of trading commanding Chushul heights on Kailash range for a couple of Fingers overlooking the Pangong Lake is insane*

*By Ashok K. Mehta*

The Chinese are delaying the announcement of dates for the ninth military dialogue as some People's Liberation Army commanders feel disengagement sought by them may be seen as loss of face even as there are reports of fresh incursion in the form of a Chinese village near Doklam in Bhutan.

According to Indian sources New Delhi will react only to presence of PLA and let Bhutan sort out Chinese civilian intrusion.

The government (and military) will be committing a strategic blunder if it were to agree with the Chinese proposal leaked to the media about vacating the dominating Chushul heights on Kailash range as part of a selective disengagement and de-escalation process on north and south bank of Pangong Lake. Curiously, Army Chief Gen M.M. Naravane hopes this will be a 'mutually beneficial' pact.



Indian Air Force's Apache helicopter is seen in the Ladakh region, September 17, 2020. Photo: Reuters/Danish Siddiqui

Given that accuracy of leaks is inevitably suspect, China had wanted Indian forces to withdraw from Chushul heights and the Chinese from the Fingers area to positions they held earlier, with India moving first. The Chinese nationalistic tabloid, *Global Times* has reported that China will withdraw from North Bank only when India vacates South Bank.

This sequence of withdrawal has been rejected by India which believes in the principle 'first in first out,' or as the Chinese like to put it, 'those who tie the knot must untie it'. With trust and protocols buried in Galwan, India will be forfeiting the only overwhelming military advantage it has over China's multiple pressure points, especially at Depsang, the albatross around Daulat Beg Oldie.

The Indian tragedy about the Chinese aggression across LAC is that even after seven months, no one from government has spelt out the scale of PLA perfidy. That there is a Chinese proposal was confirmed by External Affairs Minister S. Jaishankar in mid-October (and Gen Naravane later) when he informed the media but refused to disclose details as it was 'confidential'.

Print and electronic media have attributed their stories to unnamed government and military officials who have communicated different versions of events like hot air balloons over Pangong Lake to test these ideas. Four versions were floated:

First, withdrawal of heavy weapons and equipment like tanks and guns from rear areas. This was de-escalation sans disengagement.

The second was disengagement from North and South Banks of Pangong Lake including tanks and guns.

The third included disengagement from all friction points except Depsang.

And the fourth was withdrawal covering all areas including Depsang.

After the eighth military commanders' meeting on November 6 it was reported that the ninth military dialogue to be held shortly would tie up the loose ends of the withdrawal so that it could

start in mid December. As roads will be snow-covered and passes closed on the Indian side, only limited air withdrawal will be possible.

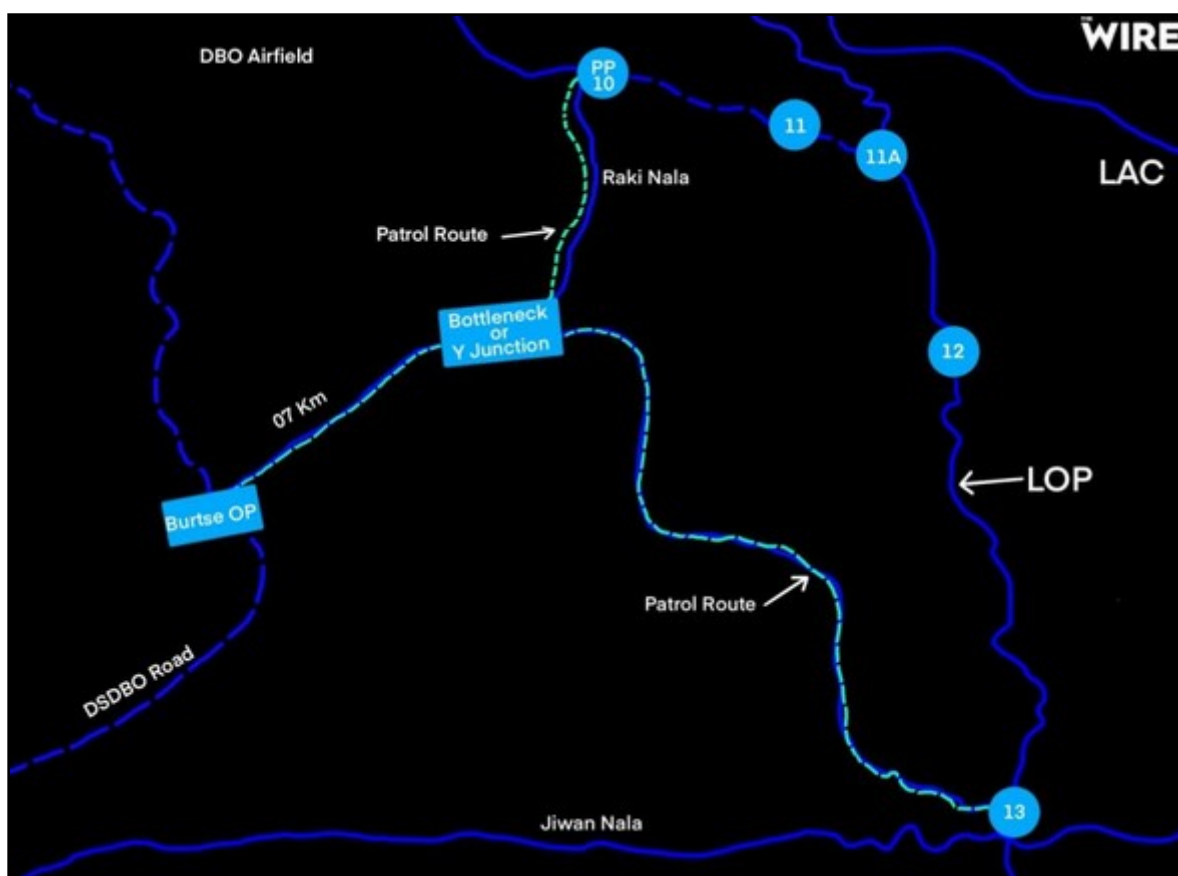
The three-step withdrawal plan confined to both banks of Pangong Lake consists of

a) Removal of heavy weapons from both banks of the lake;

b) Full vacation by PLA from North Bank from Fingers 4 area, back to the original Finger 8. Similarly Indian Army will pull back to Dhan Singh Post near Finger 3. The area between Fingers 4 and 8 will become a buffer zone;

c) Vacation of Chushul heights by Indian Army followed by PLA from Black Top. Withdrawal will include dismantling of structures on North Bank like barracks, fortifications, jetties, etc.

The partial implementation of the first and only China-imposed disengagement plan culminating in the Galwan clash has placed Indian Army in tactically adverse positions. In Galwan, Indian garrison was pushed back beyond Shyok river; only cosmetic disengagement was carried out in Hot Spring-Gogra areas and none at all in Fingers area where Chinese encroachment and domination were significant. The intrusion at Depsang, which is 18 km deep, was not even discussed.



The PLA has denied the Indian Army's patrols access to five patrol points – PP 10, 11, 11a, 12 and 13 – by blocking them at Bottleneck/Y junction around 18 km inside the LAC. Map: The Wire.

The PLA has established a blockade preventing Indian forces from patrolling upto their traditional patrolling points. Add to this infamous Chinese diktat, the proposed patrolling ban between Fingers 4 and 8, and a new buffer zone will pop on the Indian side of LAC. The Chinese have declared a virtual lockdown. This is not a happy situation to be in with the Chinese clearly calling the shots.

The question is: does the current proposal constitute a complete and comprehensive disengagement and de-escalation across all intrusion points or is it confined to the Pangong Lake area?

If as it seems it is the latter, India will be committing high altitude hara-kiri by abandoning strategic heights on Kailash range which are on Indian side of LAC and ground which was defended feebly in 1962.

The Indian Army is probably visualising some difficulty in maintaining 3,000 troops at 18,000 feet with temperatures ranging from between -20°C and -40°C and with winter yet to set in. Gen Naravane clarified there was no shortage of winter clothing and equipment and according to US sources 30,000 winter kits have been supplied by Pentagon. Stocking and maintaining supply chains nearly 200 km beyond Leh with passes closed and roads snowed out is not easy.

With much shorter interior lines, it took more than a decade to stabilise the survival status in Siachen. Up at unfamiliar forbidden heights, the Chinese have a more fundamental problem: finding acclimatised troops for the harsh winter though they are occupying only one or two posts including Black Top near the Kailash range. Chinese do not normally occupy posts along LAC.

The degree of difficulty in holding such formidable heights notwithstanding the overwhelming moral and strategic benefits far outweigh the teething problems in holding them. The commanding Chushul heights provide direct observation over PLA Moldo garrison and Spanggur Gap which was used by the Chinese for the November offensive in 1962. Withdrawal from Kailash range will only benefit the Chinese as it would surrender a high value bargaining chip for negotiations especially removal of Depsang.

For the Chinese, the Special Frontier Force seizure of strategic heights on Kailash range was like snatching victory from the jaws of defeat. After failing to evict SFF, the PLA managed to secure a foothold near Indian posts on Kailash range with symbolic presence on Black Top. The SFF did not occupy Black Top as it was across LAC and would have violated protocols. The Chinese are rattled and getting the Kailash range vacated has become an obsession.

The latest Chinese ploy is reporting that PLA has used microwave weapons (direct energy weapons) against Indian posts on Kailash, dissolving the withdrawing of Indian troops and occupying the posts. This is PLA's latest salvo of psychological warfare through fake news.

With the breakdown in trust and faith, the probability of Chinese seizing vacated heights after disengagement is highly likely. Suspicion of Pakistan committing such travesty following a proposed demilitarisation in 2005 had deterred the Indian Army from quitting Saltoro Ridge on Siachen. On extreme heights like Kailash range and Siachen, mere occupation of crest line is victory, as dislodging the holder off heights is near impossible. As news of likely withdrawal from Kailash range is gaining traction, military commanders and veterans are crying foul and calling it a sell out. The ultimate vacation of Chushul heights must be part of the return of status quo ante April 2020 and it must include Depsang.

The framework of the comprehensive disengagement and de-escalation mechanism should include a joint statement by the two foreign ministers outlining steps towards its implementation in a time bound manner with a verification and monitoring mechanism. Any thought of trading commanding Chushul heights on Kailash range for a couple of Fingers overlooking the Pangong Lake is insane.

*General Ashok K. Mehta was part of the monitoring team of Defence Planning Staff in MoD of the year long PLA intrusion at Sumdorong chu in 1987/88.*

<https://thewire.in/diplomacy/india-china-ladakh-chushul-heights-pangong-lake-disengagement>



## Thales, Kanpur's MKU to jointly make night vision devices for armed forces in UP: MSME Minister

Lucknow/Noida: Uttar Pradesh cabinet minister Sidharth Nath Singh on Monday said French multinational company Thales Group will collaborate with Kanpur-based MKU to make night vision devices in the state for armed forces, according to a statement.

The project will take place as part of UP Defence Industrial Corridor, said Singh, the Minister for Micro, Small and Medium Enterprise (MSME), Export Promotion, Investment Promotion, among others, while inaugurating the corporate office of the India unit of Thales Group in Noida.

The minister also requested Thales Group to invest in UP to make parts of fighter jets and assured of support of the state government.

Thales' country head Emmanuel de Roquefeuil, French Ambassador to India Emanuel Lenain and Thales' India, Africa and Central Asia representative Jean Marc Budin were also present during the event.

"Virtually opened #Thales India HQs in Noida. 6 storey, 1100 employees with state of art green building. Was delighted to hear the views of Ambassador of France to India Mr. Emmanuel Lenain in building relationship with #UP," the minister tweeted.

He said the opening of the multinational company's office in Noida will be a boost for Prime Minister Narendra Modi's call for "Aatmnirbhar Bharat" and Chief Minister Yogi Adityanath's call for "Aatmnirbhar Uttar Pradesh", according to the statement.

"Thales has proposed to make night vision devices for the armed forces in association with Kanpur-based defence company MKU and work is under progress over the proposal," Singh was quoted as saying in the statement.

Besides, Thales will also work as a major engineering centre for work on digital identity and security business. It will also assist the state in skill development for locals apart from developing high-standard technology, he added.

"Thales is working alongside HAL, BHEL, L&T in India in the technology sector. This makes it clear that the opening of Thales' office in UP will be a boost to the state's aspiration for becoming "aatmanirbhar" (self-reliant) in the defence sector," he said.

Earlier, MNCs and foreign-based firms preferred to invest in south Indian states, but over the last three years they have increasingly shown interest in UP as an investment destination, he added.

He also praised the leadership of the chief minister which he said has resulted in the state jumping from 12th spot to second in the country in terms of ease of doing business.

Thales' India head Emmanuel de Roquefeuil said the group is working in 68 countries in the technology sector, employs around 83,000 people and has an annual turnover of approximately USD 20 billion, according to the statement.

*(Disclaimer: This story has not been edited by Outlook staff and is auto-generated from news agency feeds. Source: PTI)*

<https://www.outlookindia.com/newscroll/thales-kanpurs-mku-to-jointly-make-night-vision-devices-for-armed-forces-in-up-msme-minister/1980866>

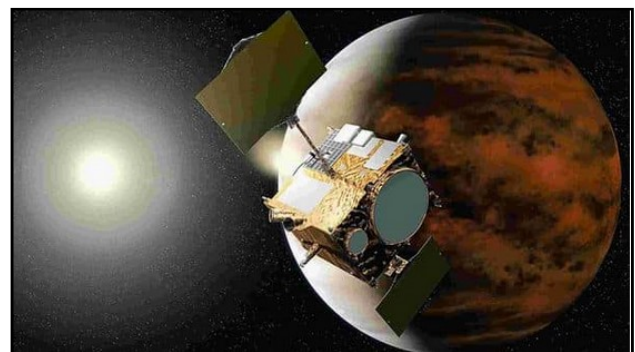
## ISRO's Venus mission attracts international payload proposals: 10 things to know

- *The proposal includes 'collaborative contributions' from Russia, France, Sweden and Germany*
- *ISRO was earlier eyeing June, 2023 for the country's first mission to Venus*

The Indian Space Research Organisation (ISRO) has short-listed 20 space-based experiment proposals, including from France, for its proposed Venus orbiter mission 'Shukrayaan' to study the planet for more than four years.

These include "collaborative contributions" from Russia, France, Sweden and Germany, sources in the Bengaluru- headquartered space agency told news agency PTI.

"But we are currently reviewing this mission timeline due to delays arising from the pandemic situation", an ISRO official said. "Future launch opportunity is either in 2024 or 2026". It was noted that the optimal launch window (when Venus is closest to the Earth) comes about every 19 months.



A concept image of 'Akatsuki' preparing to enter orbit around Venus.[jaxa/akihiro ikeshita](http://jaxa/akihiro_ikeshita)

### Here is all you need need to know on ISRO's proposed Venus mission "Shukrayaan":

- ISRO was earlier eyeing June, 2023 for the country's first mission to Venus.
- Of the Indian and international payload proposals it received in response to an announcement of opportunity for novel space-based experiments to study Venus, ISRO has short-listed 20.
- "These 20 payload (scientific instruments) proposals, including collaborative contributions from Russia, France, Sweden and Germany, are currently under review", the ISRO official said.
- The one already selected, according to French space agency CNES, is France's VIRAL instrument (Venus Infrared Atmospheric Gas Linker) co-developed with the Russian space agency Roscosmos, and the LATMOS atmospheres, environments and space observations laboratory attached to the French national scientific research centre CNRS.
- "Swedish Institute of Space Physics is engaged with India's mission to Venus", sources said. According to ISRO, scientific objectives of ISRO's Venus mission are investigation of the surface processes and shallow subsurface stratigraphy; and solar wind interaction with Venusian Ionosphere, and studying the structure, composition and dynamics of the atmosphere.
- Venus is often described as the "twin sister" of the Earth because of the similarities in size, mass, density, bulk composition and gravity. It is believed that both planets share a common origin, forming at the same time out of a condensing nebulosity around 4.5 billion years ago, ISRO had noted in its announcement of opportunity.
- Venus is around 30% closer to the Sun as compared to Earth resulting in much higher solar flux. Exploration of Venus began in the early 1960s. Venus has been explored by flyby, orbiter, a few lander missions and atmospheric probes.

- "In spite of great progress made in exploring Venus, there still exist gaps in our basic understanding about surface/sub-surface features and processes, super rotation of Venusian atmosphere and its evolution and interaction with solar radiation/solar wind", ISRO had said.
- The payload capability of the proposed 2500-kg satellite, planned to be launched onboard GSLV Mk II rocket, is likely to be 175 kg with 500W of power. The proposed orbit is expected to be around 500 x 60,000 km around Venus. This orbit is likely to be reduced gradually, over several months to a lower apoapsis (farthest point).

<https://www.livemint.com/science/news/isro-s-venus-mission-attracts-international-payload-proposals-10-things-to-know-11606123781117.html>



Tue, 24 Nov 2020

## Scientists make sound-waves from a quantum vacuum at the Black Hole laboratory

Researchers have developed a new theory for observing a quantum vacuum that could lead to new insights into the behavior of black holes.

The Unruh effect combines quantum physics and the theory of relativity. So far it has not been possible to measure or observe it, but now new research from a team led by the University of Nottingham has shed light on how this could be achieved using sound particles. The team's research has been published today in the journal *Physical Review Letters*.



Credit: Pixabay/CC0 Public Domain

The Unruh effect suggests that if you fly through a quantum vacuum with extreme acceleration, the vacuum no longer looks like a vacuum: rather, it looks like a warm bath full of particles. This phenomenon is closely related to the Hawking radiation from black holes.

A research team from the University of Nottingham's Black Hole Laboratory in collaboration with University of British Columbia and Vienna University of Technology has shown that instead of studying the empty space in which particles suddenly become visible when accelerating, you can create a two-dimensional cloud of ultra-cold atoms (Bose-Einstein condensate) in which sound particles, phonons, become audible to an accelerated observer in the silent phonon vacuum. The sound is not created by the detector, rather it is hearing what is there just because of the acceleration (a non-accelerated detector would still hear nothing).

### The vacuum is full of particles

One of the basic ideas of Albert Einstein's theory of relativity is: Measurement results can depend on the state of motion of the observer. How fast does a clock tick? How long is an object? What is the wavelength of a ray of light? There is no universal answer to this, the result is relative—it depends on how fast the observer is moving. But what about the question of whether a certain area of space is empty or not? Shouldn't two observers at least agree on that?

No—because what looks like a perfect vacuum to one observer can be a turbulent swarm of particles and radiation to the other. The Unruh effect, discovered in 1976 by William Unruh, says that for a strongly accelerated observer the vacuum has a temperature. This is due to so-called virtual particles, which are also responsible for other important effects, such as Hawking radiation, which causes black holes to evaporate.

"To observe the Unruh effect directly, as William Unruh described it, is completely impossible for us today," explains Dr. Sebastian Erne who came from the University of Nottingham to the Atomic Institute of the Vienna University of Technology as an ESQ Fellow a few months ago. "You would need a measuring device accelerated to almost the speed of light within a microsecond to see even a tiny Unruh-effect -we can't do that." However, there is another way to learn about this strange effect: using so-called quantum simulators.

### **Quantum simulators**

"Many laws of quantum physics are universal. They can be shown to occur in very different systems. One can use the same formulas to explain completely different quantum systems," says Jörg Schmiedmayer from the Vienna University of Technology. "This means that you can often learn something important about a particular quantum system by studying a different quantum system."

"Simulating one system with another has been especially useful for understanding black holes, since real black holes are effectively inaccessible," Dr. Cisco Gooding from the Black Hole laboratory emphasizes. "In contrast, analog black holes can be readily produced right here in the lab."

This is also true for the Unruh effect: If the original version cannot be demonstrated for practical reasons, then another quantum system can be created and examined in order to see the effect there.

### **Atomic clouds and laser beams**

Just as a particle is a 'disturbance' in empty space, there are disturbances in the cold Bose-Einstein condensate—small irregularities (sound waves) that spread out in waves. As has now been shown, such irregularities should be detectable with special laser beams. Using special tricks, the Bose-Einstein condensate is minimally disturbed by the measurement, despite the interaction with the laser light.

Jörg Schmiedmayer explains: "If you move the laser beam, so that the point of illumination moves over the Bose-Einstein condensate, that corresponds to the observer moving through the empty space. If you guide the laser beam in accelerated motion over the atomic cloud, then you should be able to detect disturbances that are not seen in the stationary case—just like an accelerated observer in a vacuum would perceive a heat bath that is not there for the stationary observer."

"Until now, the Unruh effect was an abstract idea," says Professor Silke Weinfurter who leads the Black Hole laboratory at the University of Nottingham, "Many had given up hope of experimental verification. The possibility of incorporating a particle detector in a quantum simulation will give us new insights into theoretical models that are otherwise not experimentally accessible. "?"

Preliminary planning is already underway to carry out a version of the experiment using superfluid helium at the University of Nottingham. "It is possible, but very time-consuming and there are technical hurdles for us to overcome," explains Jörg Schmiedmayer. "But it would be a wonderful way to learn about an important effect that was previously thought to be practically unobservable."

**More information:** Cisco Gooding et al, Interferometric Unruh Detectors for Bose-Einstein Condensates, *Physical Review Letters* (2020). DOI: [10.1103/PhysRevLett.125.213603](https://doi.org/10.1103/PhysRevLett.125.213603)

**Journal information:** *Physical Review Letters*  
<https://phys.org/news/2020-11-scientists-sound-waves-quantum-vacuum-black.html>

## Six years in 120 pages: Researchers shed light on Ricci flows

By Zhang Nannan

Differential geometry is the study of space geometry. Multiple natural phenomena, from universal expansion to thermal expansion and contraction, can come down to spatial evolution. The two core conjectures in this field, the Hamilton-Tian conjecture and the Partial  $C^0$  conjecture, were unsolved puzzles for more than 20 years.

"Most of the pebbles on the beach are round. They might have had edges and corners at first, but as time goes by and the tide ebbs and flows, their shape will get closer and closer to perfection and standard. But no matter how perfect the evolution is, there might still be some abnormalities, which are called 'singularities' in geometry."

"The Hamilton-Tian Conjecture suggests that most of the space is perfect, while the size of the 'singularity' can be restricted to a low-dimensional space," said Prof. Chen Xiuxiong, the founder of the Institute of Geometry and Physics, University of Science and Technology of China (USTC) of the Chinese Academy of Sciences (CAS).

Prof Chen, alongside with Prof. Wang Bing from USTC, first proved the two conjectures.

Their paper was split into 123 pages in two parts of, the first of which was published in 2017 and the second this year on *Journal of Differential Geometry*, which also published Hamilton's fundamental work on Ricci flow after a long course of five years of developing the theory and six years of peer-reviewing since its first submission.

This work emphasized the weak compactness theory for non-collapsed Ricci flows. It introduced many innovative thoughts and methods, which contributed far-reaching implications in the field of geometric analysis, especially for the studies of Ricci flows.

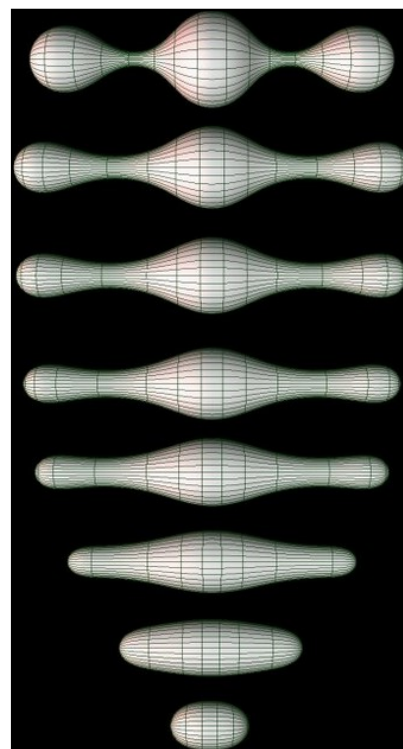
In fact, many other works have been developed based on this article. For example, a new solution for stability of Yau's conjecture based on the structure theory of Ricci flows was given by Prof. Chen, Prof. Wang and Dr. Sun Song of USTC with their derivation published in *Geometry and Topology*. Before that, they received the Oswald Veblen Prize in Geometry for the first solution of the stability of Yau's conjecture.

The theory and methods presented in this article were also applied into a series of works of Prof. Wang and his cooperators in recent years.

The core ideas of this article were generalized to the research of mean curvature flow by Prof. Wang and Prof. Li Haozhao, who solved the extension problem, and the result was published in *Inventiones Mathematicae*.

The paper by Prof. Wang, Dr. Huang Shaosai and Dr. Li Yu, "On the Regular-Convexity of Ricci Shrinker Limit Spaces," published in *Crelle's Journal*, has proven that the limit of non-collapsed shrinking Ricci solitons must be the cone shape defined by Prof. Chen and Prof. Wang.

Additionally, the paper "Heat Kernel on Ricci Shrinkers," published in *Calculus of Variations and Partial Differential Equations* by Prof. Wang and Dr. Li, developed several estimates through



The several stages of Ricci Flow on a 2D manifold. Credit: [https://en.wikipedia.org/wiki/Ricci\\_flow](https://en.wikipedia.org/wiki/Ricci_flow)

the study of the heat kernel on Ricci shrinkers and provided "necessary tools to analyze short time singularities of the Ricci flows of general dimension."

This breakthrough was honored by the reviewer of the journal and the winner of Fields Metal, Prof. Simon Donaldson, who said, "this work is a major breakthrough in geometric analysis, and it no doubt will lead many other related research projects."

**More information:** Xiuxiong Chen et al. Space of Ricci flows (II)—Part B: Weak compactness of the flows, *Journal of Differential Geometry* (2020). [DOI: 10.4310/jdg/1599271253](https://doi.org/10.4310/jdg/1599271253)

Shaosai Huang et al. On the regular-convexity of Ricci shrinker limit spaces, *Journal für die reine und angewandte Mathematik (Crelles Journal)* (2020). [DOI: 10.1515/crelle-2020-0021](https://doi.org/10.1515/crelle-2020-0021).

Xiuxiong Chen et al. Space of Ricci Flows I, *Communications on Pure and Applied Mathematics* (2012). [DOI: 10.1002/cpa.21414](https://doi.org/10.1002/cpa.21414)

Haozhao Li et al. The extension problem of the mean curvature flow (I), *Inventiones mathematicae* (2019). [DOI: 10.1007/s00222-019-00893-2](https://doi.org/10.1007/s00222-019-00893-2)

Kähler-Ricci flow, Kähler-Einstein metric, and K-stability. [msp.org/gt/2018/22-6/p01.xhtml](https://msp.org/gt/2018/22-6/p01.xhtml)  
<https://phys.org/news/2020-11-years-pages-ricci.html>



Tue, 24 Nov 2020

## Researchers overcome barriers to functionalization of bio-inspired solar energy harvesting materials

Inspired by nature, researchers at the City College of New York (CCNY) can demonstrate a synthetic strategy to stabilize bio-inspired solar energy harvesting materials. Their findings, published in the latest issue of *Nature Chemistry*, could be a significant breakthrough in functionalizing molecular assemblies for future solar energy conversion technologies.

In almost every corner of the world, despite extreme heat or cold temperature conditions, you will find photosynthetic organisms striving to capture solar energy. Uncovering nature's secrets on how to harvest light so efficiently and robustly could transform the landscape of sustainable solar energy technologies, especially in the wake of rising global temperatures.

In photosynthesis, the first step (that is, light-harvesting) involves the interaction between light and the light-harvesting antenna, which is composed of fragile materials known as supra-molecular assemblies. From leafy green plants to tiny bacteria, nature designed a two-component system: the supra-molecular assemblies are embedded within protein or lipid scaffolds. It is not yet clear what role this scaffold plays, but recent research suggests that nature may have evolved these sophisticated protein environments to stabilize their fragile supra-molecular assemblies.

"Although we can't replicate the complexity of the protein scaffolds found in photosynthetic organisms, we were able to adapt the basic concept of a protective scaffold to stabilize our artificial light-harvesting antenna," said Dr. Kara Ng. Her co-authors include Dorthé M. Eisele and Ilona Kretzschmar, both professors at CCNY, and Seogjoo Jang, professor at Queens College.

Thus far, translating nature's design principles to large-scale photovoltaic applications has been unsuccessful.

"The failure may lie in the design paradigm of current solar cell architectures," said Eisele. However, she and her research team, "do not aim to improve the solar cell designs that already exist. But we want to learn from nature's masterpieces to inspire entirely new solar energy harvesting architectures," she added.



## Scientists observe directed energy transport between neighboring molecules in a nanomaterial

When light falls on a material, such as a green leaf or the retina, certain molecules transport energy and charge. This ultimately leads to the separation of charges and the generation of electricity. Molecular funnels, so-called conical intersections, ensure that this transport is highly efficient and directed.

An international team of physicists has now observed that such conical intersections also ensure a directed energy transport between neighboring molecules of a nanomaterial. Theoretical simulations have confirmed the experimental results. Until now, scientists had observed this phenomenon only within one molecule. In the long term, the results could help to develop more efficient nanomaterials for organic solar cells, for example. The study, led by Antonietta De Sio, University of Oldenburg, and Thomas Frauenheim, University of Bremen, Germany, was published in the current issue of the scientific journal *Nature Nanotechnology*.



With the help of ultra-short laser pulses physicists at the University of Oldenburg study the ultra-fast processes occurring in nanomaterials after the absorption of light. Credit: University of Oldenburg

Photochemical processes play a major role in nature and in technology: When molecules absorb light, their electrons transit to an excited state. This transition triggers extremely fast molecular switching processes. In the human eye, for example, the molecule rhodopsin rotates in a certain way after absorbing light and thus ultimately triggers an electrical signal—the most elementary step in the visual process.

### First experimental evidence for conical intersections between molecules

The reason for this is a special property of rhodopsin molecules, explains Christoph Lienau, professor of ultrafast nano-optics at the University of Oldenburg and co-author of the study: "The rotation process always takes place in a similar way, although from a quantum mechanical point of view there are many different possibilities for the molecular movement."

This is due to the fact that the molecule has to funnel through a conical intersection during the rotation process, as a 2010 study demonstrated experimentally in visual pigment: "This quantum mechanical mechanism functions like a one-way street in the molecule: It channels the energy in a certain direction with a very high probability," explains Lienau.

The research team led by Antonietta De Sio, senior scientist in the research group Ultrafast Nano-optics at the University of Oldenburg, and Thomas Frauenheim, professor of Computational Materials Science at the University of Bremen, has now observed such a one-way street for electrons in a nanomaterial. The material has been synthesized by colleagues from the University of Ulm, Germany, and is already used in efficient organic solar cell devices.

"What makes our results special is that we have experimentally demonstrated conical intersections between neighboring molecules for the first time," explains De Sio. Until now, physicists worldwide had only observed the quantum mechanical phenomenon within a single molecule and only speculated that there might also be conical intersections between molecules lying next to each other.

### Theoretical calculations support experimental data

De Sio's Team has discovered this one-way street for electrons by using methods of ultrafast laser spectroscopy: The scientists irradiate the material with laser pulses of only a few femtoseconds in duration. One femtosecond is a millionth of a billionth of a second. The method



enables the researchers to record a kind of film of the processes that take place immediately after the light reaches the material. The group was able to observe how electrons and atomic nuclei moved through the conical intersection.

The researchers found that a particularly strong coupling between the electrons and specific nuclear vibrations helps to transfer energy from one molecule to another as if on a one-way street. This is exactly what happens in the conical intersections. "In the material we studied, it took only about 40 femtoseconds between the very first optical excitation and the passage through the conical intersection," says De Sio.

In order to confirm their experimental observations, the researchers from Oldenburg and Bremen also collaborated with theoretical physicists from the Los Alamos National Laboratory, New Mexico, U.S., and CNR-Nano, Modena, Italy. "With their calculations, they have clearly shown that we have interpreted our experimental data correctly," explains De Sio.

The Oldenburg researchers are not yet able to estimate in detail the exact effect of these quantum mechanical one-way streets on future applications of molecular nanostructures. However, in the long term the new findings could help to design novel nanomaterials for organic solar cells or optoelectronic devices with improved efficiencies, or to develop artificial eyes from nanostructures.

**More information:** Antonietta De Sio et al, Intermolecular conical intersections in molecular aggregates, *Nature Nanotechnology* (2020). DOI: [10.1038/s41565-020-00791-2](https://doi.org/10.1038/s41565-020-00791-2)

**Journal information:** [Nature Nanotechnology](https://phys.org/news/2020-11-scientists-energy-neighboring-molecules-nanomaterial.html)  
<https://phys.org/news/2020-11-scientists-energy-neighboring-molecules-nanomaterial.html>

## COVID-19 Research News



Tue, 24 Nov 2020

### An expert Explains: Where are we in the Covid-19 vaccine hunt?

*Covid-19 Vaccine: The last two weeks have seen a string of encouraging results from coronavirus vaccine trials. What do these findings mean, what questions remain, and what does India need for a mass vaccination exercise?*

*By Prabha Raghavan*

The last two weeks have seen a string of encouraging results from coronavirus vaccine trials. What do these findings mean, what questions remain, and what does India need for a mass vaccination exercise? One of India's leading medical scientists, Dr Gagandeep Kang, addresses these issues in an interview to Prabha Raghavan. Edited Excerpts:

**How surprising are the findings announced by Pfizer, Moderna and Russia that their respective vaccines have over 90 efficacy%?**

All these vaccines offering protection at a high level was surprising because, with mucosal infections, you usually see less protection than for infections at other sites. Influenza vaccines, in a good season, offer about 60%, and this can be much lower when the strains are not matched. If we look at enteric (intestinal) infection vaccines, they can be 85-90% protective, but not in all parts of the world. With parenteral (non-oral) vaccines for a mucosal infection, one example we have is the polio vaccine — you can give an injectable polio vaccine, and it's pretty good at preventing

disease, but it doesn't really protect against the mucosal component, which is infection of the enteric tract.

I don't think we expected these vaccines to perform as well as they are. As we follow them for longer, the efficacy is not going to be maintained... These are early results, when the immune response has just been made. That said, for a reasonable timeframe, I don't think the rates are going to decline incredibly.

### **What does it mean to have an efficacy rate of over 90%?**

Let's start with a very simple design, which is a 1:1 randomisation. This means half the people will get the vaccine and the other half will get a placebo. If we're looking at a vaccine trial with 20,000 people in this design, 10,000 would be vaccinated and 10,000 would not.

Let's say 10% of people would normally get the infection with a very high attack rate. So, of the 10,000 people who have not received the vaccine, 1,000 people will get the disease within a defined period. Now, we also have 10,000 people who have received the vaccine. In them, if the vaccine does not work at all, we will get 1,000 infections, because 10% will get infected. If a vaccine has 50% efficacy, 500 people will get the infection and, if it has 90% efficacy, only 100 people will get infected.



**Oxford University-AstraZeneca vaccine Phase 2 trials in Pune. Even with successful candidates, availability is likely to be limited initially. (Express Photo: Arul Horizon)**

### **What do these results say about the effectiveness of targeting the virus's spike protein?**

The fact that we have two, maybe three, vaccines based on the spike protein that are working, and that they are on different platforms, is encouraging. The understanding was that, because the spike is responsible for attachment to the cell, if there was a way that we could block the spike, then that would allow us to be protected from infection. So, given that we now have data showing three vaccines based on the spike protein that are working, it's likely we will also have other vaccines that are able to deliver the spike on any platform that will also work. Whether it is 85%, 90% or 95% efficacy is neither here nor there — they will likely work, so this is good news for the vaccine field.

### **After the information released by these firms, what questions remain?**

Will it work in younger people? Will it work in people who are immunocompromised? Are these vaccines you can give to pregnant women? What would their safety record be? How long does protection last? What does the immune response look like? What is the B-cells component [a B-cell is a type of white blood cell that helps create antibodies against a pathogen while it is infecting the body]? What's the T-cell component (T-cells are types of white blood cells that are part of the body's long-term immune response against a virus, actively seeking it out to destroy it)?

We have some of this data from the phase 2 studies, but the detailed look at immunology so far is in small numbers. It's good to see validation of the vaccines in different populations, but we also need to learn more about the safety issues — RNA, for instance, is very inflammatory. We saw there were more reactions in the people who got the highest dose in the Moderna trial, for example, and that dose is not being used for further studies.

The efficacy information released by these companies are just headline numbers in press releases. We haven't seen the actual data, so we can't say what protection looks like. Companies are going to have to publish this data and submit it to the regulators.

### **Earlier, experts said a vaccine with 60-70% efficacy was desirable. How desirable is this cut-off now?**

If you have 90% efficacy, and it lasts six months versus having 60% efficacy that lasts 10 years, which one would you pick? We can't make decisions based on press releases. It's encouraging

information, but we have to wait for the full datasets, analyse them, and then decide how we want to move forward.

It is about the performance characteristics of the vaccine and the goals you are trying to achieve.

If we look at other vaccines... In the case of the oral polio vaccine, immune responses in low — and middle-income countries are much lower than for injectable polio vaccines. But, a decision was made to go with oral polio vaccines, because they are much easier to deliver to the population.

You wound up using more doses of oral polio vaccine, but you still got to the same goal of trying to eliminate the disease from the country. Now, we are trying to eradicate it by combining oral and injectable vaccines.

### **The Pfizer and Moderna vaccines don't seem feasible for developing countries. What sort of vaccine would be better suited for India?**

A good vaccine for India is an affordable vaccine that can be made in large numbers and delivered easily — preferably as a single dose. It should give long-term protection — I would like lifetime protection. We don't know this will happen, but one dose eases the burden on the immunisation programme, because you don't have the problem of needing to track the person down for the second dose.

We don't have a vaccine as expensive as the AstraZeneca vaccine (Covishield) in our programme at the moment, and that's at \$3 a dose — the lowest price announced. It still means you need \$6 just for the vaccine and more to deliver it in campaign mode. If you're talking \$10 per person per set of vaccination, that already makes it the most expensive vaccination program this country has ever had — at the individual, per person, cost and not just in terms of the number of people that would need to be immunized.

If we're talking about national programmes and immunising everybody in the country, we are going to need something under a dollar a dose, preferably under 50 cents.

These are the kinds of things second-wave candidates should be aiming for.

### **Do any strong contenders fit the bill?**

There are many companies working on different vectored vaccines — measles, VSV — that have the potential to be single-dose vaccines, though they are a bit further behind in development. In any case, we should be thinking about second-wave vaccines. Given the results we are seeing with spike protein here with an RNA vaccine, it's feasible that, even if we had protein vaccines with an adjuvant, they would work equally well.

Something like what **Bio E is doing** with the Baylor College of Medicine, which is a protein-based candidate, might be a good way to go. Assuming that they can move rapidly through testing, you could be looking at a vaccine that will have a readout in 2021. Janssen's vaccine is an adenovector vaccine which is planned as a single dose, because it's a replicating vector. Bio E is also working with them on this, so that's potential too.

### **How soon can a first-wave Covid-19 vaccine be realistically expected in India?**

The first-wave vaccines that are going to come out quicker than others [globally] are the two mRNA candidates and probably AstraZeneca's.

Concerning ramping up of manufacturing with AstraZeneca — though we've heard about how they're going to make hundreds of millions of doses (of Covishield) — [Serum Institute of India CEO] Adar Poonawalla said this month we have 40 million doses and, in subsequent months, we will have more. That's not the message we got 3-4 months ago, when we were told about hundreds of millions of doses being made every month.

I think initial availability is going to be limited and the trickle will become stronger as production increases... we are not really going to have serious amounts of a vaccine even with the successful candidates for another three to five months.

That's time to get logistics for delivery together, because I don't think we are as ready as we should be... I don't think I've heard enough about the planning to know most problems have been anticipated and the rollout will be smooth and as high volume as is being projected.

### **What more should we know to get a better sense of how the government is geared up?**

You would need to start communicating with groups likely to be vaccinated early. The government could put out a plan telling us this is how sequencing of vaccination is going to be done — in not just the big broad term of “these are the 3-5 categories (of priority groups that will get the vaccine first)”, but also how they are going to operate within states.

The big picture is at the Centre but, at the state level, there has to be a delivery mechanism and clarity. We hear you’re going to have healthcare workers, but is it private or public healthcare? What’s the sequence? How do you break down healthcare workers? And, in our country, can you deliver to all healthcare workers around the country at the same time or will some states be prioritised?

We’ve never seen this scale of activity before, so it would be reassuring to have a public plan for how this is actually going to be done.

The Pfizer and Moderna vaccines, both mRNA, have different storage temperatures. Is it possible, then, to develop an mRNA vaccine that can be stored at warmer temperatures?

Every mRNA vaccine is different. The sequence that codes for the stabilised spike may be the same, but when you’re making a vaccine which is either enclosed within a lipid nanoparticle or integrated with it, you’re going to have different levels of stability. Just because it’s mRNA, doesn’t mean that every vaccine is equivalent.

Genova Biopharmaceuticals (which is also working on an mRNA vaccine) is planning to make a vaccine that can be stored at 2°C to 8°C. CureVac [of Germany] is also working on a 2°C to 8°C formulation. Even Pfizer is planning to modify its formulation, but it will take them a couple of years to get to that point, which is not surprising, because Moderna has been in the mRNA game for a long time, while BioNTech and Pfizer’s tie-up was fairly recent. It takes time to develop these more stable formulations.

### **Are vials and syringes still an issue?**

Yes, they are. Particularly, if you have a need for cryo-vials, then you need special kinds of glass.

I’ve mentioned auto-disabled syringes before, and that is a rate limiting — not for manufacturers, but for the immunisation programme. Glass vials certainly are (a challenge), but I don’t know whether there are even enough rubber stoppers and the aluminum foil that goes on top of these injection vials. Those are significant issues. And then, if you are going to have vaccine vial monitors (VVMs) to monitor the temperature of vaccines and excursions — those little printed stickers — there’s only one company in the world authorized to make them. Companies using VVMs will have to get in line for them.

Even for making the vaccines, they are made out of different kinds of chemicals. You are going to have another problem here, and that’s one of the issues with the mRNA vaccines — are there going to be sufficient nucleotides to manufacture the RNA on the scale that people want? You will have to break each vaccine down into its components and look at the supply chain. Glass, rubber stoppers and syringes are common for all vaccines, but the actual composition of different vaccines really depends on what the formulations are.

### **How has vaccine development changed from the time of rotavirus to this pandemic?**

In the case of the rotavirus vaccine, the technology used is the same as the oral polio vaccine. When we were looking at the rotavirus vaccine, we expected, from the polio experience, to have lower efficacy in developing countries. The phase 3 efficacy trials we did had a lower bound of efficacy of 20% — the vaccine would have been considered working if it met this 20% protection mark. It finally wound up being 55%, and that is no different from the performance of any other oral rotavirus vaccines in similar parts of the world.

The challenges we will see in the future with SARS-CoV-2 vaccines are what we saw with our rotavirus vaccine. Essentially, if these Pfizer and Moderna vaccines get licensed — and they are pretty close to being able to apply for licensure soon — then those vaccines might become the standard of care, which means any future vaccine trials cannot have the standard placebo-

controlled design and have to be designed as non-inferiority trials, which then makes the study very large.

In the case of the rotavirus trials, the Rotarix and Rotateq vaccines were already in the market, and we had to then have discussions with ethicists to see whether a placebo-controlled trial was needed. Finally, it was decided it could be done under certain special circumstances. Although the multinational vaccines were licensed in India, they were not recommended as part of the national immunization programme. The study team also made a commitment to ensure every child would be looked after as well as possible for the entire duration of the trial and followed up, whether that was an illness related to what the vaccine was trying to prevent or not.

I think these are the kinds of issues that we will see in the future with the entire field of SARS-CoV-2 vaccines. Where manufacturing of these vaccines is concerned, with mRNA, we have no idea what the issues might be once you make large scale batches. Failures of batches are very much a fact in the development of vaccines. Whether that will happen with mRNA and if it is a failsafe, easy to use technology are aspects we really have no clue about yet.

### **What new challenges does this pandemic present in vaccine development?**

Right now, we don't know, because we haven't made large batches of vaccines with the newer technologies. So, it's very hard to say that it's going to work, and even with the older technologies, every programme of manufacturing has to be optimised. That's why what are called Chemistry Manufacturing Controls are very important for regulators.

We talk about clinical efficacy all the time, but the process of vaccine development, assessment of the vaccine quality also is a long process vaccine manufacturers undertake, and every programme is different. Even if you're using the same platform to make a new vaccine, you can use your learning for prior experience, but the tweaking will have to be individual to that programme.

***DR GAGANDEEP KANG**, Professor at Christian Medical College–Vellore, is one of India's leading medical scientists. Dr Kang's work on vaccines includes a key role in development of India's indigenous rotavirus vaccine. She is the first Indian woman inducted as Fellow of the Royal Society. She was recently Chair of an ICMR panel on Covid-19 drugs and vaccines.*

<https://indianexpress.com/article/explained/an-expert-explains-where-are-we-in-vaccine-hunt-7061655/>

## Covid-19 vaccine update: India to immunise 250 million citizens, US vaccinations might begin in December

*The United Kingdom could give approval to Pfizer's vaccine candidate this week, a report claimed. Meanwhile, the official Twitter account of Russia's vaccine candidate Sputnik V claimed the price per dose of the vaccine would be "much lower" than that of Moderna and Pfizer's vaccine candidates*

*Edited By Karan Manral*

Hopes for an early arrival of a potential vaccine for the coronavirus disease (Covid-19) have been rekindled as various vaccine candidates are in the middle or beginning of late-stage trials. Meanwhile, the total number of people who have contracted the disease globally is at 58.9 million, while nearly 1.4 million have lost their lives due to it, as per a worldometers tally.

In the latest update for a coronavirus vaccine, Union health minister Dr Harsh Vardhan on Sunday expressed confidence that Bharat Biotech International Limited's vaccine candidate, Covaxin, could complete its trials in a "month or two." A top official in the United States, meanwhile, said the US might begin vaccinations in December, in what is the world's worst-hit nation.

### **Here are the latest updates on the Covid-19 vaccine front:**

1. Dr Harsh Vardhan on Sunday reiterated the government plans to immunise 200 million to 250 million citizens by next July. "We are in the process of developing our indigenous vaccines, in the process of completing our third-phase trials in the next one or two months," the minister said on Bharat Biotech's Covaxin, which started its third-phase trials last week. Covaxin is among five vaccine candidates undergoing trials in India and the only indigenous candidate among them. Bharat Biotech has partnered with the Indian Council of Medical Research (ICMR) to develop the candidate.

2. In the United States, Moncef Slaoui, head of the US government's virus vaccine effort, said the country might begin its vaccination programme by December 11-12. Speaking to CNN, Slaoui said the plan is to be "able to ship vaccines to immunisation sites within 24 hours of approval" by the Food and Drug Administration (FDA). 20 million people across the US could be vaccinated next month, with a further 30 million per month after that, Slaoui further estimated.

3. Pfizer may have applied for emergency use authorisation (EUA) of its vaccine candidate in the United States but it is the United Kingdom which could give regulatory approval before the US does, the Telegraph has reported. While EUA in the US is expected to be given in December, the UK could give its approval this week, the report said. Pfizer has developed its vaccine candidate, BNT162b2, in partnership with Germany's BioNTech SE.

4. The official Twitter account of Russia's vaccine candidate Sputnik V on Sunday said the price per dose of the vaccine would be "much lower" than that of vaccines of American firms Moderna and Pfizer. "Translating pharma lingo: the announced price of Pfizer of USD 19.50 and Moderna of USD 25-USD 37 per dose actually means their price of USD 39 and USD 50-USD 74 per person. Two doses are required per person for the Pfizer, Sputnik V and Moderna vaccines. The price of Sputnik V will be much lower," the official account said. *(With agency inputs)*

<https://www.hindustantimes.com/india-news/covid-19-vaccine-update-india-to-immunise-250-million-citizens-us-vaccinations-might-begin-in-december/story-16Sa8U04V0GAPJP8ASSKfN.html>

