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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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## Amid border row, new DRDO lab created for research along China-Pak border

*The two new labs merged by the government are the Manali-headquartered Snow and Avalanche Studies Establishment and the other is the Delhi-based Defence Terrain Research Establishment*

In the middle of a border conflict, the government has merged two DRDO laboratories to create a new one to do focused research on terrain and avalanches along the borders with China and Pakistan.

"The Defence Research and Development Organisation (DRDO) has created a new laboratory named Defence Geo Informatics Research Establishment by merging two exiting labs.

The new lab will focus on research on terrain and avalanches along the border with China from Ladakh to Arunachal Pradesh," Government Sources told ANI.

The two new labs merged by the government are the Manali-headquartered Snow and Avalanche Studies Establishment (SASE) and the other is the Delhi-based Defence Terrain Research Establishment.

The merger of these labs is the first step in the large-scale reforms to be taken in the DRDO by its Chief Dr G Satheesh Reddy to make the organisation "leaner, mean, and more result-oriented".

The SASE had been very actively engaged in the study of snow and avalanches in the operational areas and has prepared an avalanche atlas of almost 3,000 on-road locations in different parts of the country where the armed forces are deployed.

Similarly, the Defence Terrain Research Laboratory (DTRL) had been working on different terrains where the armed forces are deployed.

Sources said the new lab would also be spreading out its teams in different parts of the border with China like Arunachal Pradesh and work with the forces deployed there.

The merger of two labs has happened soon after Prime Minister Narendra Modi took a detailed review meeting on the DRDO with all the stakeholders including his ministerial colleagues, DRDO chairman, and Chief of Defence Staff Gen Bipin Rawat.

Reddy has also been given a tenure extension by the government and he has been entrusted with the task of bringing reforms in the premier defence research agency.

The DRDO Chief recently set up a committee under IIT Delhi, Director P Ramagopal Rao to review the charter of duties of the laboratories to prepare the armed forces for futuristic battlefields.

The select panel will delve deep into the nature of work being carried out by each lab under the organisation and will present a report to redefine the charter of work being carried out and minimize technology overlaps.



File Photo: DRDO Chief G Satheesh Reddy (ANI Photo)

(This story has been published from a wire agency feed without modifications to the text. Only the headline has been changed.)

<https://www.livemint.com/news/india/amid-border-row-new-drdo-lab-created-for-research-along-china-pak-border-11606748404021.html>



Tue, 01 Dec 2020

## **DRDO merges 2 labs for focused research along borders with China, Pakistan**

*The DRDO's new lab, formed by merging two existing labs, will focus on research on terrain and avalanches along the border with China from Ladakh to Arunachal Pradesh*

*By Manjeet Singh Negi*

New Delhi: In line with Prime Minister Narendra Modi's directives, the government has merged two DRDO laboratories to create a new one to do focused research on terrain and avalanches along the borders with China and Pakistan.

"The Defence Research and Development Organisation [DRDO] has created a new laboratory named Defence Geo Informatics Research Establishment by merging two exiting labs. The new lab will focus on research on terrain and avalanches along the border with China from Ladakh to Arunachal Pradesh," government sources told India Today TV.

The merger would help in bringing together the capabilities and resources of the two labs which will now be working with the same mission statement.

The two new labs merged by the government are the Manali-headquartered Snow and Avalanche Studies Establishment (SASE) and the Delhi-based Defence Terrain Research Establishment.

The merger of these labs is the first step in the large scale reforms to be taken in the DRDO by its Chief Dr G Satheesh Reddy, with an aim to make the organisation more lean and mean and more result-oriented.

The SASE has been very actively engaged in the study of snow and avalanches in the operational areas. It has prepared an avalanche atlas of almost 3,000 on-road locations in different parts of the country where the armed forces are deployed.

Similarly, the DTRL had been working on different terrains where the armed forces are deployed.

Sources said that the new lab will also be spreading out its teams in different parts of the border with China like Arunachal Pradesh and work with the forces deployed there.

The merger of two labs happened soon after PM Narendra Modi took a detailed review meeting on the DRDO with all the stakeholders, including his ministerial colleagues, DRDO Chairman and Chief of Defence Staff Gen Bipin Rawat.

DRDO Chief Satheesh Reddy has also been given a tenure extension by the government and he has been entrusted with the task of bringing reforms in the premier defence research agency.

The DRDO Chief recently set up a committee under IIT Delhi, Director P Ramagopal Rao, to review the charter of duties of the laboratories to prepare the armed forces for futuristic battlefields.

<https://www.indiatoday.in/india/story/drdo-merges-labs-focused-research-borders-china-pakistan-1745543-2020-12-01>

## बॉर्डर पर तनाव के बीच DRDO ने बनाई नई लैब, चीन-पाकिस्तान सीमा पर होगा खास फोकस

नई लैब लद्दाख (Laddakh) से लेकर अरुणाचल प्रदेश (Arunachal Pradesh) तक चीन के साथ लगी सीमा और हिमस्खलन पर शोध में ध्यान केंद्रित करेगी। दोनों प्रयोगशालाओं का विलय कर एक लैब बनाना डीआरडीओ (DRDO) में बड़े पैमाने पर होने वाले सुधारों की दिशा में पहला कदम माना जा रहा है।

By Ruchir Shukla

हाइलाइट्स:

- DRDO की दो प्रयोगशालाओं को मिलाकर बनाई गई एक नई लैब
- नई लैब चीन-पाकिस्तान सीमा वाले भूभाग और बर्फीले तूफान पर रिसर्च में करेगी फोकस
- दो प्रयोगशालाओं का विलय कर एक लैब बनाना DRDO में बड़े पैमाने पर होने वाले सुधारों की दिशा में पहला कदम
- नई लैब चीन की सीमा से अलग-अलग इलाकों में अपनी टीम तैनात करेगी, वहां तैनात सशस्त्र बलों के साथ काम करेगी

नई दिल्ली: बॉर्डर पर तनाव (India China Border Conflict) के बीच केंद्र सरकार ने रक्षा अनुसंधान विकास संगठन (DRDO) की दो प्रयोगशालाओं को मिलाकर एक नई लैब बनाई है। ये नई प्रयोगशाला चीन और पाकिस्तान की सीमा वाले इलाकों और बर्फीले तूफान पर रिसर्च में खास फोकस करेगी। सरकारी सूत्रों के हवाले से एएनआई ने बताया कि डीआरडीओ ने दो प्रयोगशालाओं को मिलाकर 'डिफेंस जियो इंफॉर्मेटिक्स रिसर्च एस्टेब्लिशमेंट' नाम से एक नई लेबोरेट्री बनाई है।

### दो प्रयोगशालाओं का विलय कर बनाई गई नई लैब

सरकारी सूत्रों ने एएनआई को बताया कि नई लैब लद्दाख से लेकर अरुणाचल प्रदेश तक चीन के साथ लगी सीमा और हिमस्खलन पर शोध में ध्यान केंद्रित करेगी। सरकार की ओर से बनाई गई नई लैब में जिन दो प्रयोगशालाओं का विलय किया गया वो हैं- मनाली मुख्यालय का बर्फ और हिमस्खलन अध्ययन प्रतिष्ठान (एसएएसई) और दूसरा दिल्ली स्थित रक्षा भूभाग अनुसंधान प्रयोगशाला। इन दोनों प्रयोगशालाओं का विलय कर एक लैब बनाना डीआरडीओ में बड़े पैमाने पर होने वाले सुधारों की दिशा में पहला कदम माना जा रहा है।

### SASE और DTRL लैब का हुआ विलय

डीआरडीओ के प्रमुख डॉ. जी. सतीश रेड्डी ने कहा है कि इसको और ज्यादा रिजल्ट ओरिएंटेड बनाया जाएगा। एसएएसई बेहद सक्रिय रूप से परिचालन क्षेत्रों में बर्फ और हिमस्खलन के अध्ययन में लगा था और देश के अलग-अलग हिस्सों में लगभग 3,000 ऑन-रोड जगहों पर एक हिमस्खलन एटलस तैयार किया है, जहां सशस्त्र बल तैनात हैं। इसी तरह रक्षा भूभाग अनुसंधान प्रयोगशाला (डीटीआरएल) देश के अलग-अलग भूभागों पर रिसर्च करती रही है, जहां सशस्त्र बलों की तैनाती है।

### पीएम मोदी के साथ हाईलेवल मीटिंग के बाद फैसला

सूत्रों ने कहा कि नई लैब चीन की सीमा से अलग-अलग इलाकों जैसे अरुणाचल प्रदेश आदि में अपनी टीम तैनात करेगी और वहां तैनात सशस्त्र बलों के साथ काम करेगी। दोनों लैब का विलय प्रधानमंत्री नरेंद्र मोदी की अपने मंत्रिस्तरीय सहयोगियों, डीआरडीओ के अध्यक्ष और चीफ ऑफ डिफेंस स्टाफ जनरल बिपिन

रावत के साथ एक विस्तृत समीक्षा बैठक के तुरंत बाद किया गया। इस बीच डीआरडीओ के प्रमुख डॉ. जी. सतीश रेड्डी का कार्यकाल भी सरकार की ओर से बढ़ा दिया गया है और उन्हें प्रमुख डिफेंस रिसर्च एजेंसी में जरूरी सुधार लाने की अहम जिम्मेदारी सौंपी गई है।

### DRDO प्रमुख ने IIT दिल्ली डायरेक्टर के नेतृत्व में समिति का किया गठन

डीआरडीओ प्रमुख ने हाल ही में आईआईटी दिल्ली, निदेशक पी. रामगोपाल राव के नेतृत्व में एक समिति का गठन किया, जो भविष्य के युद्धक्षेत्रों के लिए सशस्त्र बलों को तैयार करने के लिए प्रयोगशालाओं के ड्यूटी चार्टर की समीक्षा करे। चयनित पैनल संगठन के तहत प्रत्येक प्रयोगशाला की ओर से किए जा रहे कामों की प्रकृति में गहराई लाने और प्रौद्योगिकी ओवरलैप को कम करने और किए जाने वाले काम के चार्टर को फिर से परिभाषित करने के लिए एक रिपोर्ट पेश करेगा।

<https://navbharattimes.indiatimes.com/india/amid-border-row-new-drdo-lab-created-for-focused-research-along-china-pakistan-border/articleshow/79500643.cms>



Tue, 01 Dec 2020

## सीमा पर तनाव के बीच DRDO ने बनाई नई लैब, चीन-पाकिस्तान सीमा पर रखेगी नजर

*डीआरडीओ की नई लैब का गठन प्रधानमंत्री नरेंद्र मोदी द्वारा समीक्षा बैठक करने के बाद लिया गया है*

नई दिल्ली: पूर्वी लद्दाख (Eastern Ladakh) में सीमा पर जारी तनाव के बीच केंद्र सरकार ने रक्षा अनुसंधान एवं विकास संगठन (DRDO) की दो लैबोरेट्रीज को मिलाकर एक नई लैबोरेट्रीज बना दी है। नई लैबोरेट्रीज चीन और पाकिस्तान की सीमा पर बर्फीले तूफान और भूभाग पर केंद्रित शोध पर अपना ध्यान लगाएगी। सरकारी सूत्रों के हवाले से ANI ने ये जानकारी दी है। सूत्रों के मुताबिक, 'डीआरडीओ (DRDO) ने डिफेंस जियो इंफॉर्मेटिक्स रिसर्च इंस्टीट्यूट नाम से एक नई लैबोरेट्री का गठन किया है। इसके लिए रक्षा संस्थान की मौजूदा दो लैबोरेट्रीज का विलय कर दिया गया है। नई लैब अरुणाचल प्रदेश (Arunachal Pradesh) से लद्दाख तक चीन से लगी सीमा पर बर्फीले तूफान और भूभाग से जुड़े रिसर्च पर अपना ध्यान केंद्रित करेगी।'

नई लैब के गठन के लिए जिन दो पुरानी लैब का विलय किया गया है, उनमें मनाली स्थित बर्फ और हिमस्खलन अध्ययन संस्थान (Snow and Avalanche Studies Establishment) और दूसरा दिल्ली स्थित रक्षा भूभाग शोध प्रयोगशाला (Defence Terrain Research Laboratory) शामिल है।

बता दें कि SASE लंबे समय से बर्फ और हिमस्खलन के बारे में शोध को लेकर काम कर रहा है। संस्थान ने अब तक सड़कों किनारे 3,000 जगहों को चिन्हित करते हुए हिमस्खलन मानचित्र बनाया है। इस मानचित्र में देश के अलग-अलग हिस्सों को शामिल किया है, जहां सशस्त्र बलों की तैनाती है।



नई लैब का गठन रक्षा अनुसंधान एवं विकास संगठन में बड़े पैमाने पर होने वाले सुधारों की दिशा में पहला कदम है. (PTI)



इन दोनों लैब का विलय रक्षा अनुसंधान एवं विकास संगठन में बड़े पैमाने पर होने वाले सुधारों की दिशा में पहला कदम है। डीआरडीओ चीफ डॉ। जी। सतीश रेड्डी ने कहा कि डीआरडीओ को और ज्यादा रिजल्ट ओरिएंटेड बनाया जाएगा। इसी तरह रक्षा भूभाग शोध प्रयोगशाला (DTRL) देश के अलग-अलग भूभागों पर शोध करती रही है, जहां सशस्त्र बलों की तैनाती है।

सूत्रों के मुताबिक नई लैब चीन सीमा पर अलग-अलग राज्यों में जैसे अरुणाचल प्रदेश में अपनी टीम तैनात करेगी, जो सशस्त्र बलों के साथ मिलकर काम करेगी। डीआरडीओ की इन लैब्स का विलय तब हुआ है, जब प्रधानमंत्री नरेंद्र मोदी ने डीआरडीओ को लेकर एक गहन समीक्षा बैठक की। इस बैठक में केंद्रीय मंत्रियों के साथ, डीआरडीओ चेयरमैन और चीफ ऑफ डिफेंस स्टाफ जनरल बिपिन रावत ने भी शिरकत की।

केंद्र सरकार ने डीआरडीओ चीफ सतीश रेड्डी के कार्यकाल को बढ़ा दिया है और उन्हें डीआरडीओ में सुधार को अमलीजामा पहनाने की जिम्मेदारी दी गई है। डीआरडीओ चीफ ने हाल ही में आईआईटी दिल्ली के साथ मिलकर एक कमेटी का गठन किया है। कमेटी की अगुवाई पी। रामगोपाल राव करेंगे, जोकि आईआईटी दिल्ली के डायरेक्टर हैं। कमेटी भविष्य की जंग के लिए सशस्त्र बलों को तैनात करने खातिर अलग-अलग लैबोरेट्रीज के लिए इयूटी चार्टर की समीक्षा करेगी।

<https://hindi.news18.com/news/nation/new-drdo-lab-created-for-focused-research-along-china-pakistan-border-3359148.html>



Tue, 01 Dec 2020

## PM Modi के सुरक्षा घेरे को अभेद्य बनाएगा DRDO का एंटी ड्रोन सिस्टम

*DRDO के वैज्ञानिकों ने एक ऐसे एंटी ड्रोन सिस्टम का निर्माण किया है जो पीएम मोदी के सुरक्षा घेरे को और भी मजबूत बनाएगा और साथ ही रक्षा क्षेत्र में भी महत्वपूर्ण साबित होगा*

*खास बातें*

1. सेना के लिए तैयार किया एंटी ड्रोन सिस्टम
2. दुश्मन के ड्रोन को किया जा सकता है निष्क्रिय

नई दिल्ली: प्रधानमंत्री नरेंद्र मोदी की सुरक्षा को अभेद्य और पूर्ण सुरक्षित बनाने के लिए सुरक्षा एजेंसियों को बहुत मशक्कत करनी पड़ती है। आये दिन PM मोदी पर आघात करने की आतंकी साजिशों का खुलासा होता रहता है इसलिए सुरक्षा एजेंसी प्रधानमंत्री की सिक्योरिटी के सम्बंध में विशेष सतर्कता बरतती हैं। इस बीच DRDO के वैज्ञानिकों ने एक ऐसे एंटी ड्रोन सिस्टम का निर्माण किया है जो पीएम मोदी के सुरक्षा घेरे को और भी मजबूत बनाएगा और साथ ही रक्षा क्षेत्र में भी महत्वपूर्ण साबित होगा।



**सेना के लिए तैयार किया एंटी ड्रोन सिस्टम**

गौरतलब है कि डिफेंस रिसर्च एंड डेवेलपमेंट ऑर्गेनाइजेशन (DRDO) ने सेनाओं के लिए बेहद जरूरी एंटी ड्रोन सिस्टम्स के विकास और उत्पादन की जिम्मेदारी भारत इलेक्ट्रॉनिक्स को सौंपी है। यह भी बताया जा रहा है कि एंटी ड्रोन सिस्टम अब पीएम नरेंद्र मोदी (PM Modi) की सुरक्षा का भी हिस्सा है। DRDO का ये यंत्र पीएम के आवास के अलावा पोर्टेबल 'ड्रोन किलर' के रूप में उनके काफिले में भी मौजूद रहेंगे।

## दुश्मन के ड्रोन को किया जा सकता है निष्क्रिय

उल्लेखनीय है कि सरहद पर पाकिस्तानी आतंकवादी हर समय घात लगाकर बैठे रहते हैं और भारतीय सेना को निशाना बनाते हैं। ऐसे में सीमा सुरक्षा बल को अतिरिक्त आधुनिक सुविधाओं की सबसे अधिक आवश्यकता है। DRDO का ये यंत्र इस मांग की भी आपूर्ति करता है।

पाकिस्तान की कायर फौज आतंकवादियों को कश्मीर में घुसपैठ करने में मदद करती है। पाकिस्तानी आतंकवादी लाइन ऑफ कंट्रोल और इंटरनेशनल बॉर्डर के पार जम्मू-कश्मीर में हथियार भेजने के लिए चाइनीज निर्मित कॉमर्शियल ड्रोन का इस्तेमाल कर रहे हैं।

आपको बता दें कि DRDO ने पैसिव और एक्टिव एंटी ड्रोन टेक्नॉलजी विकसित की है जिससे दुश्मन के ड्रॉन्स को निष्क्रिय किया जा सकता है या फिर ध्वस्त किया जा सकता है। DRDO के प्रमुख सतीश रेड्डी जल्द ही देसी एंटी ड्रॉन्स सिस्टम के उत्पादन को लेकर सेनाओं को सूचित करेंगे। इस साल गणतंत्र दिवस और स्वतंत्रता दिवस पर तैनात किए गए एंटी ड्रोन सिस्टम्स का रेंज 2-3 किलोमीटर तक का था।

<https://zeenews.india.com/hindi/zee-hindustan/national/drdo-made-anty-drone-system-which-help-security-forces-to-neutralize-enemies-power/796304>



Tue, 01 Dec 2020

## To counter the rogue drone, DRDO puts plan of action in motion

By Vicky Nanjappa

New Delhi: With the drone threat looming large, the Defence Research and Development Organisation (DRDO) has designated Bharat Electronics as the lead agency for the production and development of an anti-drone system.

The anti-drone systems are part of Prime Minister Narendra Modi's security detail at his residence. The portable one will be part of his car cavalcade.

This is an important development since rogue drones have become India's latest security headache. These drones are a potential threat and the government had been looking for solutions to counter this problem. In this regard the agencies conducted a data estimation and learnt that there are over 6 lakh rogue or unregulated drones of various sizes and capacities.



Representational Image

Recent incidents like the lethal drone attack on Saudi Arabia's largest petroleum company and arms dropping by UAVs in Punjab from across the India-Pakistan border has only alerted the agencies to come up with a plan to counter the drones.

These agencies are now looking at some specific anti-drone techniques like sky fence, drone gun, ATHENA, drone catcher and Skywall 100 to intercept and immobilise suspicious and lethal remote-controlled aerial platforms.

A recent paper titled 'Drones: A new frontier for Police' published in the Indian Police Journal (IPJ) by IPS officer and Additional Director General in Rajasthan Police, Pankaj Kumar Singh, has talked about these new techniques.

A drone gun is capable of jamming the radio, global positioning system (GPS) and mobile signal between the drone and the pilot and forces the drone to ground in good time before it could wreak any damage. This Australia designed weapon has an effective range of 2 kms, the paper said.



Another solution to block a lethal drone is the sky fence system that uses a range of signal disruptors to jam the flight path and prevent them from entering their target, a sensitive installation or event venue, it said.

Officials said prototypes of these counter-drone weapons were displayed for the first time at an open field in a BSF camp in Bhondsi, Haryana last week as part of a national conference organised by the Bureau of Police Research and Development (BPRD) on anti-drone technology.

The Centre now wants to impart training to police officers of all states to check this menace. The Bureau of Police Research and Development is currently in talks with the police chiefs of all states so that training can be imparted to counter new terror threats that have been emerging.

OneIndia had reported recently that, a new committee was constituted by Union Home Minister, Amit Shah to analyse the various threats, including the ones that are posed by drones. In Punjab, the police found that drones were used by Pakistan to drop off weapons at the border areas, so that it could be transported to Jammu and Kashmir.

The committee held a demonstration on the anti-drone technology in Haryana, where several officers took part. Sources tell OneIndia that rogue drones pose a major threat.

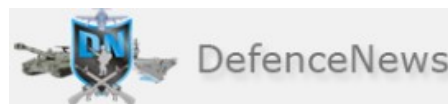
This would be one of the key threats in the coming days. The police force needs to be sensitised to such threats, the officer also said.

The programme would include training in anti-drone detection, tracking and identification.

The police would also be taught on how to handle the anti-drone equipment at critical areas including airports, which face a high level of threat from drones.

While the technology would be used heavily in the border areas, the Centre wants the training to imparted to those officials handling airport security. Currently there is no mechanism in place at the airports to handle the threat of drones. Hence this would have to be done on a priority basis and regular training programmes would be held in this regard, the officer also said.

<https://www.oneindia.com/india/to-counter-the-rogue-drone-drdo-puts-plan-of-action-in-motion-3183143.html>



*Tue, 01 Dec 2020*

## **Why this ‘Astra’ is more than just another weapon for India**

When the flight trials of India’s indigenously produced ‘Astra’ missile on the domestically developed Tejas jet fighter start soon, it will mark a huge leap for the country’s armaments industry. It will propel India into the exclusive league of a handful of nations that have been able to fit domestically produced fighter jets with indigenous ‘beyond visual range air to air’ (BVRAAM) missiles.

Apart from the boost to the country’s pride and self-confidence, Astra will give India’s fighters a definite edge over China’s PLA Air Force (PLAAF) and the Pakistan Air Force (PAF).

That’s because Astra compares favourably with the United States-made AMRAAM AIM-120C BVRAAMs that the PAF’s prized F-16s are weaponised with.

What’s more, Astra is operationally superior to China’s PL-15 BVRAAM that the PLAAF inducted just four years ago.

The physical parameters of the Mark 1 (Mk1) version of Astra being produced now is similar to those of the AIM-120C. Astra, in fact, can travel at 4.5 Mach while the AIM 120C has a top speed of 4 Mach.

The range of the Astra Mk1 is also more – 80 to 110 km in a head-on chase – whereas the AIM 120C has a range of only 80 km in a head-on chase. Being smoke-free and equipped with a two-way data link, the Astra Mk1's stealth capabilities are also more than the US-made BVRAAM.

Indian Air Force (IAF) sources said that the ground trials of the Astra Mk1 have been completed successfully. The missile, which has all-weather day-and-night capabilities, has been successfully tested on Sukhoi 30MKI.

The Defence Acquisition Council, headed by Defence Minister Rajnath Singh, has already granted 'acceptance of necessity' for an initial order of 248 Astra Mk1 missiles that will be delivered by July 2021.

Commercial production of the Astra Mk1 at the defence public sector undertaking (PSU) "Bharat Dynamics" will start once the flight trials on Tejas fighters is completed by next month.

The missiles will cost Rs 7.5 crore apiece, a fraction of the cost of Russian, French, and Israeli BVRAAMs that IAF fighters are now armed with.

Meanwhile, defence PSU Hindustan Aeronautics Limited (HAL) will get an order for producing 83 Tejas Mk1 fighter jets at a cost of Rs 37,000 crore. This deal will be inked within this fiscal, IAF chief Air Chief Marshal R K S Bhadauria has said.

The IAF has already started getting 40 Tejas Mk1 fighters under two contracts valued at Rs 8,802 crore that were signed earlier.

The Astra Mk1, say defence industry experts, will be capable of detecting, tracking, and destroying highly agile supersonic fighters armed with anti-missile measures at long ranges.

The Astra Mk1 will also be equipped with advanced electronic counter-counter measures to negate jamming by hostile aircraft.

The Astra Mk1's active radar terminal guidance and other features enable a very high single-shot kill probability in both head-on and tail-chase modes.

The Astra Mk1, a fifth-generation missile, will replace the Vympel R-77 and Matra Super 530D missiles that the IAF fighters are equipped with now.

The Astra Mk1 has already been integrated with the Sukhoi 30MKI and MiG-29 fighter jets with the IAF.

The Astra Mk1 can be launched from different altitudes: from an altitude of 15,000 metres, its range is 110 km; when fired from an altitude of 8,000 m, its range is 44 km, and from sea level its range is 21 km.

Since the Astra Mk1 compares favourably with the US-made AIM-120C, the sunlight superiority that PAF fighters enjoyed over the IAF will be effectively negated.

On 27 February last year – a day after the Balakot air strikes – F-16s of the PAF tried to enter Indian airspace and fired five to six AIM-120Cs at IAF fighter jets.

The IAF fighters – Sukhoi 30MKI and MiG-21 Bisons – successfully dodged the AIM-120C missiles, but did not engage with the PAF fighters since they were equipped with the inferior R-77 and MICA missiles.

The PAF shot down one MiG-21 and the IAF also shot down an F-16, but that claim was strongly contested by Pakistan.

But that encounter hit the Indian defence establishment hard and drove home the strong message that the IAF needs the latest BVRAAMs for its fighters.

The decks cleared for quicker acquisition of the French Rafale fighter jets along with the Meteor missiles developed by MBDA, a pan-European consortium comprising the United Kingdom, Germany, Italy, France, Spain, and Sweden.



The Meteor is superior to the AMRAAM AIM-120C. Apart from its longer range (120 km), it is the Meteor's unique propulsion system that makes it superior to the American missile that Pakistan uses.

The AIM-120C is powered by rocket engines that deliver a uniform thrust for the duration of the flight, after which the motor burns out.

The missile then glides at high speed to its target, but the longer the distance this missile travels to its target, the lesser the energy it has for its critical terminal phase of flight.

This allows the target aircraft to engage in steep manoeuvring and to deploy counter-measures to confuse the missile. This is exactly how the IAF's Sukhoi 30MKI fighters dodged the AIM-120C missiles in February last year.

The Meteor missile, on the other hand, has a miniature supersonic jet engine called the "ramjet" that allows the missile to throttle back its engine during the cruise, thus saving fuel, and throttle up when it approaches the target.

This allows the Meteor to achieve its highest energy state during the critical terminal stage of the attack, making it nearly impossible for the target aircraft to successfully dodge it.

MBDA (the Meteor's manufacturer) asserts that the missile has the largest 'no escape zone' (NEZ) of any air-to-air missile. The NEZ is the zone in which an aircraft cannot rely on manoeuvres to evade an incoming missile.

The Meteor's NEZ is estimated to be three times that of the AIM-120C. Also, since the Meteor weighs just 190 kg, a Rafale fighter jet can easily carry up to four of those missiles at a time.

China's PL-15 BVRAAMs, which have a range of 200 km, are propelled by rocket motors like the AIM-120C. That makes the Meteor superior to the PL-15.

#### **Future Versions of Astra**

"The successful integration of the Astra Mk1 into IAF fighters has given our confidence levels a huge boost and ignited a passion among our scientists at DRDO (Defence Research and Development Organisation) to quicken the pace of development of the Mark 2 and Mark 3 versions of the BVRAAM," said Defence Minister Rajnath Singh.

A top IAF officer told Swarajya that the DRDO is only a short distance away from developing the Astra Mk2, which will have a longer range of 160 km and will be powered by a dual-pulse solid rocket motor.

This motor is a cheaper version of the ramjet (which powers the Meteor). Its design allows the motor to be burned in segments (pulses) and thus achieves the same effect as the ramjet engine.

This will increase the NEZ of the Astra Mk2 to much more than that of both the AIM-120C and the PL-15.

The Astra Mk3, which is also being developed by the DRDO and whose prototype will be out soon, will have the newly developed solid fuel ducted ramjet (SFDR) technology with a range of 350 km, at par with the Meteor.

The Astra Mk3 will impart a huge edge to the IAF over both the PAF and PLAAF and enable the IAF to fight a 'two-front' war.

As of now, the Astra Mk1 and the Meteors that have come with the Rafale will give the IAF a major boost and overcome the advantage the PAF and PLAAF had come to enjoy over it of late.

<https://www.defencenews.in/article/Why-This-%e2%80%98Astra%e2%80%99-Is-More-Than-Just-Another-Weapon-For-India-1022940>

## BrahMos' 'first import destination' Philippines hints deal may be delayed, cites Covid hit

*Roman Babushkin, the Deputy Chief of Mission at Russian Embassy in India, had said this month that BrahMos Aerospace was looking at exporting the missiles to other countries*

*By Snehash Alex Philip*

New Delhi: Plans for the possible sale of the Indo-Russian BrahMos supersonic cruise missiles to the Philippines have hit a roadblock with Manila Monday citing budgetary limitations caused by the Covid-19 pandemic.

Filipino Defence Secretary Delfin Lorenzana has told media in his country that the economic impact of coronavirus has led the government to prioritise its citizens over the cruise missile.

“Because of the pandemic, we lost the budget to procure it. We need to prioritise our citizens instead of the cruise missile, so there are no funds yet,” the Defence Secretary was quoted as saying by *The Philippine Daily Inquirer*.

“Negotiations were underway, it was already in the advanced stages of the procurement process, but it stopped because of funding issues... The procurement process stopped because we no longer had funds for it,” he said.

Roman Babushkin, the Deputy Chief of Mission at the Russian Embassy in India, had said earlier this month that BrahMos Aerospace — the Indo-Russian joint venture (JV) firm manufacturing the missiles — is looking at exporting the weapons to other countries, starting with the Philippines.

The statement had come as a surprise to the Indian security and defence establishment, because while talks were underway with the Philippines, the modalities were yet to be worked out.



BrahMos supersonic cruise missile | File photo: ANI

BrahMos is the only supersonic cruise missile in the world that flies at three times the speed of sound (2.8 Mach). It is much sought-after because it can be used for both coastal defence and ground attack.

Multiple countries have expressed their interest in acquiring the missiles, but talks were said to be most positive with Vietnam and the Philippines. Such an acquisition would mean a major enhancement in the firepower of the countries, both of which are locked in territorial disputes with the Chinese in the South China Sea.

### **‘Don’t want to enter loan agreements’**

India had offered a \$100 million line of credit for the purchase of the weapon but Lorenzana remained sceptical.

“The problem is, it’s a multi-year obligation. The President does not want us to enter into loan agreements that would be inherited by the administration after him... So, we are caught with two dilemmas: How do we buy one when we don’t have money, and what if we acquire one through a loan, but the next administration might criticise us,” he said.

Asked if there is any plan to sweeten the deal further for the Philippines, defence sources said there is no such discussion on the issue as of now.

Sources said while India is working to extend the range of the BrahMos missile, the weapons that will be exported will be the ones with a “normal range” of 290 km.



India and the Philippines had earlier this month resolved to strengthen defence engagement and maritime cooperation, especially in military training, as well as in procurement of defence equipment.

This came about after the fourth meeting of the India-Philippines joint commission on bilateral cooperation, co-chaired by External Affairs Minister S. Jaishankar and his Philippines counterpart Teodoro Locsin Jr, which was held via video link.

<https://theprint.in/defence/brahmos-first-import-destination-philippines-hints-deal-may-be-delayed-cites-covid-hit/554781/>

## Defence News

# Defence Strategic: National/International

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Tue, 01 Dec 2020

## Eye in the sky for Indian Navy-Sea Guardians

*As the world is entering into a war strategic era where machines are becoming the first line of defence followed by human intervention, which was the other way round earlier, the role of Unmanned Aerial Vehicles (UAVs) has become more protuberant*

*By Raaj Nair*

As the world is entering into a war strategic era where machines are becoming the first line of defence followed by human intervention, which was the other way round earlier, the role of Unmanned Aerial Vehicles (UAVs) has become more protuberant. Giving a major fillip to Indo-US defence cooperation, India has begun the process to procure remotely piloted MQ9 Predator 'B' Sea Guardian from the United States. The Indian Navy has taken on lease two Sea Guardian drones from an American defence major (General Atomics) to enhance surveillance over the Indian Ocean Region (IOR). India and the US signed the Communications Compatibility and Security Agreement (COMCASA) in Sept last year. The drone deal that was put on hold for 2 years has fructified after the signing of the COMCASA thus recognising India as a Major Defence Partner.

Last month, India and the US signed the Basic Exchange and Cooperation Agreement (BECA) that allows the US to share sensitive geospatial data with India that could be used in increasing the performance of both weapon and surveillance systems.

The Sea Guardian UAS manufactured by General Atomics Aeronautical Systems of the US is the naval variant of the Predator B drone which is now known more appropriately by the name MQ-9 Reaper. This is a long-endurance, high-altitude platform that can be employed in an armed patrol role. It was the first hunter-killer unmanned aerial vehicle (UAV) that was employed operationally by the US Air Force for the first time as early as in March 2007.

This unmanned platform has also been in service with the armed forces of Australia, Britain, Netherlands and Italy. In comparison with its predecessor, the MQ-1 Predator, the MQ-9 Reaper is larger and more powerful



The Sea Guardian UAS manufactured by General Atomics Aeronautical Systems of the US is the naval variant of the Predator B drone which is now known more appropriately by the name MQ-9 Reaper.

as it is equipped by a 900 horsepower Honeywell TPE 331-10 turboprop engine, as against the 119horsepower engine on the MQ-1 Predator. Also, the MQ-9 Reaper is capable of flying at an altitude of up to 50,000 feet and can cruise at nearly three times the speed of the MQ-1 Predator.

These birds have an endurance of over 27 hours, a speed of 240 knots true airspeed and have a 3,850 pound (1,746 kg) payload capacity that includes 3,000 pounds (1,361 kg) of external stores.

These drones will have significant capabilities for the Indian Navy increasing its domain awareness and ability to maintain a vigil over the areas that stretch from the Gulf in the west to the crucial Malacca strait in East and vast waters of the southern Indian Ocean in a cost-effective way as operating these drones are far cheaper than the surveillance sortie of Boeing's P8i maritime reconnaissance aircraft.

The Army, Navy and Air Force had collectively come to the conclusion that India should opt for a weaponised drone rather than the 22 x reconnaissance and surveillance Sea Guardian drones approved in 2017 by the US administration for supply to India. India had first expressed its interest in these General Atomics armed drones in 2015 and the procurement had been in the works since then. First, it was being processed as the purchase of 22 Sea Guardians for the Indian Navy till 2017 and was later converted into an acquisition for all three services.

In a significant step to reduce the high upfront cost of acquiring latest weapon platforms, Indian Navy this month inducted two MQ-9B Sea Guardian drones manufactured by the US defence major General Atomics on lease. American crew from General Atomics is also accompanying the equipment and would support the Indian Navy in operating the machines. The intelligence data from the two drones is being fed into the Indian Navy's warfare network and the country will have exclusive control over the data gathered by the two drones. Under the lease agreement, the drone manufacturer's crew will only help in the maintenance and technical issues while the mission planning and operational control will rest with Indian Navy. The data gathered by the drones during the flight would also be the exclusive property of the Navy. The sale to India of the armed Predators was controversial when it was first mooted — with India asking for 22 Sea Guardian maritime variants for its Navy

— way back in 2016. UAVs that can carry missiles fall under the Missile Technology Control Regime's (MTCR) Category 1 classification, for which there is a presumption of denial of exports. In order to facilitate the export (as well as other sales of sensitive US defence equipment), the Obama Administration designated India as a Major Defence Partner — a totally new category for US-foreign relationships specific to India. The goal was to create a tighter defence partnership between India and the US to counter Chinese ambitions and to undercut Russia's long hold on arms sales to Delhi.

To increase its surveillance capabilities, India in the last two decades has purchased Searcher Mk I and II as also the Heron from Israel Aerospace Industries (IAI). The Indian Navy has been operating UAVs since 2006. In 2015, Israel agreed to sell ten Heron TP armed drones for \$400 million to India. Project Cheetah with Israel was commissioned to upgrade the in-service drones to carry out offensive operations against the enemy. Under this project, 90 Heron drones of the three services would be upgraded to be armed with laser-guided bombs, air to ground and air-launched anti-tank guided missiles.

Presently, two Heron UAVs need to be flown in tandem with a time gap because they are not fitted with a satellite package. Without this package, information has to be relayed back to base through the second drone in case of long-range surveillance. Obviously, when we acquired the Heron UAVs from Israel, the thinking was primarily for deployment against counter-terrorists and counter-infiltration operations. The type of long-range surveillance requirements that have come up with the Chinese aggression was not visualised because the requirements for offensive operations were not the focus. The upgrade sought from Israel now involves fitting the Heron drone with a satellite package so that the UAV links with the satellite above and information is sent on a real-time basis. The upgrade will allow the Heron to conduct long-range surveillance without the fear of losing contact with the base or go into no contact zone. With this upgrade in reconnaissance capabilities, the forces on the ground would also be able to get pin-point intelligence about



hideouts in areas where men have to be involved in operations and enable the Armed forces; ground station handlers to operate these aircraft from far-off distances and control them through the satellite communication system. This would boost the capability to monitor enemy movement, keeping an eye on enemy locations and stations for taking action against them as and when required. The project is yet to be completed.

India has, so far, been using drones primarily for ISR purposes. It began early by importing Searcher 1 and 2 drones from Israel in the late 1990s for the three Services. These were followed by the Heron — a sophisticated long-range, long-endurance and high-altitude unarmed drone. Ninety Herons are currently in service with the Indian armed forces. The Indian Air Force (IAF) has also imported a limited number of Harop suicide drones from Israel, primarily for suppression of enemy air-defence systems.

China has the formidable capability of all type of drones and has also been practising the use of swarm drones in recent years while India is lagging far behind in this regard. China is exporting drones to Pakistan and is helping Pakistan develop indigenous drones like the ‘Burraq’ unarmed combat aerial vehicle (UCAV) developed by the National Engineering and Scientific Commission (NESCOM) in conjunction with the Pakistani air force. During China’s National Day parade in Oct 2019, the People’s Liberation Army (PLA) displayed a number of UAVs — DR-8 supersonic spy drone, the GJ-11 stealth combat drone and the GJ-2 reconnaissance and strike drone. The PLA has also deployed another drone named CH-4, which underwent tests in the Tibetan plateau region in 2018 and the BZK-005C, specifically modified for use in high altitudes. Since 2017, China has exported CH-4 and CH-5 fixed-wing reconnaissance and strike drones, selling them to more than 10 countries, shipping more than 200 units every year.

Rustom is a Medium Altitude Long Endurance (MALE) RPA being developed by DRDO for the three services. First flights of Rustom-1& Rustom 2 took off on 11 Nov 2009 & 15 Nov 2016 respectively. Despite years of development, the present status:- Rustom-1 MALE UAV (Prototype flight testing), Rustom-H HALE UAV (Under development) and Rustom-2 UCAV (Prototype flight testing). Rustom-2 has been renamed to TAPAS-BH-201 (Tactical Airborne Platform for Aerial Surveillance-Beyond Horizon-201). The American RQ-1 Predator is an obvious template for the Rustom program. Rustom-2 is capable of carrying a different combination of payloads (350kg) including synthetic aperture radar, electronic intelligence systems and situational awareness systems. DRDO is in the process of enhancing the endurance to over 24hrs.

MQ9 Predator ‘B’ Sea Guardian which are less manoeuvrable and carry a lesser payload, are very vulnerable to air defences, a capability both of India’s rival neighbours (China and Pakistan) excel at. The engagements over Afghanistan and the success rate could be attributed to the lack of air defence capability of the Taliban, while in other parts of the middle east, these drones have been shot down by even the oldest of soviet-era missile systems. The recent clashes between Armenia and Azerbaijan might have shown how effective these drones could be against enemy armour, meanwhile, it also shows the high number of drone losses for both sides. The high costs and the susceptibility of these systems would also have raised eyebrows for the Indian services. The costs incurred would have been Rs 900 crore per unit along with a 10% additional annual maintenance cost. Along with this, the deal would have given no transfer of technology or offsets, an issue raised during several internal meetings.

The costs saved from signing the Sea Guardian deal could be used more efficiently by investing in long-sought indigenous procurement of LCA Tejas Mk-1As and Light Combat Helicopters and supporting the internal industries under the helm of Aatmanirbhar Bharat.

*(The author is Indian Navy Veteran. Views are personal)*

<https://www.financialexpress.com/defence/eye-in-the-sky-for-indian-navy-sea-guardians/2139908/>

## Basin trials of indigenous aircraft carrier successful

*It will now be taken out to sea for extensive trials before induction*

Kochi: The basin trials of the maiden indigenous aircraft carrier (IAC) were successfully conducted at Cochin Shipyard Limited on Monday.

The Navy said that the carrier would now be taken out to the sea in the first half of 2021 for extensive trials before induction.

The basin trials were aimed at proving the main propulsion plant of the ship in harbour.

On board the carrier, which will be named Vikrant upon commissioning, trials of all four LM2500 gas turbines, main gear boxes, shafting and controllable pitch propellers, along with their integrated control systems, were conducted and proven. In addition, major auxiliary equipment and systems such as steering gear, air conditioning plants, compressors, centrifuges, all 60 critical pumps, power generation and distribution system, major machinery of fire-fighting and de-flooding systems, all deck machinery as well as entire internal communication equipment were proven during the harbour phase trials, the Navy said in a communication.



Basin trials of the Indigenous Aircraft Carrier being conducted in Kochi on Monday. | Photo Credit: Special Arrangement

Vice Admiral A.K. Chawla, Flag Officer Commanding-in-Chief of the Southern Naval Command, and Madhu S. Nair, Chairman and Managing Director, Cochin Shipyard Limited (CSL), which has built the carrier, were present on the occasion.

The Navy said that the restrictions imposed by COVID-19 notwithstanding, the shipyard and the Navy worked closely together to ensure timely completion of all essential tasks leading up to the basin trials.

N.V. Suresh Babu, Director, Operations, of CSL; Commodore Ishan Tandon, Director, Carrier Acceptance Trial Team (CATT); Commodore Sameer Aggarwal, Chief Staff Officer (Technical), Southern Naval Command; Commodore Cyril Thomas, Warship Production Superintendent (WPS), and Commodore Vivek Dahiya, Commanding Officer (Designated), also witnessed the event.

The carrier has close to 75% of the material and equipment, indigenously sourced.

<https://www.thehindu.com/news/cities/Kochi/basin-trials-of-indigenous-aircraft-carrier-successful/article33217266.ece>

# Indian Navy's IMAC to transform into NDMA: Here's what it means

*The International Maritime Organisation (IMO) publishes the guidelines for onboard operational use of the ship borne Automatic Identification Systems (AIS)*

*By Huma Siddiqui*

The Information Management and Analysis Centre (IMAC) of the Indian Navy is set to become a National Maritime Domain Awareness (NDMA) centre.

Though all including the Indian Navy and Coast Guard and related agencies are well equipped that the terror acts like 26/11 are not repeated, "The NDMA will be a multi-agency centre and will have all the stakeholders present," according to sources.

## Role of IMAC

The reason for setting this up was connecting all the operational Centres and lower rungs of the Indian Navy and the Coast Guard located along the huge coastline and the island territories.

This is the main centre of the National Command Control Communication and Intelligence System (NC3I).

And it tracks vessels on the high seas and gets data from the coastal radars.

White shipping agreements.

Automatic Identification Systems (AIS) transponders which are fitted on merchant ships, air and traffic management system and global shipping databases.

The approval by the DAC was given in 2012 and at the cost of around Rs 450 crore this became operational from Gurugram in 2014.

## What is AIS?

Following the 26/11 terror attack, fishing vessels which are more than 20m long were directed to have AIS transponders installed. And efforts are on to include the fishing vessels which are less than 20 m to have AIS transponders. The challenge is huge in terms of tracking more than 12,000 fishing vessels present in the Indian Ocean Region (IOR).

The International Maritime Organisation (IMO) publishes the guidelines for onboard operational use of the ship borne Automatic Identification Systems (AIS).

Milind Kulshreshtha, C4I expert, explains, "AIS is mainly intended to enhance the safety of life at sea (SOLAS) through safe navigation in the marine environment. SOLAS regulations require that AIS system onboard exchange data ship-to-ship and with shore-based facilities."

"The use of AIS is to help identify and track ships and SAR (Search and Rescue) operations and reduce the mandatory verbal information exchange. With a digital display, shipborne AIS enables the provision of automatic information by calculating Closest Point of Approach (CPA) and Time to Closest Point of Approach (TCPA) and AIS works on two dedicated VHF channels," the C4I expert says.

## How does the AIS System work? The technology behind it:

"It is an automated tracking system installed on all commercial vessels of specific tonnage. And the AIS equipment composes of a broadcast transponder system which operates in the VHF mobile maritime band" says Mr Kulshreshtha.



The Indian Ocean Region (IOR) is the commercial highway for large traffic and critical for the prosperity of many nations.

### **How does it work?**

According to him, “It is fitted onboard individual ships for identification of ships and navigational marks closer to the vessel underway. However, it is not a Navaid against Collision avoidance procedure. Vessel Traffic Services (VTS) ashore use the AIS information to identify, locate and monitor vessel traffic. Ships fitted with AIS are required to keep the equipment operating at all times.”

### **What kind of information is exchanged?**

“The AIS information exchanged pertains to ship’s identity, type, position, course, speed and other safety-related information. The operating mode of AIS is continuous and autonomous on a sea-going vessel.

It is expected that Chinese ships operating in the Indo-pacific shall not either be fitted with AIS or AIS not switched on so that there is no exchange of information on ships via AIS,” Mr Kulshreshtha explains.

### **IFC-IOR**

The Indian Ocean Region (IOR) is the commercial highway for large traffic and critical for the prosperity of many nations. Hence, threats such as maritime terrorism, piracy, trafficking, illegal fishing etc. are required to be kept subdued at all times.

A regional repository of maritime data, along with IMAC is located in Delhi NCR and the IFC-IOR is in lines with the principles listed under Security and Growth of All in the Region (SAGAR). It presently has linkages with 21 partner countries and 22 multi-national agencies across the globe.

As has been reported earlier, France became the first country to deploy a LO at the IFC-IOR and this was followed by several countries including the US, Australia, Japan and the UK who have announced their intention to post their LOs.

### **Maritime Domain Awareness (MDA)**

During the recently concluded 2+2 Indo-US Ministerial talks in New Delhi, Indo-US agreement decided positioning a US Navy Liaison Officer (LO) at IFC-IOR and Indian LO at NAVCENT, Bahrain.

Earlier this year in March, India has joined the Indian Ocean Commission (IOC) as Observer in March along with the United Nations and Japan, and is planning to post Naval LO at the Regional Maritime Information Fusion Centre (RMIFC) in Madagascar, which functions under the aegis of the IOC.

And at the European maritime surveillance awareness in the Strait of Hormuz (EMASOH) in Abu Dhabi and has officers from Belgium, France, Netherlands and Denmark.

### **Why India wants to post-LOs?**

This will help in further improving the linkages of the Navy’s IFC-IOR other IFCs. And this will then become the repository for all maritime data in the IOR. The posting of the LOs got delayed due to the global pandemic of COVID-19.

### **What is IOC?**

Based in the southwest of the Indian Ocean, it is a five nations regional forum — Comoros, France (Reunion), Madagascar, Mauritius and Seychelles. Both the European Union (2017) and China have been observers (2016)

<https://www.financialexpress.com/defence/indian-navys-imac-to-transform-into-ndma-heres-what-it-means/2140048/>

## Swarm drone system work fast-tracked to take on China's air defence

New Delhi: India is accelerating plans to develop an air-launched swarm drone system designed to assault enemy advanced air defences, like those deployed by China throughout the Ladakh border, thereby drastically decreasing vulnerability of pilots and fighter jets to floor based mostly air defences.

The venture, which envisages a Jaguar land assault plane launching up to 24 killer drones that take down particular person targets, already has the Indian Air Force on board and includes a minimum of two startups in addition to Hindustan Aeronautics Ltd (HAL), individuals conscious of the event advised ET.

Centre for Artificial Intelligence and Robotics (CAIR) can also be concerned to assist construct synthetic intelligence (AI) capabilities for goal acquisition.

Being developed underneath the Combat Air Teaming System (CATS) venture, the plan is to full the event course of inside 4 years, sources stated. The venture includes growth of 4 particular person techniques that can be parallely examined, they stated. The design is underway.

As per present plans, the system can be designed round a manned Jaguar land assault plane that's used for deep penetration assault missions, sources stated. The mothership could be modified to carry 4 pods – every a drone that will have the opportunity to fly alongside the Jaguar as soon as launched.

The idea is that every pod would carry six hunter killer drones that may be launched in the direction of a goal space. As the pods are being designed for autonomous operation, the Jaguar crew would have the opportunity to direct them in an anti-aircraft weapons surroundings whereas staying out of vary.

Also being designed is a Very High Altitude Long Endurance (VHALE) unmanned plane that can be ready to monitor the system and supply actual time suggestions to controllers. The VHALE is being designed to loiter for days at a stretch at above 70,000 ft, enabling a relentless eye on the goal space, whereas staying out of vary of most air defence techniques.

Sources stated detailed displays on the system have been made to the air power that has expressed a eager curiosity within the venture. The subsequent step is to take a look at particular person techniques after the design course of is accomplished.

The venture would take India right into a choose league of countries with such expertise, the others being France and the US. Sources stated the preliminary projections make it a extremely cost-effective system, with the developmental and prototype price pegged at underneath Rs 1,000 crore.

While India has a fight edge within the neighbourhood so far as fighter jets go, the ever-present menace has been superior air defence techniques being acquired by adversaries.

The Chinese facet has deployed its newly acquired S400 air defence system close to Aksai Chin and is creating its personal gear that it's doubtless to share with Pakistan within the close to future.

<https://www.pehalnews.in/swarm-drone-system-work-fast-tracked-to-take-on-chinas-air-defence/323255/>







Tue, 01 Dec 2020

# HAL delivers biggest ever cryogenic propellant tank to ISRO

*The C32-LH2 tank is a developmental cryogenic propellant tank of aluminium alloy designed for improving the payload capability of GSLV MK-III launching vehicle, HAL said in a release*

Bangaluru: Hindustan Aeronautics Limited on Monday said it has delivered the biggest cryogenic propellant tank (C32 LH2) ever fabricated by the company to ISRO, much ahead of the contractual schedule. The C32-LH2 tank is a developmental cryogenic propellant tank of aluminium alloy designed for improving the payload capability of GSLV MK-III launching vehicle, HAL said in a release.

According to HAL, the four metre diametric tank is of eight metre length to load 5,755 Kg propellant in the 89 cubic metre volume.

Total length of weld carried out in the tank was 115 metre at different stages to the quality requirement of 100 per cent tests on radiography, Die penetrant check and Leak proof, it said.

HAL has mastered the skills and technologies required for fabricating welded propellant tanks of Aluminium alloy to such stringent quality requirements, it claimed.

HAL as a strategic reliable partner, has been associating with ISRO for the prestigious space programmes since the last five decades, the company said pointing out that it has supplied critical structures, tankages, satellite structures for the PSLV, GSLV-MkII and GSLV-MkIII launch vehicle.

Various new projects like PS2/GS2 integration, Semi-Cryo structure fabrication and manufacture of cryo and semi cryo engines are being taken up at HAL, for which setting up of necessary infrastructure and facilities is nearing completion, it said.

HAL has also supported ISRO right from the developmental phase of Crew Atmospheric Re-entry Experiment, PAD Abort test for Crew Escape for Human Space Mission and is currently building hardware for full-fledged launch vehicle GSLV Mk-III for Gaganyaan programme, it added.



HAL delivers biggest ever cryogenic propellant tank to ISRO

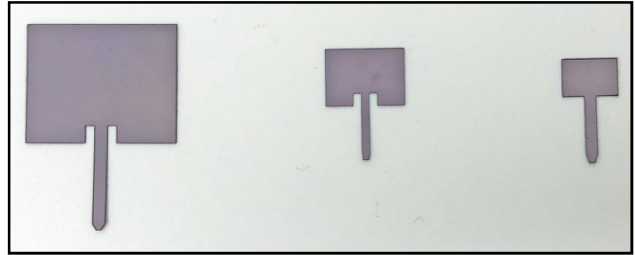
<https://www.indiatvnews.com/news/india/hal-delivers-biggest-cryogenic-propellant-c32-lh2-tank-isro-668404>



## Ultrathin spray-applied MXene antennas are ready for 5G

New antennas so thin that they can be sprayed into place are also robust enough to provide a strong signal at bandwidths that will be used by fifth-generation (5G) mobile devices. Performance results for the antennas, which are made from a new type of two-dimensional material called MXene, were recently reported by researchers at Drexel University and could have ramifications for mobile, wearable and connected "internet of things" technology.

The MXene antennas, which have been in development at Drexel for just over two years, are already performing nearly as well as the copper antennas found in most mobile devices on the market today, but with the benefit of being just a fraction of their thickness and weight.



"This combination of communications performance with extreme thinness, flexibility and durability sets a new standard for antenna technology," said Yury Gogotsi, Ph.D., Distinguished University and Bach professor of Materials Science and Engineering in Drexel's College of Engineering, who is the lead author of a paper on the MXene antennas recently published in the journal *Advanced Materials*. "While copper antennas have been the best in terms of performance for quite some time, their physical limitations have prevented connected and mobile technology from making the big leaps forward that many have predicted. Due to their unique set of characteristics MXene antennas could play an enabling role in the development of IoT technology."

Drexel University researchers have produced flexible, spray-applied antennas made from a two-dimensional material called MXene, that have reached performance measures on par with current telecommunications technology. Credit: Drexel University (Meikang Han)

While mobile communications companies currently are on the cusp of introducing 5G technology, which could capitalize on an less-used portion of the telecommunication spectrum to enable faster data transmission, it will likely become the standard range of operation for new technology.

Beyond reaching performance capabilities, antennas for devices of the future must also be able to acquit themselves well in a variety of environments outside of the circuitboards of phones and computers. According to Gogotsi, this makes MXene an appealing material for new antennas because it can be spray applied, screen printed or inkjet-printed onto just about any substrate and remains flexible without sacrificing performance.

"Generally copper antenna arrays are manufactured by etching printed circuit boards, this is a difficult process to undertake on a flexible substrate," said Meikang Han, Ph.D., a post-doctoral researcher at the A.J. Drexel Nanomaterials Institute who contributed to the research. "This puts MXene at a distinct advantage because it disperses in water to produce an ink, which can be sprayed or printed onto building walls or flexible substrates to create antennas."

In the paper, Gogotsi and his collaborators, including Professor Gary Friedman, Ph.D., and Kapil Dandekar, Ph.D., E. Warren Colehower Chair Professor of the Electrical and Computer Engineering Department in Drexel's College of Engineering, reported on the performance of three sets of spray-coated MXene antennas, which were between 7-14 times thinner and 15-30 times lighter than a similar copper antenna—even thinner than a coat of paint. They tested the antennas in both lab and open environments for key performance measures of how efficiently the antenna converts power into directed waves—gain, radiation efficiency and directivity. And they did the

testing at the three radio frequencies commonly used for telecommunication, including one in the target frequency of operation for 5G devices.

In each instance, the MXene antennas performed within 5% percent of copper antennas, with performance increasing with thickness of the antenna. The best performing MXene patch antenna, about one-seventh the thickness of standard copper antennas, was 99% as efficient as a copper antennas operating at 16.4 GHz frequency in an open environment. MXenes were also 98% as effective as their copper counterparts operating in the 5G bandwidth.

Their performance exceeded that of several other new materials being considered for antennas, including silver ink, carbon nanotubes and graphene. And, significantly, these performance numbers did not waiver when the MXene antennas were subjected to as many as 5,000 bending cycles—a mark of durability that far surpasses its peer materials.

"MXene's scalability and environmental sustainability in manufacturing has been well established, for this material to now achieve performance goals on pace with the best materials on the market today is certainly a significant development," Gogotsi said. "As we continue to test various coating patterns and techniques while additionally optimizing the composition of MXene materials, I expect their performance to continue to improve."

**More information:** Meikang Han et al, Solution-Processed  $Ti_3C_2Tx$  MXene Antennas for Radio-Frequency Communication, *Advanced Materials* (2020). DOI: [10.1002/adma.202003225](https://doi.org/10.1002/adma.202003225)

**Journal information:** [Advanced Materials](https://phys.org/news/2020-11-ultrathin-spray-applied-mxene-antennas-ready.html)  
<https://phys.org/news/2020-11-ultrathin-spray-applied-mxene-antennas-ready.html>



Tue, 01 Dec 2020

## Light confinement in a 3-D space

The emerging services such as data center cloud interconnection services, ultra-bandwidth video services, and 5G mobile services stimulate the fast development of photonic integrated circuits (PIC), which can meet the increasing demand of communication systems for internet.

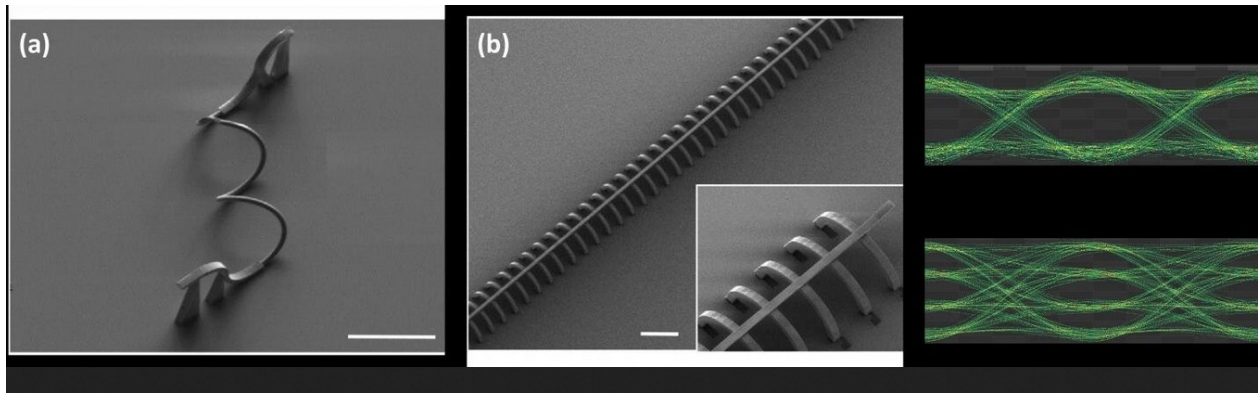
However, PICs today are largely perceived as planar structures, able to guide light in a single plane. This planarity arises because of the traditional top-down fabrication processes.

Multiphoton lithography is a new and promising 3-D printing technology that allows for 3-D objects to be fabricated more easily, compared to the fabrication of 3-D objects in conventional cleanroom type fabrication methods used in electronics and optoelectronics.

With this technique, there is no longer a restriction of the top-down exposure for the realization of PICs as it unlocks the functions availed by the third dimension. Leveraging concepts of additive manufacturing, 3-D multi-photon lithography involves the use of a femtosecond light source to initiate two-photon polymerization when focused onto a specific location in material. This technique was used to realize the high-resolution 3-D photonic structures.

Researchers at the Singapore University of Technology and Design (SUTD) have demonstrated high-resolution 3-D waveguides which transcend the restrictions of light confinement in a single plane. In the paper published in *Advanced Optical Materials*, Dr. Gao Hongwei, Associate Professor Dawn Tan and their colleagues at the Photonics Devices and Systems Group demonstrated high-resolution 3-D waveguides which guide light in a spiral and air-bridge configuration (refer to SEM images below).

Alongside these novel devices, they also demonstrated very low loss 3-D waveguide couplers with 1.6dB fiber-waveguide coupling losses and 3dB bandwidth exceeding 60nm. This is in contrast with the current industry standards which require very labor intensive packaging for losses of around 1dB. The research team demonstrated their losses to be low without requiring any post processing or post-fabrication packaging. The high-resolution fabrication also resulted in ring resonators with sub-micron feature sizes.



a) 3D spiral waveguide. (b) Suspended air-bridge waveguide; inset shows the input and output coupling sections. (c) 30Gb/s NRZ and (d) 56Gb/s PAM4 eye diagram of the 3D Printed Waveguide output. Credit: SUTD

"The fabricated photonic devices are an innovative advancement in the domain of photonic integrated circuits. Importantly, we were also able to demonstrate error-free 30Gb/s NRZ and 56Gb/s PAM4 data transmission through these waveguides. This is important because these high-speed testing formats and rates are in alignment with those used in commercial direct-detection transceiver products today," explained principal investigator Associate Professor Tan who heads the photonics devices and systems group at SUTD.

Indeed, the team managed to derive only small power penalties of 0.7 dB for NRZ (bit error rate [BER] =  $10^{-12}$ ) and 1.5 dB for PAM4 (BER =  $10^{-6}$ ) from the photonic devices. These results successfully demonstrate high speed, error-free optical transmission through the 3-D fabricated waveguides. This also showcases the devices' suitability as low-loss waveguides and optical interconnects.

"Importantly, the 3-D quality of these waveguides allows us to exceed the limitations of traditional planar structures. In this way, it is possible to achieve far higher density PICs. The high resolution, sub-micron feature sizes are also promising, especially to achieve advanced functions such as spectral filtering, resonator structures and metasurfaces," said Dr. Gao, the first author of the paper and postdoctoral researcher from SUTD.

"This work demonstrates the potential of additive manufacturing in making advanced photonic devices with superior 3-D designs in high resolution," added co-author Associate Professor Low Hong Yee from SUTD.

In the future, the capability to realize high resolution 3-D photonic structures may create even more advancements in both form and function in photonics, including advanced optical signal processing, imaging techniques and spectroscopic systems.

**More information:** Hongwei Gao et al, 3D Photonic Waveguides: High-Resolution 3D Printed Photonic Waveguide Devices, *Advanced Optical Materials* (2020). DOI: [10.1002/adom.202070071](https://doi.org/10.1002/adom.202070071)

**Journal information:** [Advanced Optical Materials](https://phys.org/news/2020-11-confinement-d-space.html)  
<https://phys.org/news/2020-11-confinement-d-space.html>

## Air-filled fiber cables capable of outperforming standard optical fibers

The next generation of optical fiber could be a step closer as a new study has shown that fibers with a hollowed out center, created in Southampton, could reduce loss of power currently experienced in standard glass fibers.

The COVID-19 crisis has seen people all over the world rapidly move their work and social lives online and communities have never relied on the internet more. The ever-increasing number of Zoom calls and webinars has highlighted the need to keep advancing the technology that has made this possible.

For over 50 years, optical fibers made of silica glass have been the transmission medium of choice for high-speed optical communications—powering the global internet and cloud-based services used by households and businesses around the world. They are also used for sensing oil and gas installations, structural monitoring for railways and bridges, medical endoscopes and many more applications as part of a \$40 billion global market.

However, due to "scattering" of the light inside the glass, a fraction of the transmitted power is lost, a process known as attenuation, and this power loss becomes increasingly more of a problem as the wavelength of light is shortened. This higher transmission loss through the fiber poses a serious limitation to the performance of all applications that require shorter wavelengths.

In this new study, published in *Nature Communications*, researchers from the University of Southampton have demonstrated that guiding light through air filled fibers offers a potential way to overcome this insurmountable attenuation limit set by the glass's scattering.

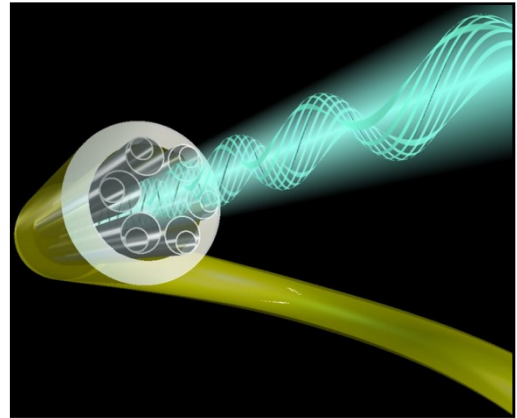
A team from the University's Optoelectronics Research Center (ORC) created three different hollow core fibers, with losses comparable or lower than that achieved in solid glass fibers around technologically relevant wavelengths of 660, 850 and 1,060 nanometres. The lower attenuation, in a fiber that guides light through air, offers the potential for advances in quantum communications, data transmission, and laser power delivery.

Professor Francesco Poletti from the ORC said, "Many alternative glass types and waveguide technologies have been investigated since the 1970s to try to solve this problem, all to no avail."

"Our findings show that hollow core fibers have the potential to outperform the current optical fibers at various wavelengths used in optical technology today. Not only do they have lower attenuation, they can also withstand higher laser intensities, such as those needed to melt rocks and drill oil wells, as well as produce more efficient lasers for manufacturing."

Professor Poletti added that the hollow core fibers can also transmit undistorted laser pulses with peak power levels so high that they would be unusable if transmitted by standard glass fibers, and preserve the polarization of light needed to produce more accurate sensors and imaging endoscopes.

The fibers developed and reported in the paper are the result of over ten years research by the ORC in developing Nested Antiresonant Nodeless Fibers (NANFs), a special type of hollow core fibers that confine light in the central void thanks to thin glass membranes surrounding the core. Their first fibers had attenuations of 5 decibels (dB), i.e. only 30% of light transmission, for every meter of fiber. New physical understanding with contributions from the worldwide community,



"Hollow core optical fibres with comparable attenuation to silica fibres between 600 and 1100 nm" has been published in *Nature Communications* with DOI [10.1038/s41467-020-199107](https://doi.org/10.1038/s41467-020-199107)



and substantial development in fabrication technology led by the Southampton team, have now led one of the fibers reported in this study to improve this by a factor of 10,000 by achieving an attenuation of only 5 dB every 10 kilometers.

Professor Poletti continued. "The technology we are developing has the potential to underpin the development of faster datacentres with shorter delays for the end-user, more accurate gyroscopes for interplanetary missions, more efficient laser based manufacturing, to name but a few."

The University of Southampton team that has invented and developed this optical fiber technology under funding from the ERC project Lightpipe is continuing to work on improving the optical performance of these fibers, while producing longer lengths at a lower cost.

Professor Sir David Payne, director of the Optoelectronics Research Center, added, "The transmission capacity of optical fibers is so large that we never thought we'd reach the point where we would use it all up. But in the last five to ten years, we've realized that we're now close to doing just that and the impact of COVID-19 has accelerated this further. This means that no longer can we tweak conventional fibers to mine more capacity but must resort to the sledgehammer approach of installing huge numbers of new fiber cables. This is possible but drives up costs.

"A faster, more reliable internet with larger bandwidth would help us sustain our current levels of online work and socializing and also enable us to take this further in areas like 3-D video conferencing and virtual reality."

Professor Poletti said, "We are convinced that we might have finally identified a solution with the potential to complement, and in many cases, replace all-solid silica fibers that have been the mainstay in domestic and commercial applications for half a century."

**More information:** Hollow core optical fibers with comparable attenuation to silica fibers between 600 and 1100 nm, *Nature Communications*. DOI: [10.1038/s41467-020-199107](https://doi.org/10.1038/s41467-020-199107)

**Journal information:** *Nature Communications*  
<https://phys.org/news/2020-11-air-filled-fiber-cables-capable-outperforming.html>



Tue, 01 Dec 2020

## Decoupling electronic and thermal transport

A new University of Wollongong study overcomes a major challenge of thermoelectric materials, which can convert heat into electricity and vice versa, improving conversion efficiency by more than 60%.

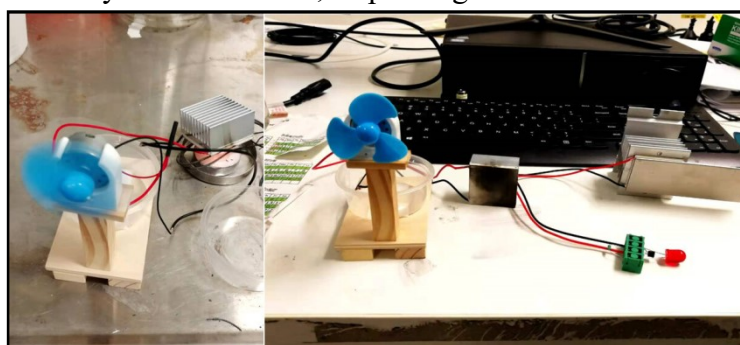
Current and potential future applications range from low-maintenance, solid-state refrigeration to compact, zero-carbon power generation, which could include small, personal devices powered by the body's own heat.

"The decoupling of electronic (electron-based) and thermal (phonon-based) transport will be a game-changer in this industry," says the UOW's Prof Xiaolin Wang.

### Thermoelectric applications and challenges

Bismuth telluride-based materials ( $\text{Bi}_2\text{Te}_3$ ,  $\text{Sb}_2\text{Te}_3$  and their alloys) are the most successful commercially-available thermoelectric materials, with current and future applications falling into two categories: converting electricity into heat, and vice versa:

- Converting electricity into heat: reliable, low-maintenance solid-state refrigeration (heat pump) with no moving parts, no noise, and no vibration.



Thermoelectric material demonstration: powering a small fan, LED. Credit: FLEET

- Converting heat into electricity including fossil-free power generation from a wide range of heat sources or powering micro-devices for free, using ambient or body temperature.

Heat harvesting takes advantage of the free, plentiful heat sources provided by body heat, automobiles, everyday living, and industrial process. Without the need for batteries or a power supply, thermoelectric materials could be used to power intelligent sensors in remote, inaccessible locations.

An ongoing challenge of thermoelectric materials is the balance of electrical and thermal properties: In most cases, an improvement in a material's electrical properties (higher electrical conductivity) means a worsening of thermal properties (higher thermal conductivity), and vice versa.

"The key is to decouple thermal transport and electrical transport," says lead author, Ph.D. student Guangsai Yang.

### **Better efficiency through decoupling**

The three-year project at UOW's Institute of Superconductivity and Electronic Materials (ISEM) found a way to decouple and simultaneously improve both thermal and electronic properties.

The team added a small amount of amorphous nano-boron particles to bismuth telluride-based thermoelectric materials, using nano-defect engineering and structural design.

Amorphous nano boron particles were introduced using the spark plasma sintering (SPS) method.

"This reduces the thermal conductivity of the material, and at the same time increases its electron transmission," explains corresponding author Prof Xiaolin Wang.

"The secret of thermoelectric materials engineering is manipulating the phonon and electron transport," explains Professor Wang.

Because electrons both carry heat and conduct electricity, material engineering based on electron transport alone is prone to the perennial tradeoff between thermal and electrical properties.

Phonons, on the other hand, only carry heat. Therefore, blocking phonon transport reduces thermal conductivity induced by lattice vibrations, without affecting electronic properties.

"The key to improving thermoelectric efficiency is to minimize the heat flow via phonon blocking, and maximize electron flow via (electron transmitting)," says Guangsai Yang. "This is the origin of the record-high thermoelectric efficiency in our materials."

The result is record-high conversion efficiency of 11.3%, which is 60% better than commercially-available materials prepared by the zone melting method.

As well as being the most successful commercially-available thermoelectric materials, bismuth telluride-based materials are also typical topological insulators.

Ultra-High Thermoelectric Performance in Bulk BiSbTe/Amorphous Boron Composites with Nano-Defect Architectures was published in *Advanced Energy Materials* in September 2020.

**More information:** Guangsai Yang et al. Ultra-High Thermoelectric Performance in Bulk BiSbTe/Amorphous Boron Composites with Nano-Defect Architectures, *Advanced Energy Materials* (2020). DOI: [10.1002/aenm.202000757](https://doi.org/10.1002/aenm.202000757)

**Journal information:** [Advanced Energy Materials](https://phys.org/news/2020-11-decoupling-electronic-thermal.html)  
<https://phys.org/news/2020-11-decoupling-electronic-thermal.html>



## A new hybrid X-ray detector goes toe-to-toe with state-of-the-art rivals

A new hybrid X-ray detector developed by the University of Surrey outperforms commercial devices—and could lead to more accurate cancer therapy.

In a study published by the *Advanced Functional Materials* journal, researchers from Surrey's Advanced Technology Institute (ATI) demonstrate a new hybrid X-ray [detector](#) architecture with slightly higher sensitivity for X-rays than typically used for radiotherapy.

The authors also show that their new architecture brings several new benefits, including industry-standard ultra-low dark currents that are the lowest reported for such detectors. The device also has fast response characteristics that compete with commercial X-ray semiconductor detectors based on silicon and selenium.

Prabodhi Nanayakkara, the lead scientist of the study and Ph.D. student at the University of Surrey, said, "Our hybrid detector has shown promising results—chief of which is its ability to be more accurate than current X-ray detectors. We hope that our technology will lead to improved patient survival rates and ultimately to a healthier society."

Professor Ravi Silva, Director of ATI at the University of Surrey, said, "Technologies with unique capability such as this only appear once in a lifetime—with its plethora of applications that range from low dose mammography to high-speed border security to non-destructive testing over large areas using portable wireless technology.

"We are proud of this cutting-edge breakthrough and look forward to further developing the technology via our university spin-out vehicle, SilverRay Ltd."

**More information:** M. Prabodhi A. Nanayakkara et al, Ultra-Low Dark Current Organic–Inorganic Hybrid X-Ray Detectors, *Advanced Functional Materials* (2020). [DOI: 10.1002/adfm.202008482](https://doi.org/10.1002/adfm.202008482)

**Journal information:** [Advanced Functional Materials](#)  
<https://phys.org/news/2020-11-hybrid-x-ray-detector-toe-to-toe-state-of-the-art.html>

Tue, 01 Dec 2020

## Chemical compounds in foods can inhibit a key SARS-CoV-2 enzyme

By Mick Kulikowski

Chemical compounds in foods or beverages like green tea, muscadine grapes and dark chocolate can bind to and block the function of a particular enzyme, or protease, in the SARS-CoV-2 virus, according to a new study by plant biologists at North Carolina State University.

Proteases are important to the health and viability of cells and viruses, says De-Yu Xie, professor of plant and microbial biology at NC State and the corresponding author of the study. If proteases are inhibited, cells cannot perform many important functions—like replication, for example.

"One of our lab's focuses is to find nutraceuticals in food or medicinal plants that inhibit either how a virus attaches to human cells or the propagation of a virus in human cells," Xie said.

In the study, the NC State researchers performed both computer simulations and lab studies showing how the so-called 'main protease' (Mpro) in the SARS-CoV-2 virus reacted when confronted with a number of different plant chemical compounds already known for their potent anti-inflammatory and antioxidant properties.

"Mpro in SARS-CoV-2 is required for the virus to replicate and assemble itself," Xie said. "If we can inhibit or deactivate this protease, the virus will die."

Computer simulations showed that the studied chemical compounds from green tea, two varieties of muscadine grapes, cacao powder and dark chocolate were able to bind to different portions of Mpro.

"Mpro has a portion that is like a 'pocket' that was 'filled' by the chemical compounds," Xie said. "When this pocket was filled, the protease lost its important function."

In vitro lab experiments completed by Yue Zhu, an NC State Ph.D. student in Xie's lab, showed similar results. The chemical compounds in green tea and muscadine grapes were very successful at inhibiting Mpro's function; chemical compounds in cacao powder and dark chocolate reduced Mpro activity by about half.

"Green tea has five tested chemical compounds that bind to different sites in the pocket on Mpro, essentially overwhelming it to inhibit its function," Xie said. "Muscadine grapes contain these inhibitory chemicals in their skins and seeds. Plants use these compounds to protect themselves, so it is not surprising that plant leaves and skins contain these beneficial compounds."

**More information:** Yue Zhu et al, Docking Characterization and in vitro Inhibitory Activity of Flavan-3-ols and Dimeric Proanthocyanidins Against the Main Protease Activity of SARS-Cov-2, *Frontiers in Plant Science* (2020). DOI: [10.3389/fpls.2020.601316](https://doi.org/10.3389/fpls.2020.601316)

<https://phys.org/news/2020-11-chemical-compounds-foods-inhibit-key.html>



Chemical compounds in muscadine grapes effectively inhibit an important SARS-CoV-2 protease. Credit: De-Yu Xie, NC State University

## All eyes on COVID-19 vaccine — PM Modi holds talks with three more teams involved in developing the vaccine

- *PM Modi spoke to Gennova Biopharma, Biological E, and Dr Reddy's.*
- *While Gennova Biopharma and Biological E are working on their own vaccines, Dr Reddy's has tied up with Russia to conduct trials of the Sputnik V vaccine.*
- *He had earlier visited the top three contenders – Zydus Biotech Park in Ahmedabad, Bharat Biotech in Hyderabad, and the Serum Institute of India in Pune.*

India's Prime Minister Narendra Modi is accelerating COVID-19 vaccine talks with various stakeholders in the country. After visiting the Serum Institute, Bharat Biotech, and Zydus Cadila – the front runners of the COVID-19 vaccine from India, PM Modi interacted with three more stakeholders to understand the progress on the vaccine.

He spoke to Gennova Biopharma, Biological E and Dr Reddy's today (November 30). While Gennova Biopharma and Biological E are working on their own vaccines, Dr Reddy's has tied up with Russia to conduct trials of the Sputnik V vaccine.

A statement from the Prime Minister's Office said that Modi also asked the companies, represented by these teams, to come out with their suggestions and ideas regarding the regulatory processes and related matters. "The PM advised all the departments concerned to engage with the manufacturers and seek to resolve matters so that the efforts by these companies bear fruit in order to serve the needs of the country and the entire world," it added.

On November 28, Modi went on a three-city tour for an extensive review of the vaccine development and manufacturing process, which involved visits to the top three contenders – Zydus Biotech Park in Ahmedabad, Bharat Biotech in Hyderabad, and the Serum Institute of India in Pune.

After Modi's visit, IANS quoted an SII official to say that the government is hoping for 300-400 million doses of coronavirus vaccine by July 2021. "Presently, we have nothing in writing from the government on how many doses it will buy, but the indication is that the need would be for around 300-400 million doses by July 2021," said Adar Poonawalla, after the Prime Minister's visit.

Modi's vaccine visit was praised by many, including opposition leaders of the Congress, who believed that the Prime Minister's presence would have given a boost to the manufacturers.

Earlier, the Indian government announced a ₹900 crore fund dedicated to the research, and development of COVID-19 vaccine. "India is waiting for an effective vaccine to come - one or many more. We are spending on research and development apart from what we will give when the vaccine is ready to be bought and distributed. We are also keeping abreast of the developments around the vaccine," Finance Minister Nirmala Sitharaman had said while announcing the fund.

<https://www.businessinsider.in/india/news/pm-modi-to-hold-talks-gennova-biopharma-biological-e-dr-reddys-teams-involved-in-developing-the-covid-19-vaccine/articleshow/79484713.cms>



PM Narendra Modi interacting with CMD Bharat Biotech Dr. Krishna Ella, Joint Managing Director Suchitra Ella(L) and also seen is Executive Director Dr Krishna Mohan(second from left)BCCL

