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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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**Press Information Bureau  
Government of India**

**Ministry of Defence**

*Tue, 08 Dec 2020 8:30PM*

## **Curtain Raiser of India International Science Festival (IISF) 2020**

Minister for Science & Technology, Earth Sciences and Health & Family Welfare Dr Harsh Vardhan presided over the Curtain Raiser event of India International Science Festival (IISF) - 2020, today on at Defence Institute of High Altitude Research (DIHAR), a DRDO laboratory at Leh-Ladakh. The event was organized as a virtual conference.



India International Science Festival (IISF) is celebrated every year to promote Science and Technology and demonstrate how science could lead India towards a developed nation within a short span of time. The aim is to engage public with science and celebrate the joy of science and show the ways how science, technology, engineering and mathematics (STEM) provide us with the solutions to improve our lives.

Dr Harsh Vardhan in his address via online media, briefed the audience about the importance and relevance of celebrating this festival and asked all the stakeholders to promote and make science and technology reach every remote location of the country. He further emphasized the importance of S&T in realizing the theme of

6th IISF to “make India self reliant and contribute in global welfare”. He also congratulated DIHAR for its contribution towards improving the agro-animal development of Ladakh region.

Lt Governor of Ladakh UT, Shri R K Mathur in his address briefed about the role of Science & Technology to improve the socio-economic standard of population as well as its inherent capacity to reach every corner of the country, irrespective of challenging physical boundaries. He further said that this is relevant for Ladakh region’s life, where the prevailing harsh environment throws greater challenge for sustenance of humans and animal. He stated that S&T has immensely helped to make life in Ladakh more comfortable for general public and remunerative for the local farmers. In this area contributions of DIHAR are commendable.

Shri JamyangTsering Namgyal, Member of Parliament Ladakh in his address appreciated the contributions of DIHAR in developing suitable technologies to increase the availability of vegetable diversity in Ladakh and said that endeavors of utilizing the potential of S&T has to be disseminated in various other domains and far flung locations.

Dr G Satheesh Reddy, Secretary, DD R&D & Chairman DRDO sent his wishes to the organisers and the scientific community for this large festival of science and technology. Dr AK Singh, DG (Life Sciences) in DRDO emphasized upon strengthening S&T to find local solutions to the prevailing local problems.

The event witnessed participation via online media from diverse areas like administration, policy, education, agriculture, entrepreneurship and students.

<https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1679194>



**Press Information Bureau**  
**Government of India**

**Ministry of Science & Technology**

*Tue, 08 Dec 2020 6:02PM*

## **Dr Harsh Vardhan virtually addresses the Curtain Raiser function of IISF 2020 organised by Defence Institute of High Altitude of DRDO, Ladakh**

*“DIHAR has been chosen for the event due to its unique contributions to the region of Ladakh in improving living conditions of local population and soldiers through scientific development and also for contributing to military civil fusion in this strategically located area”:*

*Dr. Harsh Vardhan*

*IISF-2020 being organised at a Virtual platform signifies the indomitable spirit of nurturing and celebrating scientific temperament amongst all the stakeholders of Science, Technology and Innovation: Dr. Harsh Vardhan*

*“The theme for IISF-2020: ‘Science for Self-Reliant India and Global Welfare’ is very relevant in present context when nation is looking towards Science & Technology for accelerating growth and for spearheading vision of Atmanirbhar Bharat” : Dr. Harsh Vardhan*

*“S & T become more relevant in Ladakh like region, where the prevailing harsh environment throws great challenge for sustenance of humans and animal:*

*Lt Governor of Ladakh UT, Shri R K Mathur*

Dr. Harsh Vardhan, Union Minister of Science & Technology, Earth Sciences and Health & family Welfare has said that organising the India International Science Festival -2020 this year on a virtual platform due to COVID-19, signifies the indomitable spirit of nurturing and celebrating scientific temperament amongst all the stakeholders of Science, Technology and Innovation. He was addressing the audience through video-conferencing as the Chief Guest at the Curtain Raiser function of IISF-2020 organised by the Defence Institute of High Altitude Research (DIHAR) of the Defence Research and Development Organisation (DRDO), Ladakh.

Among the participants in the virtual function included Shri R K Mathur, Lt Governor, UT Ladakh; Shri JamyangTsering Namgyal, Member of Parliament, Ladakh; Shri TashiGyalson, Chief Executive Councilor, LAHDC, Leh, Ladakh; Dr G Satheesh Reddy, Secretary, DD R&D and Chairman DRDO; Dr OP Chaurasia, Director DIHAR , Leh; Dr AK Singh, DS & DG (LS) DRDO.

Dr. Harsh Vardhan expressed the hope that “with use of digital platform, IISF will be able to bring together people from the remotest corners of the country in a single click, thereby helping in fulfilling the objectives of organising IISF”. Wishing all the stake holders of science and technology and allied organizations who are part of this festival a grand success, the Minister said, “The IISF-2020 proposes to bring more than 10,000 researchers, scientists and experts from different subjects to discuss their research findings and exchange innovative ideas on the identified research themes”.

Dr. Harsh Vardhan explained, “The theme for IISF-2020: ‘Science for Self-Reliant India and Global Welfare’ is very relevant in present context when nation is looking towards Science & Technology for accelerating growth and for spearheading the vision of an ‘Atmanirbhar Bharat’.” He said, “IISF is a much-awaited annual event for students and science loving citizens from all spheres of life”.

“The Defence Institute of High Altitude Research i.e. DIHAR of DRDO located at Leh at an altitude of 11500 ft has been chosen for the event due to its unique contributions to the region of Ladakh in improving the living conditions of local population and soldiers through scientific development and also for contributing to military civil fusion in this strategically located area”, Dr. Harsh Vardhan expressed his happiness “Today farmers in Ladakh are growing varieties of fruits and vegetables in the uncongenial terrain, which was not possible few decades back”. “The contributions of the Institute are true reflection of the power of science and technology to bring changes at grass root level. In my opinion, organisers of the IISF-2020 have made the right selection of the venue for launch of the curtain raiser of this upcoming festival. The work being carried by the institute truly matches with the goal of the event”, he noted with satisfaction. He said, “I have great satisfaction that one of the curtain raisers in the series is being organised at newly established Union Territory of Ladakh”.

Lt Governor of Ladakh UT, Shri R K Mathur in his address, briefed about the role of Science & Technology to improve the socio-economic standard of population as well as its inherent capacity to reach every corner of our country, irrespective of challenging physical boundaries. “This becomes more relevant in Ladakh like region, where the prevailing harsh environment throws great challenge for sustenance of humans and animals. S&T has immensely helped to make livelihood in



Ladakh more comfortable for the general public and remunerative for the local farmers, for which contribution of DIHAR is commendable”. He also briefed about the huge potential to exploit renewable energy sources of Ladakh to make the region self sustainable with zero carbon emission.

Shri JamyangTsering Namgyal, MP Ladakh, in his address, spoke about contributions made by DIHAR by developing suitable technologies to increase the availability of vegetable diversity in Ladakh. Endeavors like this, utilizing the potential of S&T have to be disseminated in various other domains and far flung locations, he said.

Dr AK Singh, DS &DG (LS) DRDO talked about the importance of taking science out of R&D premises to the actual field locations so that livelihood of the population is made healthier, economical and sustainable. He further emphasized upon strengthening S&T to find local solutions to the prevailing local problems.

Dr. OP Chaurasia, Director, DIHAR and overall coordinator of this event at Leh, in his welcome address, mentioned about the importance of organizing such an event in remote location of Ladakh and he pledged to disseminate the developed technologies among the masses in this high altitude region of Ladakh.

The event witnessed participation via online media from diverse areas like administration, policy, education, agriculture, entrepreneurship and students.

Established in 1960, DIHAR has developed regionally suited agro-animal technologies for the unique terrain and climatic conditions.

The institute continues to carry on the good work to fuse economic and social development strategies for local populace with security strategies for the country to build an integrated national strategic system and capabilities in support of national rejuvenation goals which is the need of the day. DIHAR under the aegis of DRDO endeavours to strengthen food, health and energy security of the troops deployed in high Himalayas through scientific innovations, transfer of technologies and involvement of the local population to augment the availability of fresh food for the army. Over the years, DIHAR has evolved as a doyen of high altitude research and pioneered the development of the cold arid agro-animal technologies for high altitude to ensure sustenance and enhancing the performance of troops guarding the northern frontiers.

The 6th India International Science Festival (IISF)-2020 is being organised from 22 to 25 December 2020 in virtual mode. It is in this context that a series of curtain raisers are being organised in different regions of country so that maximum population can benefit from the event.

This is the largest science festival on virtual platform. This year, 41 events will be organized under 9 verticals. This year IISF 2020 is attempting entries in **Guinness World Records** under five different categories. The registration is open for 33 events out of 41 events. The participation in the overseas ministers and diplomats’ conclave, state S&T conclave, science education in India and Guinness World Records will be through nominations and direct invitation. The other events will have open registrations. The registrations can be done through the IISF 2020 website

<https://www.scienceindiafest.org/#/home>

<https://www.pib.gov.in/PressReleasePage.aspx?PRID=1679133>

## Harsh Vardhan speaks at Leh institute; stresses science should reach every corner of the country

*He emphasised upon the importance of science and technology to make India self-reliant and contribute in global welfare*

Chandigarh: Union Minister of Science and Technology, Earth Sciences, Dr Harsh Vardhan on Tuesday asked all stakeholders to promote and make science and technology reach every remote location of the country.

Speaking online at the curtain raiser of India International Science Festival, 2020, organised at the Defence Institute of High Altitude Research (DIHAR), Leh, he emphasised upon the importance of science and technology to make India self-reliant and contribute in global welfare.

He briefed the audience about the importance and relevance of celebrating this festival and felicitated DIHAR for the contribution it is making in terms of research and development to improve the agro-animal development of Ladakh region, according to a statement issued here.



Harsh Vardhan speaking online at the curtain raiser of India International Science Festival, 2020, organised at the Defence Institute of High Altitude Research (DIHAR), Leh. Tribune photo

Lieutenant Governor of Ladakh, RK Mathur, spoke about the role of science and technology to improve the socio-economic standards of the local population and briefed the audience about the huge potential of renewable energy sources of Ladakh to make the region self-sustainable with zero carbon emission.

He said the inherent capacity of science and technology to reach every corner of our country irrespective of challenging physical boundaries becomes more relevant for Ladakh, where the prevailing harsh environment throws great challenge for sustenance of humans and animals.

It has immensely helped to make livelihood in Ladakh more comfortable for the public and remunerative for the local farmers, for which contribution of DIHAR is commendable, he added.

Jamyang Tsering Namgyal, Member of Parliament from Ladakh, said contributions made by DIHAR by developing suitable technologies to increase the availability of fresh vegetables in Ladakh should be disseminated in various other domains and far flung locations.

Dr AK Singh, Director General (Life Science) DRDO, mentioned about the importance of taking science beyond the premises of research and development institutes to actual field locations so that livelihood of the population is made healthier, economical and sustainable. He further emphasised upon strengthening science and technology to find local solutions to local problems.

Dr OP Chaurasia, Director DIHAR, spoke about the importance of organising such an event in remote location of Ladakh and said that DIHAR is committed to disseminate the technologies developed by it among the masses in this high-altitude region.

He added that the aim of the event is to engage the public with science and celebrate the joy of science and show the ways how science, technology, engineering and mathematics provide us with the solutions to improve our lives.

<https://www.tribuneindia.com/news/j-k/harsh-varadhan-speaks-at-leh-institute-stresses-science-should-reach-every-corner-of-the-country-181567>

## Explore green hydrogen potential to boost Ladakh's economy: LG RK Mathur

*Ladakh Lieutenant Governor R K Mathur stressed on exploring the possibility of using 'green hydrogen' for transport, heating and lighting purposes in the Union territory*

Leh: Ladakh Lieutenant Governor R K Mathur on Tuesday stressed on exploring the possibility of using 'green hydrogen' for transport, heating and lighting purposes in the Union territory.

Attending a digital curtain raiser ceremony of the 6th India International Science Festival, Mathur said scientific intervention can help Ladakh in many ways and foremost in reducing carbon emission that would help the region contribute to the country's carbon neutrality.

This will help achieve the prime minister's vision of a carbon-neutral Ladakh, he said.

The Union Territory Administration has initiated certain steps in collaboration with various institutes to have science-based developmental activities in Ladakh, Mathur said.



Tso Moriri in Ladakh. Photo: Khalid Anzar

He stressed on exploring the possibility of a 'green hydrogen' economy for Ladakh that can be used for transport, heating and lighting purposes covering even the remotest and scattered hamlets.

He batted strongly for exploration of green hydrogen potential to boost the economy of Ladakh.

The Lt Governor thanked Union Science and Technology Minister Harsh Vardhan, present on the occasion, for selecting Ladakh to hold the curtain raiser event.

He also appreciated the endeavours of Defence Research and Development Organisation (DRDO) in successfully launching various science projects in Ladakh like polycarbonate greenhouse, setting up of RTPCR lab, and promotion of white kernel apricot.

The theme of this year's science festival to be held from December 22 to 25 is 'science for self-reliant India and global welfare'.

*(Only the headline and picture of this report may have been reworked by the Business Standard staff; the rest of the content is auto-generated from a syndicated feed.)*

[https://www.business-standard.com/article/current-affairs/explore-green-hydrogen-potential-to-boost-ladakh-s-economy-lg-r-k-mathur-120120801461\\_1.html](https://www.business-standard.com/article/current-affairs/explore-green-hydrogen-potential-to-boost-ladakh-s-economy-lg-r-k-mathur-120120801461_1.html)

## सेना और मजबूत: देश में निर्मित युद्धक टैंक हंटर किलर का अंतिम परीक्षण सफल, मिसाइल का भी इस पर नहीं होगा असर

जोधपुर: भारतीय सेना और डीआरडीओ ने संयुक्त रूप से पोकरण फील्ड फायरिंग रेंज में एक बार फिर देश में निर्मित उन्नत युद्धक टैंक अर्जुन मार्क-1ए का परीक्षण किया है। सेना में हंटर किलर के नाम से प्रसिद्ध 118 टैंक खरीदने का ऑर्डर मार्च में तैयार कर लिया था, लेकिन सेना ने इस टैंक में कुछ और सुधार की मांग की थी। इसके बाद डीआरडीओ ने करीब 14 नए फीचर्स को टैंक में शामिल किया। इस टैंक का सोमवार को पोकरण में किया गया परीक्षण अपने सभी मानकों पर एकदम खरा उतरा। अब इसके सेना में शामिल होने का मार्ग प्रशस्त हो गया है। सेना की दो टैंक रेजिमेंट के पुराने टैंक इससे बदले जाएंगे।

2004 में सेना में देश में ही निर्मित अर्जुन टैंक को शामिल किया गया था। इस टैंक को काम में लेने के बाद सेना ने इसके उन्नत वर्जन के लिए कुल 72 तरह के सुधारों की मांग की। डीआरडीओ ने सेना के सुझावों को शामिल करते हुए हंटर किलर टैंक तैयार किया। मार्च में पोकरण में ही किए गए परीक्षणों में यह खरा उतरा, लेकिन सेना ने कुछ और सुधार की सूची डीआरडीओ को थमा दी।

इसके बाद डीआरडीओ ने ये सुधार कर 4 टैंक तैयार किए। इन टैंकों का परीक्षण पोकरण में किया गया। इस दौरान सैन्य विशेषज्ञों के साथ डीआरडीओ में इसे तैयार करने वाले विशेषज्ञ भी मौजूद थे। सेना ने इसे रूस के टी-90 पर तव्वजो प्रदान की है। डीआरडीओ का दावा है कि इतने सुधारों के बाद यह टैंक अपने आप में परिपूर्ण है और दुनिया के किसी भी बेहतरीन टैंक से किसी मायने में कम नहीं है।

### टैंक हंटर किलर की खासियत

नए उन्नत वर्जन में इसकी फायर पावर क्षमता को काफी बढ़ाया गया है। साथ ही इसमें एकदम नई तकनीक का ट्रांसमिशन सिस्टम लगाया गया है। हंटर किलर अपने लक्ष्य को स्वयं तलाश करने में सक्षम है। यह स्वयं तेजी से आगे बढ़ते हुए दुश्मन के लगातार हिलने वाले लक्ष्यों पर भी सटीक प्रहार कर सकता है।

टैंक में कमांडर, गनर, लोडर व चालक का कू होगा। इन चारों को यह टैंक युद्ध के दौरान भी पर्याप्त सुरक्षा प्रदान करेगा। टैंक की सबसे बड़ी खासियत यह है कि रणक्षेत्र में बिछाई गई माइंस को साफ करते



हुए आसानी से आगे बढ़ सकता है। कंधे से छोड़ी जाने वाले एंटी टैंक ग्रेनेड और मिसाइल का इस पर कोई प्रभाव नहीं पड़ता है।

इसके अलावा, केमिकल अटैक से बचाने के लिए इसमें विशेष तरह के सेंसर लगे हैं। केमिकल या परमाणु बम के विस्फोट की स्थिति में इसमें लगा अलार्म बज उठेगा। साथ ही टैंक के अंदर हवा का दबाव बढ़ जाएगा ताकि बाहर की हवा अंदर प्रवेश न कर सके। क्रू मेंबर के लिए ऑक्सीजन के लिए बेहतरीन फिल्टर लगाए गए हैं। इसके अलावा इसमें कई नए फीचर्स शामिल किए गए हैं, जो इस टैंक को न केवल बेहद मजबूत बनाते हैं बल्कि सटीक प्रहार करने में इसका कोई सानी नहीं है।

<https://www.bhaskar.com/local/rajasthan/jodhpur/news/final-test-of-hunter-killer-built-in-country-battle-tank-successful-paves-way-to-join-army-127991911.html>



Wed, 09 Dec 2020

## DRDO's new Arjun tank demonstrates advanced capability to Army

*The Mark1A are the advanced version of the two regiments of the Arjun tanks in the Army and the force is looking to place orders for 118 more of these*

New Delhi: Soon after Prime Minister Narendra Modi took a ride in the Arjun tank on Diwali, senior Indian Army officials were shown the advanced capabilities of the DRDO-manufactured Mark1A version of the tank.

Some rounds were fired during the demonstration and remote-controlled weapon system operation was also showcased during the demonstration before the Director-General Armoured Corps Lt Gen MJS Kahlon and Lt Gen Hasabnis in Jaisalmer, sources told ANI.

“The DRDO tank capability upgradation trials would continue for some more days,” they said.

The Mark1A are the advanced version of the two regiments of the Arjun tanks in the Army and the force is looking to place orders for 118 more of these.

The Army had placed an order for 124 of these tanks in the first go and is now likely to order more if they meet its requirements.

<https://www.hindustantimes.com/india-news/drdo-s-new-arjun-tank-demonstrates-advanced-capability-to-army/story-1LfwK9xMTqInxOsRNXhglJ.html>



The Army had placed an order for 124 of the Mark1A tanks in the first go and is now likely to order more if they meet its requirements.(Bloomberg (Representative Image))

## Upgradation and trials of MBT Arjun Mk-1A to continue for few more days

*The development of the tank is significant in light of the government's fresh call for made in India systems as a part of 'Aatmanirbhar Bharat'*

### **Key Highlights**

- **Development of Arjun is important in light of the Make in India programme**
- **Two regiments of the tank are likely to be inducted over the next six months**

New Delhi: Upgradation trials of Main Battle Tank (MBT) Arjun Mk-1A are expected to continue further. The capabilities of Arjun Mark 1-A tank were shown to senior officials of Army including Director-General Armoured Corps Lt Gen MJS Kahlon on Tuesday.

"During the demonstration, few rounds were fired and remote-controlled weapon system operation showcased. Upgradation trials are likely to continue for few more days," news agency ANI cited sources as saying. The development of the tank is not only crucial for boosting the capability of the Indian Army but even for the Defence Research and Development Organisation (DRDO), which is central to India's Make in India programme.

In what underlined the importance attached with the development of the platform, PM Narendra Modi, in November, rode an Arjun tank as he spent his Diwali with the troops along the western borders. "Today the whole world is troubled by expansionist forces. Expansionism is, in a way, a mental disorder and reflects 18th-century thinking. India is also becoming a strong voice against this thinking," PM had said in his address to the troops.



File photo | Photo Credit: ANI

### **Two regiments of MBT Arjun likely over the next few months**

The Indian Army is expected to raise two regiments of the tank, which is likely to have certain improvements over its previous version. The two regiments are expected to be inducted into the Indian Army in the next few months.

The Army has 124 Arjun tanks which are deployed along the western sector. Developed by DRDO, Arjun is a state-of-the-art tank with superior firepower, high mobility, and excellent protection. Its development assumes more importance in light of the government's call for 'Aatmanirbhar Bharat', meaning 'self-reliant India'.

<https://www.timesnownews.com/india/article/upgradation-and-trials-of-mbt-arjun-mk-1a-to-continue-for-few-more-days/692152>

## सेना और डीआरडीओ ने युद्धक टैंक अर्जुन मार्क-1ए का परीक्षण किया, सभी मानकों पर खरा उतरा

*battle tank Arjun 14 नए फीचर्स के साथ ही अब इसके सेना में शामिल होने का मार्ग प्रशस्त हो गया। सेना की दो टैंक रेजिमेंट के पुराने टैंक इससे बदले जाएंगे। 118 टैंक खरीदने का ऑर्डर मार्च में तैयार किया था लेकिन सेना ने कुछ सुधार की मांग की थी।*

*By Vijay Kumar*

जयपुर: भारतीय सेना और डीआरडीओ ने संयुक्त रूप से राजस्थान के सीमावर्ती जैसलमेर स्थित पोकरण फील्ड फायरिंग रेंज में एक बार फिर देश में निर्मित उन्नत युद्धक टैंक अर्जुन मार्क-1ए का सोमवार को परीक्षण किया। परीक्षण में टैंक अपने सभी मानकों पर खरा उतरा है। अब इसके सेना में शामिल होने का मार्ग प्रशस्त हो गया। सेना की दो टैंक रेजिमेंट के पुराने टैंक इससे बदले जाएंगे। सेना में हंटर किलर के नाम से प्रसिद्ध 118 टैंक खरीदने का ऑर्डर मार्च में तैयार किया गया था, लेकिन सेना ने इसमें कुछ सुधार करने की मांग की थी। इसके बाद डीआरडीओ ने करीब 14 नए फीचर्स को टैंक में शामिल किया था।

### कुछ और सुधार की डीआरडीओ को कही गई थी

उल्लेखनीय है कि साल, 2004 में देश में ही निर्मित अर्जुन टैंक को सेना में शामिल किया गया था। इस टैंक को काम में लेने के बाद सेना ने इसके उन्नत वर्जुन के लिए कुल 72 तरह के सुधारों की मांग की थी। डीआरडीओ ने सेना के सुझावों को शामिल करते हुए हंटर किलर टैंक तैयार किया था। मार्च में पोकरण में ही इसका परीक्षण किया गया, जिसमें खरा उतरा। लेकिन सेना ने कुछ और सुधार की डीआरडीओ को कही थी।

### केमिकल अटैक से बचाने के विशेष तरह के सेंसर

इसके बाद डीआरडीओ ने टैंक में चार सुधार किए। अब इसमें फायर पावर क्षमता को काफी बढ़ाया गया है। नई तकनीक का ट्रांसमिशन सिस्टम लगाया गया है। यह अपने लक्ष्य को खुद तलाशने में सक्षम है। टैंक में कमांडर, गनर, लोडर व चालक का क्रू होगा। यह टैंक युद्धक्षेत्र में बिछाई गई माइंस को साफ करते हुए आसानी से आगे बढ़ सकेगा। केमिकल अटैक से बचाने के लिए विशेष तरह के सेंसर लगे हैं।



*battle tank Arjun 14 नए फीचर्स के साथ ही अब इसके सेना में शामिल होने का मार्ग प्रशस्त हो गया। सेना की दो टैंक रेजिमेंट के पुराने टैंक इससे बदले जाएंगे। 118 टैंक खरीदने का ऑर्डर मार्च में तैयार किया था लेकिन सेना ने कुछ सुधार की मांग की थी।*

<https://www.jagran.com/rajasthan/jaipur-army-and-drdo-tested-battle-tank-arjun-mark-1a-met-all-standards-21146975.html>

## DRDO के 'अर्जुन' ने साथे अचूक निशाने, 118 टैंक और खरीदेगी आर्मी

जैसलमेर में प्रधानमंत्री नरेंद्र मोदी के अर्जुन टैंक की सवारी करने तुरंत  
बाद सैन्य अधिकारियों ने टैंक की क्षमताओं का जायजा लिया था

नई दिल्ली: दिवाली के मौके पर प्रधानमंत्री नरेंद्र मोदी ने राजस्थान के रण में अर्जुन टैंक (Arjun Tank) की सवारी की थी, उसके तुरंत बाद ही भारतीय सेना के अधिकारियों के सामने टैंक की अत्याधुनिक क्षमताओं और डीआरडीओ (DRDO) द्वारा निर्मित मार्क1ए वर्जन का प्रदर्शन किया गया था। सूत्रों के हवाले ANI ने जानकारी दी है कि प्रदर्शन के दौरान अर्जुन टैंक ने कुछ राउंड फायर किए थे, साथ ही रिमोट कंट्रोल वीपन सिस्टम ऑपरेशन भी सेना के अधिकारियों के सामने प्रदर्शित किया गया था।

जैसलमेर में टैंक की क्षमता का प्रदर्शन देखने वाले वरिष्ठ अधिकारियों में डायरेक्टर जनरल आर्मर्ड कोर के लेफ्टिनेंट जनरल एमजेएस काहलो और लेफ्टिनेंट जनरल हसनबीस भी शामिल थे। सूत्रों के मुताबिक डीआरडीओ टैंक की अपग्रेडेशन क्षमताओं का ट्रायल कुछ और दिन तक जारी रहा। अर्जुन टैंक का मार्क1ए वर्जन एडवांस्ट कैटेगिरी का है। आर्मी के पास अर्जुन टैंक के दो रेजिमेंट हैं और सेना 118 और टैंकों की खरीद के लिए ऑर्डर देने की तैयारी में है। आर्मी ने पहले ही 124 टैंकों की खरीद का ऑर्डर दे रखा है और अपग्रेडेशन क्षमताओं के ट्रायल अर्जुन खरा उतरा तो सेना अपनी जरूरतों के हिसाब से और ऑर्डर दे सकती है।



आर्मी के पास अर्जुन टैंक के दो रेजिमेंट हैं और सेना 118 और टैंकों की खरीद के लिए ऑर्डर देने की तैयारी में है।  
फाइल फोटो

बता दें कि पूर्वी लद्दाख में सीमा पर चीन के साथ तनाव के बीच डीआरडीओ ने एमबीटी अर्जुन टैंक से लेजर गाइडेड एंटी टैंक मिसाइल का परीक्षण किया था। ये परीक्षण रहा था और रक्षामंत्री राजनाथ सिंह ने एंटी टैंक गाइडेड मिसाइल के सफलतापूर्व परीक्षण के लिए डीआरडीओ को बधाई दी थी।

रक्षा मंत्री ने कहा था कि निकट भविष्य में भारत निकट भविष्य में आयात निर्भरता को कम करने की दिशा में काम कर रहा है।

<https://hindi.news18.com/news/nation/drdo-arjun-tank-demonstrates-advanced-capability-to-army-3369445.html>

## **The growing role of the CDS in India's military strategy**

*New posts have been created as part of a restructuring of the Army*

*By Pradip R Sagar*

On January 1 this year, General Bipin Rawat took over as the country's first Chief of Defence Staff (CDS). Besides bringing jointness to the three services, the office of the CDS, also known as the Department of Military Affairs, has been instrumental in the restructuring of the Army.

As per the charter of duty, the office of CDS does not have any operational role in the functioning of Services. But, with the increasing complexity of security challenges in the modern warfare arena, there was a need to have a CDS for an integrated approach towards defence strategy. Over eight months of tensions along the China border, General Rawat has held several meetings to discuss India's response to the Chinese military's aggression in the Eastern Ladakh sector. The involvement of the Indian Air Force and of the MARCOS in the Pangong Tso region also indicated the active role of the CDS.

Last week, the office of the CDS gave its nod to the appointment of Deputy Chief (Strategy), who shall deal with military operations, military intelligence, strategic planning and operational logistics. With this, the Director-General Military Operations (DGMO) and Director General of Military Intelligence (DGMI), who presently report to the Vice Chief of Army Staff (VCOAS), will now report to DCOAS (Strategy).

The creation of the new post was part of the restructuring plan initiated by General Rawat which include slashing non-operational flab and downsizing the Army HQs through merging or relocating different directorates and by creating integrated battle groups.

Lt General Paramjit Singh has been appointed as the Deputy Chief Strategy, who will now deal with operations, intelligence, information and logistics. He will replace the Director General Military Operations (DGMO) as one the Principal Staff Officers of the Army Chief.

The Director-General Information Warfare will head the media outreach wing and will tackle misinformation on social media and other information for media include, print, electronic and digital. During the ongoing military standoff with China, psychological warfare through media witnessed its new peak as both the PLA and Indian Army released videos and pictures for their deployment pattern on the Line of Actual Control. Director-General Information Warfare will also report to the Deputy Chief (Strategy). Earlier, DGMO and DGMI used to report to the Vice Chief of Army on routine military operations.



**Chief of Defence Staff Bipin Rawat | PTI**

The long-pending demand of the Armed Forces was first recommended in 2001 by a Group of Ministers (GoM) that was tasked with studying the Kargil Review Committee (1999) report. CDS is a four-star General who will act as the Principal Military Advisor to the Defence Minister on all tri-services (Army, Navy and Indian Air Force) matters, eventually becomes the country's senior-most military man.

CDS has the mandate of force planning and changing role of warfare- being more technology-oriented over rightsizing of manpower.

CDS is also finalising the work towards operationalising Theatre Commands which integrate the operations of the Army, Air Force and Navy.

<https://www.theweek.in/news/india/2020/12/08/the-growing-role-of-the-cds-in-indias-military-strategy.html>

# ThePrint

Wed, 09 Dec 2020

## What India, Saudi, UAE look to gain from Gen. Naravane trip, a first by an Indian Army Chief

*to make India self-reliant and contribute in global welfare General M.M. Naravane will begin a week-long trip to both countries, starting 9 December, in what is considered a sign of growth in India's ties with the Middle East*

*By Snehesh Alex Philip*

New Delhi: Regular joint military exercises and training besides joint production of defence equipment are some of the goals that India, UAE and Saudi Arabia look to achieve on Army chief General M.M. Naravane's week-long trip to the two key Middle East countries.

This is the first visit by an Indian Army chief to Saudi Arabia and the UAE and is seen as a sign of how India's ties with the Middle East has improved over the past few years, sources in the defence and security establishment said.

During the visit from 9 to 14 December, Gen. Naravane will be meeting his counterparts and the senior military leadership of these countries.

Sources said that the visit was scheduled for earlier but was postponed due to the Covid pandemic. The delay also affected the first bilateral Army exercise with both countries.

According to the plan, 45-member delegations from each of the UAE and Indian armies were set to travel to the other country for similar military exercises.

### Historic visit

In a statement issued Tuesday, the Army said Naravane's trip was "historic in the sense that it will be the first time an Indian Army Chief is visiting the UAE and Kingdom of Saudi Arabia.

Gen. Naravane will be in the UAE on 9 and 10 December, during which time he is scheduled to call on senior military officials. He is expected to discuss avenues for enhancing India-UAE defence relations.

Sources said that one area of focus will be the coming together in the field of defence production.

"Both countries top the list when it comes to defence imports. Both countries are focusing on developing their indigenous capability and this is an area that they can collaborate on," a source said.



Army chief Gen. M M Naravane | ANI File photo

Both countries are already in talks with each other for a possible Make in India route for the supply of carbines to the Indian Army, a contract of which was won by the state-owned UAE firm Caracal.

### **Saudi leg**

From the UAE, Gen. Naravane will travel to Saudi Arabia for the second leg of his tour spanning 13-14 December.

The Army said that its chief will take forward the “excellent defence cooperation between the Kingdom of Saudi Arabia and India through multiple meetings with senior functionaries of security establishment and exchange views on various defence related issues”.

The Army chief will visit the headquarters of Royal Saudi Land Force, the Joint Force Command headquarters and the King Abdulaziz Military Academy.

Gen. Naravane is also scheduled to visit the National Defence University and address the students and faculty at the institution.

Explaining the significance of this visit, sources highlighted that this could eventually pave the way for deeper military ties.

“There are a number of proposals on the table. The military authorities will talk and come back with concrete proposals that would then be taken up by the government of both countries,” a second source said.

### **Pakistan, Turkey vs Saudi Arabia, UAE**

Gen. Naravane’s visit comes at a time when there is a lot of churning within the Islamic world, from attempts by the UAE and Saudi to ease ties with Israel to Pakistan trying to create an alternative bloc.

It is also at a time Pakistan’s relationship with Saudi Arabia, once its strongest ally, has hit turbulence.

Decades of close military, political and economic relations between Saudi Arabia and Pakistan plummeted in August this year when the South Asian country’s foreign minister, Shah Mehmood Qureshi, criticised Riyadh for failing to call a special meeting of the Organisation of Islamic Cooperation on the Kashmir issue.

Pakistan Army chief General Qamar Javed Bajwa’s visit to Saudi Arabia in August, to ease the diplomatic strain between the countries, ended with him being denied a meeting with Crown Prince Mohammed bin Salman.

As it stands, Pakistan’s former army chief, Gen. Raheel Sharif, heads a Saudi Arabia-led Islamic military coalition.

At the moment, the UAE, Bahrain and Sudan are also working to normalise relations with Israel.

<https://theprint.in/defence/what-india-saudi-uae-look-to-gain-from-gen-naravane-trip-a-first-by-an-indian-army-chief/562866/>

# Indian Army Chief sets off on strategically-crucial 6-day trip to UAE, Saudi Arabia

*General MM Naravane's visit is viewed as a reflection of India's progressive strategic ties with both countries*

## **Key Highlights**

- ***This is the first-ever trip by a Chief of Indian Army to the two Gulf countries***
- ***The COAS' first pit stop will be the United Arab Emirates where he is set to meet senior military officials***
- ***As per the official schedule, General Naravane will visit Saudi Arabia from December 13-14***

New Delhi: In a major boost to the strategic ties between India and the Gulf countries in the space of defence and national security, Chief of Army Staff (COAS) General MM Naravane on Tuesday left on a six-day tour of the United Arab Emirates and Saudi Arabia.

This is the first-ever trip by a Chief of Indian Army to the two Gulf countries.

General Naravane's visit is viewed as a reflection of India's progressive strategic ties with both countries, and this trip is expected to further open up fresh avenues for cooperation in defence and security.

The Army Chief's visit comes in the backdrop of some really massive developments in the Gulf region, such as normalisation of Israel's relations with Arab countries and the tense situation arising from the assassination of Iran's top nuclear weapons scientist Mohsen Fakhrizadeh.

The COAS' first pit stop will be the United Arab Emirates where he is set to meet senior military officials and discuss ways to enhance bilateral cooperation in the defence sector.

"General MM Naravane, the Chief of Army Staff has proceeded on a visit to the United Arab Emirates and the Kingdom of Saudi Arabia from December 9 to 14. During the visit, he will be meeting his counterparts and senior military leadership of these countries. The visit is historic in the sense that it will be the first time an Indian Army Chief is visiting the UAE and Kingdom of Saudi Arabia," the Army said in a statement.

As per the official schedule, General Naravane will visit Saudi Arabia from December 13-14.

"He will take forward the excellent defence cooperation between the Kingdom of Saudi Arabia and India through multiple meetings with senior functionaries of the security establishment and exchange views on various defence related issues," the Army stated.

Among the places on his checklist are also the headquarters of Royal Saudi Land Force, the Joint Force Command headquarters and King Abdul Aziz Military Academy, along with Saudi Arabia's National Defence University.

General Naravane's trip comes just days after External Affairs Minister S Jaishankar's visits to Bahrain and the UAE.

<https://www.timesnownews.com/india/article/indian-army-chief-general-mm-naravane-in-uae-saudi-arabia-today/692227>



Indian Army Chief General Manoj Mukund Naravane. | Photo Credit: IANS

# Future warfare: Is Indian Army ready for the use of Artificial Intelligence and Smart Technologies?

*It is for the first time that the machine gun was controlled remotely using advanced cameras and artificial intelligence and targeted only one individual without causing any collateral damage*

*By Huma Siddiqui*

Recent use of a satellite controlled weapons platform used in the killing of Iranian nuclear scientist, Mohsen Fakhrizadeh has invited international attention probably for the fact that a remotely controlled machine gun mounted on a pickup was used to pointedly kill him. It is for the first time that the machine gun was controlled remotely using advanced cameras and artificial intelligence and targeted only one individual without causing any collateral damage.

Artificial intelligence-based platforms are the future of any battlefield. They can be easily deployed without being detected easily and cause havoc through enemy fire. They are stealthy and very effective.

“The development of remote-controlled devices has seen phenomenal development since US forces started targeting terrorist networks with precise accuracy using the drones. Scores of Taliban, ISIS and other terrorist leaders were targeted making use of satellite controlled weapon platform. However the nature of such weapons led to the elimination of targets in close vicinity of the targeted individual as well,” Brig NK Bhatia tells Financial Express Online.



Artificial intelligence-based platforms are the future of any battlefield. (Photo source: IE)

The Indian Army veteran says, “In the recent conflict between Azerbaijan and Armenia extensive reports of the use of the artificial intelligence-based weapon platforms, more particularly swarm drones, came to light caused huge casualties amongst not only to soldiers but also to armoured vehicles.”

“Artificial intelligence ‘smart bombs’ has been in use for quite a while. But their use in land warfare is now gaining prominence. It is only a matter of time before we may see their deployment to counter large armour and mechanised columns,” according to Brig Bhatia.

## More about Artificial Intelligence

To put it simply AI refers to the Information Systems which are capable of using computer algorithms or rule-sets to do things which would require human intelligence.

It is a tool which is used to carry out functionalities which are coded in them. And these are usually based on the intelligence of the human programmers. Working with a huge database moving at a high data rate, these AL tools can be trained to learn to identify the pattern and information which may not be humanly possible.

## Face Recognition

Facial Recognition (FR), Artificial Neural Networks and Social Network Analysis are some of the popular tools used in AI. And FR is used for automatic identification and recognition of a person.

## So how does FR work?

The facial data which is gathered from specific demographics are for training FR algorithms of Artificial Neural Network — for ethnicity-based FR accuracy.

Also, social networks are used to gather huge amounts of personal information.

According to experts with AI, the ethics of the use of ‘people targeting’ has become more covert. And with technology moving fast and intelligently, the Human-Technology (HUMTEC) process is now at a crucial juncture. Governments globally are unable to take the top-down view.

### **Is the Indian Army ready?**

Not yet. As has been reported earlier in Financial Express Online, to become a fully network-centric force, use of artificial intelligence (AI) in the military is expected to begin in the near future. It will take around 3-4 years before the AI tool is used in the Indian Military. The process of this has already started, and the plan is that every army personnel will be having the tools in which Artificial Intelligence will be integrated.

A Defence Artificial Intelligence Council is already set up in the Ministry of Defence and the defence minister is the chairman, and the three service chiefs, the defence secretary and secretary defence production are members.

### **What does it mean?**

The times and methodology of fighting wars are undergoing a quantum jump. It is a matter of time that artificial intelligence gains currency in land warfare by exploiting the space and cyber domain.

<https://www.financialexpress.com/defence/futre-warfare-is-indian-army-ready-for-the-use-of-artificial-intelligence-and-smart-technologies/2145585/>

# ThePrint

Wed, 09 Dec 2020

## **Navy orders Israeli SMASH 2000 Plus systems to tackle drones, more contracts in offing**

*The contract, awarded by the defence ministry, is expected to increase operational effectiveness with quicker and more accurate strike abilities against drones*

*By Snehesh Alex Philip*

New Delhi: The Indian Navy has gone in for an unspecified number of Israeli, cutting-edge fire control systems that tackle drone threats from close range besides improving a soldier’s accuracy and speed of hitting targets.

Sources in the defence and security establishment told ThePrint that while this is an initial order, the Army along with the Border Security Force are already in talks with Israeli firm Smart Shooter.

A statement released by the firm Tuesday said it had been awarded a contract for the supply of its SMASH Fire Control Systems to the Indian Navy by the defence ministry.



The Smash 2000 plus | By special arrangement

The contract calls for the supply of Smart Shooter’s SMASH 2000 Plus fire control systems, which will be installed mainly on AK-47 and AK 203 rifles. SMASH is a kind of electro-optic sight system.

“SMASH 2000 Plus provides an inimitable hard-kill solution against the growing threats of drones, and delivers proven ability to hit any ground or airborne targets and eliminate the threat quickly and effectively,” Michal Mor, the company’s CEO said in the statement.

She added, “We will be happy to keep offering the Indian Military diverse cutting-edge solutions for protection against ground and aerial threats at land, air, and sea.”

### **Systems upgrade to tackle drone threat**

In his annual press conference last week, Navy chief Admiral Karambir Singh had said that the force was procuring SMASH-2000s as anti-drone equipment to protect against attacking drones.

Smart Shooter claims the SMASH 2000 Plus features built-in targeting algorithms that can track and hit very small drones skimming along at high speed, at ranges of up to 120 metres, with the first shot.

It said that SMASH 2000 Plus fully complies with the Indian needs and shall significantly improve a soldier's accuracy and speed of hitting targets and shooting down threats, hence dramatically maximising operational effectiveness.

The SMASH 2000 Plus is based on the SMASH 2000 system and includes the whole feature set with an additional advanced Counter-UAS (Unmanned Aerial Systems) Mode, which provides accurate Hard Kill capability to counter the emerging drone threat.

The electro-optic (EO) sight system, which was brought into the market last year, provides a day/night rapid target acquisition capability to target small, fast-moving aerial threats such as incendiary balloons and kites.

This was later upgraded to target small, moving drones from closer ranges of rifle.

<https://theprint.in/defence/navy-orders-israeli-smash-2000-plus-systems-to-tackle-drones-more-contracts-in-offing/562955/>



*Wed, 09 Dec 2020*

## **After Russian Submarines & US' Drones, Indian Navy Will Now Lease Light Utility Helicopters**

*By Smriti Chaudhary*

Under the newly introduced Defense ministry leasing guidelines, the Indian Navy is looking to lease light utility helicopters for its logistical needs. The Navy is looking to fill vital gaps in the frontline warships by urgently leasing 12-18 helicopters from foreign vendors.

Amid the ongoing border row between India and China, last month Navy leased two Sea Guardian drones from the American giant General Atomics for intelligence gathering, surveillance and reconnaissance over the Indian Ocean.

With increased Chinese People's Liberation Army's (PLA) activity in the region, the need for drones has increased to keep an eye on the enemy.

As reported earlier by EurAsian Times, in 2019, India had rented an Akula-1 class nuclear-powered attack submarine from Russia for a period of 10 years at a \$3billion contract. Russia will deliver the Akula-1 class submarine, to be known as Chakra III, to the Indian Navy by 2025.

The Navy has approached foreign vendors to enquire about short term lease of helicopters that can be used to transport supplies and personnel between ships with a secondary surveillance role, reported *Economic Times*, citing sources.

It further said that the helicopters that will be leased will later be refitted with light weapons by the Navy as per its requirement adding that the helicopters will likely be equipped only with a machine gun during the lease period.

The Navy currently possesses the multirole Chetak choppers that were first delivered in 1965 and have been the backbone of the Search and Rescue (SAR), Casualty Evacuation and Route Transport Role (RTR) operations. However, the Navy is now looking to replace the ageing fleet of choppers.

The indigenous Advanced Light Helicopters (ALH), that the navy is currently operating, comes under 5.5-ton weight class and are reportedly difficult to operate from smaller vessels. It is majorly used for passenger/commuter role, VIP travel, casualty evacuation, search and rescue and training.

While the navy is already operating the ALH in a utility role, it requires 111 helicopters for deployment onboard ships to carry out multiple roles, including surveillance and ferrying supplies. The requirement is urgent and a specialized chopper is needed that can be quickly deployed and retrieved and can be stored in the space-constrained hangar onboard all vessels.

The navy is already in the process of acquiring the choppers under Rs. 21,000 crore 'Make in India' initiative but has rejected the contract for Advanced Light Helicopter (ALH) by Hindustan Aeronautics Limited (HAL). The Indian Navy believes that that Advanced Light Helicopters by HAL does not meet its requirement and that there is a dire need to establish alternative capability in the private sector to manufacture modern choppers.

The process to acquire the choppers is already in advanced stages with four Indian companies shortlisted who can partner with a foreign technology provider to make the helicopters domestically.

The Defense Ministry introduced a stop-gap solution under the Defence Acquisition Procedure (DAP) 2020. The government allowed the three services — Army, Navy and the Air Force — to lease equipment rather than buying them in one go.

Experts believe that leasing allows a cost-effective process to acquire military equipment without a commitment to capital expenditure.

“While leasing can mitigate the burden on the military’s stressed capital budget, additional funds would be needed to pay the rent,” noted Amit Cowshish, former Financial Advisor (Acquisition), Ministry of Defence. He added that even leasing requires a “realistic assessment of likely budgetary allocations before opting for large-scale equipment leasing.”

However, critics believe that even for leasing military equipment, a formal process of acceptance of necessity (AON), request for information (RFI) and so on are required to be followed, which is similar to the regular acquisition process and can be time-consuming.

<https://eurasianimes.com/after-russian-submarines-us-drones-indian-navy-will-now-lease-light-utility-helicopters/>

# Chinese trawlers on the prowl in the Indian Ocean: IUU pose the greatest maritime threat

*IUU has been rated as the highest maritime security threat, more serious than Piracy and Narcotic Smuggling, according to research undertaken by 'Caught Red Handed project'*

*By Huma Siddiqui*

Illegal, Unregulated and Unreported (IUU) fishing is one of the gravest non-traditional global maritime security threats facing nations as there is an alarming depletion of fish in the sea. This concern has been flagged worldwide. “However, this is blatantly disregarded by China, which is a member of the UNSC and also a signatory to the UN Convention on the Law of the Sea. China ranked as the worst offender on the IUU Index of 2019, has committed to the Sustainable Development Goals (SDG) of the Paris Conference 2015, Indian Navy veteran Commodore Anil Singh tells Financial Express Online.

IUU has been rated as the highest maritime security threat, more serious than Piracy and Narcotic Smuggling, according to research undertaken by 'Caught Red Handed project'.

'Gaps in Fisheries Regulation in High Seas of the Indian Ocean' a report released by Trygg Matt Tracking (TMT), has stated that in just five years Squid fishing in one unregulated area grew by 830 per cent. According to the findings of the report, on earth, the Indian Ocean is home to some of the most important fisheries, accounting for over 14 per cent of global wild-caught fish. But, 30 per cent of assessed stocks in the region are already being fished beyond sustainable limits. The TMT report has also observed that unregulated fishing, which is not factored into the 30 per cent calculation is increasing in intensity, putting essential sources of revenue for millions of people and wider ecosystem health at risk.

## What do these numbers mean?

One out of five fish sold in the market is caught illegally. This means a loss to the global economy because of IUU estimated to be touching around \$ 23 billion as per an analysis undertaken by Global Fishing Watch.

## Maritime Security & Chinese Trawlers

“In the South China Sea, Chinese trawlers are usually large enough that the sizes and types of vessels can be observed from the satellite imagery. These could be involved in actual fishing or assist in transshipment activities. However, the Chinese trawlers can always move into more direct harassment of Indian fishing vessels like manoeuvring dangerously close or physically ramming them, thereby, making it unsafe for Indian fishing boats to operate in open International waters. China can be using hundreds of fishing vessels as maritime militia to limit the Indian fishing boats,” Milind Kulshreshtha, C4I expert, explains to Financial Express Online.

However, more than this the trawlers too can be deployed for covert ISR missions. A swarm of such vessels closer to Indian EEZ region can be a real nuisance for the Indian Navy.

On a regular basis, these trawlers can serve as a surveillance flotilla for the PLA, monitoring and reporting on the activities of Indian Navy.



Explaining the technology involved, Milind Kulshreshtha, says, “A high-precision, dual-frequency side-scan sonar system can obtain seabed information and use a dual-channel underwater tow-fish for the survey.

## **How do these trawlers work? What are Side Scan Sonars**

According to the C4I expert, “Legally the fishing trawlers are allowed to carry sonar — specialised sonar like the side-scan sonar for fishing purposes. And, the Chinese trawlers can have onboard Sonar usually — side-scan sonar. These Side-scan sonars are used to efficiently create an image of large areas of the seafloor and assists in mapping the seabed for creation of nautical charts and detection and identification of underwater objects and bathymetric features.”

Explaining the technology involved, Milind Kulshreshtha, says, “A high-precision, dual-frequency side-scan sonar system can obtain seabed information and use a dual-channel underwater tow-fish for the survey.

These trawlers can deploy hydrophones which can send alerts in near real-time to assist in naval activities. These are highly sophisticated hydrophones and use AI-based algorithms for sound event detection. A signal detected can be transmitted through a buoyancy-controlled antenna which moves to the surface and transmits the information via Chinese satellite. Such messages can then be sent to ISR Centres for the Chinese Navy to use in the Indo-Pacific and IOR regions.”

“Chinese fishing boats can be over the minimum specified average tonnage of a vessel size undertaking international voyages and required to legally carry the Automatic Identification System (AIS) transceivers as mandated by the IMO. AIS transponder broadcasts various identification information like vessels destination location, headings and other data about the oceangoing vessels. But the Trawlers engaged in the covert activities, or otherwise, are not likely to actually broadcast AIS signals at any given time. This suggests the obvious intent to hide its numbers and actions,” he says.

### **UW Vehicle for Explosives**

And, these Chinese trawlers can comfortably carry weaponized underwater vehicles which are portable and trawler launched. “These Portable Underwater Vehicle (PUV) have the capability to carry and fix or fire explosives on a target in the high seas too. Due to the small size and the stealth, these PUVs are very difficult to detect. The portable underwater vehicle can be electrically propelled in the water using the control surfaces. These are small equipment measuring below 2m and half a meter wide weighing less than 100kgs. They have the capability to operate at 100 m with an endurance of four to five hours,” according to the C4I expert.

### **More about PUV**

“The main control system for operating the PUV can be fitted on the Trawler, and a secondary control unit ashore or another afloat unit. It has an onboard high-quality Sonar and Electro-Optic camera. It also carries high-frequency sonar to support operations during poor visibilities. Other specialized equipment onboard are the echo sounder, doppler velocity log and explosive firing system. Using propellers and thrusters for optimized high hydrodynamic manoeuvrability and low stealth signature (magnet and acoustic),” Mr Kulshreshtha says.

Therefore, monitoring and limiting the operations of Chinese Trawlers closer to Indian regions of interest can be a nuisance which the Indian Navy can find itself as a challenge.

### **Growing Chinese presence in IOR**

As has been reported by Financial Express Online, India has observed an increase in the number of Chinese research and fishing vessels which are operating in the Indian Ocean. This, according to sources is a matter of maritime security concern for the countries in IOR.

These vessels are likely to be monitoring and surveying the seawater which would help them to improve their submarine capabilities and possible deep-sea mining.

The area where the numbers of Chinese Research Vessels has gone up is in “ninety-degree East Ridge and South-West Indian Ridge.” And, the number of Chinese Fishing Vessels has gone up in the high seas of IOR — in the Central Arabian Sea and South-West Indian Ocean.

<https://www.financialexpress.com/defence/chinese-trawlers-on-the-prowl-in-the-indian-ocean-iuu-pose-the-greatest-maritime-threat/2145847/>

## IIT Gandhinagar researchers developed a new class of nano-additives for fuels used in space and defence applications

Gandhinagar: A team of researchers at the Indian Institute of Technology Gandhinagar (IITGN), including Prof Kabeer Jasuja (Associate Professor, Chemical Engineering), Prof Chinmay Ghoroi (B S Gelot Chair Professor, Chemical Engineering), and a PhD student Harini Gunda, has developed a new class of nano-additives for fuels used in space and defence applications. This new class of nano-additives result in a superlative enhancement in the performance of solid propellants used in rocket propulsion systems and can also help carry additional payload/satellites into an orbit.

### What are solid propellants and how do they work?

Many countries in the world are eyeing to take the lead in the development of their capabilities in space missions. India has also made its space program more visible and active as the country aims for greater self-reliance in space technology. Multiple aspects are being researched thoroughly that can lead to a successful and economic mission. Fuel is one of those critical parameters. In rockets and missiles, 'solid propellants'



are used as fuel. Solid propellants are a mixture of fuel and oxidizer. Whether it is ISRO's famous PSLV launch vehicles to lift satellites or DRDO's AGNI intercontinental ballistic missile, all are powered by solid propellants as fuel. Ammonium Perchlorate (AP) is one such energetic fuel used widely in rocket propulsion systems. However, solid propellants usually need multiple additives to improve their burning rates, performance and maximise the energy of the fuel.

Conventionally, several additives are added to AP to improve its performance. These additives can take up to 30% of the total weight of the fuel. Boron is one of those fuel additives, but it faces severe ignition delay and a low burning rate because of an inert boron oxide layer formation.

### About the new class of nano-additives by IITGN researchers

To overcome this issue, Ms Harini Gunda, a PhD student working with Prof Kabeer Jasuja in the Chemical Engineering discipline at IIT Gandhinagar, has developed a significantly efficient boron-rich nano-additive. It can be used as a single substitute for multiple additives that are conventionally required in propellants. What is more impressive is that this nano-material takes only 1% of the total weight.

Prof Kabeer Jasuja says, "This boron-based nano-additive is synthesised using a well-known superconductor, magnesium diboride (MgB<sub>2</sub>). The simple method involves solid exfoliation to form mechanically activated (MA)-MgB<sub>2</sub> nanosheets. In controlled experiments, adding just one wt. % of these nanosheets enhances the energy release/fuel energy by nearly 80 % and reduces the fuel decomposition temperature by approximately 73 °C, which surpasses both conventional and other nano-additives."

The unprecedented dual role as catalyst and fuel nature of these MA-MgB<sub>2</sub> nanosheets is due to its 2D boron honeycomb planes sandwiched with metal atoms with unique and rich chemistry. The

research team highlights that they can obtain different additive variants by simply tuning the recipe's parameters.

The scalable and economical way of synthesis makes it more promising in the market. Prof Kabeer Jasuja's team estimates that production will also be 40 times cheaper than the conventional additives.

Ms Harini Gunda says that adding their nano additive to solid propellant eliminates the dead mass associated with other multiple additives. Decreasing the dead mass helps increase the active mass of the payload and improves the rocket's thrust. The payload in rockets varies from 16 to 140 metric tons. If we reduce ~30 wt.% of the payload, this will help carry additional satellites into an orbit (each satellite weighs approximately 5 to 6 tons). Depending on the type of rocket, we can take either one to eight additional satellites than what we are carrying today in a single rocket.

The research findings were recently published in the journal *Thermochimica Acta* by Elsevier publishers. The research team had also filed an Indian patent in 2019.

Developing energy-efficient fuels for both defence and space applications is the need of the hour to meet our nation's targets and be among the top space-faring nations. The research team is now seeking platform and resources for pilot-scale studies to bring their discovery from the lab to the market.

Its potential of being used in applications like energy storage in batteries, hydrogen production, and hydrogen storage makes it even more valuable. The team has obtained encouraging preliminary results for these applications also.

<https://indiaeducationdiary.in/iit-gandhinagar-researchers-developed-a-new-class-of-nano-additives-for-fuels-used-in-space-and-defence-applications/>

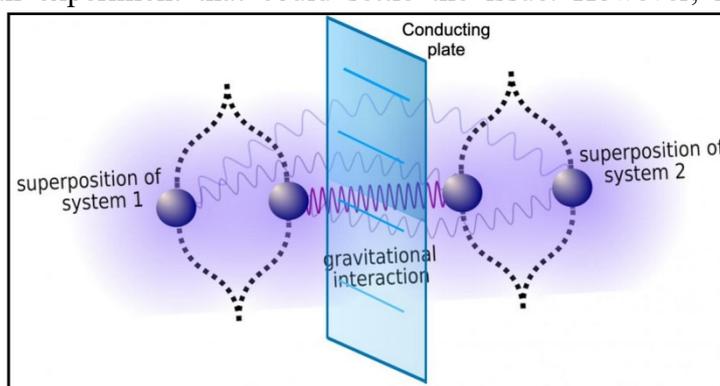


Wed, 09 Dec 2020

## Experiment to test quantum gravity just got a bit less complicated

Is gravity a quantum phenomenon? That has been one of the big outstanding questions in physics for decades. Together with colleagues from the UK, Anupam Mazumdar, a physicist from the University of Groningen, proposed an experiment that could settle the issue. However, it requires studying two very large entangled quantum systems in freefall. In a new paper, which has a third-year Bachelor's student as the first author, Mazumdar presents a way to reduce background noise to make this experiment more manageable.

Three of the four fundamental forces in physics can be described in terms of quantum theory. This is not the case for the fourth force (gravity), which is described by Einstein's theory of general relativity. The experiment that Mazumdar and his colleagues previously designed could prove or disprove the quantum nature of gravity.



In the proposed experiment, two diamonds are each placed in superposition and studied in freefall. Apart from gravity, the Casimir effect also draws them together, causing noise in the experiment. A thin copper plate can shield this effect, reducing the noise and making the experiment more manageable. Credit: A. Mazumdar, University of Groningen

## Superposition

A well-known consequence of the quantum theory is the phenomenon called quantum superposition: in certain situations, quantum states can have two different values at the same time. Take an electron that is irradiated with laser light. Quantum theory says that it can either absorb or not absorb the photon energy from the light. Absorbing the energy would alter the electron's spin, a magnetic moment that can be either up or down. The result of quantum superposition is that the spin is both up and down.

These quantum effects take place in tiny objects, such as electrons. By targeting an electron in a specially constructed miniature diamond, it is possible to create superposition in a much larger object. The diamond is small enough to sustain this superposition, but also large enough to feel the pull of gravity. This characteristic is what the experiment exploits: placing two of these diamonds next to each other in freefall and, therefore, canceling out external gravity. This means that they only interact through the gravity between them.

## Challenging

And that is where another quantum phenomenon comes in. Quantum entanglement means that when two or more particles are generated in close proximity, their quantum states are linked. In the case of the diamonds, if one is spin up, the other, entangled diamond should be spin down. So, the experiment is designed to determine whether quantum entanglement occurs in the pair during freefall, when the force of the gravity between the diamonds is the only way that they interact.

"However, this experiment is very challenging," explains Mazumdar. When two objects are very close together, another possible mechanism for interaction is present, the Casimir effect. In a vacuum, two objects can attract each other through this effect. "The size of the effect is relatively large and to overcome the noise it creates, we would have to use relatively large diamonds." It was clear from the outset that this noise should be reduced to make the experiment more manageable. Therefore, Mazumdar wanted to know if shielding for the Casimir effect was possible.

## Lockdown

He handed the problem to Thomas van de Kamp, a third-year Bachelor's student of Physics. "He came to me because he was interested in quantum gravity and wanted to do a research project for his Bachelor's thesis," says Mazumdar. During the spring lockdown, when most normal classes were suspended, Van de Kamp started working on the problem. "Within a remarkably short time, he presented his solution, which is described in our paper."

This solution is based on placing a conducting plate of copper, around one millimeter thick, between the two diamonds. The plate shields the Casimir potential between them. Without the plate, this potential would draw the diamonds closer to each other. But with the plate, the diamonds are no longer attracted to each other, but to the plate between them. Mazumdar: "This removes the interaction between the diamonds through the Casimir effect, and therefore removes a lot of noise from the experiment."

## Remarkable

The calculations performed by Van de Kamp show that the masses of the two diamonds can be reduced by two orders of magnitude. "It may seem like a small step, but it does make the experiment less demanding." Furthermore, other parameters such as the level of vacuum needed during the experiment also become less demanding due to the shielding of the Casimir effect. Mazumdar says that a further update on the experiment, which also includes a contribution from Bachelor's student Thomas van de Kamp, will probably appear in the near future. "So, his six-month project has brought him co-authorship on two papers, quite a remarkable feat."

**More information:** Thomas W. van de Kamp et al, Quantum gravity witness via entanglement of masses: Casimir screening, *Physical Review A* (2020). [DOI: 10.1103/PhysRevA.102.062807](https://doi.org/10.1103/PhysRevA.102.062807)

**Journal information:** [Physical Review A](https://arxiv.org/abs/2007.11201)

<https://phys.org/news/2020-12-quantum-gravity-bit-complicated.html>

## Researchers develop new theoretical approach to manipulate light

The quest to discover pioneering new ways in which to manipulate how light travels through electromagnetic materials has taken a new, unusual twist.

An innovative research project, carried out by experts from the University of Exeter, has developed a new theoretical approach to force light to travel through electromagnetic materials without any reflection.

The discovery could pave the way for more efficient communications and wireless technology.

The project focused on finding new kinds of electromagnetic materials where light can travel in only one direction, without any reflection, using Maxwell's equations. These four pivotal equations, published in the 1860s by physicist James Clerk Maxwell, describe how electric and magnetic fields move through space and time. These equations underpin much of modern technology from optical and radio technologies, to wireless communication, radar and electric motors.



Credit: Petr Kratochvil/public domain

These new unusual materials had previously been understood using ideas that won to 2016 Nobel prize, ideas borrowed from an abstract area of mathematics known as topology, which studies the properties of shapes that stay the same when you squeeze and mold them.

The novelty of this work is that it has found these new electromagnetic materials using only a slight twist on the high-school concept of the refractive index.

This finding may simplify the design of materials where light can propagate in only one direction and might, for instance, be used to improve telecommunication where information propagates as pulses, information that is lost when there is reflection.

The study is published in leading journal *Nature Physics*.

Mitchell Woolley, co-author and who carried out the research while studying Natural Sciences at the University of Exeter said: "Our paper tests the limits of how light can behave by using Maxwell's equations and electromagnetic theory to engineer exotic optical materials. I think the novelty here was neither using topology nor traditional methods of numerical simulation and optimization to find these materials."

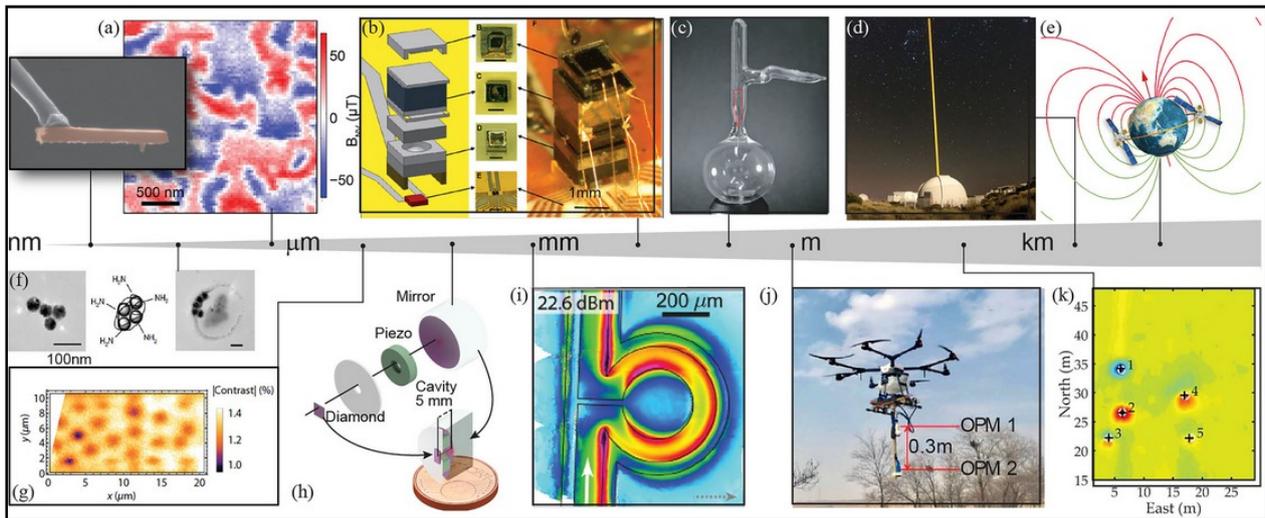
Dr. Simon Horsley, lead author of the paper and also from the University of Exeter added: "There is a lot of interesting physics and mathematics still to be found in understanding how light moves through matter. It's very satisfying that the simple concept of the refractive index can be used in such unusual materials."

**More information:** S. A. R. Horsley et al, Zero-refractive-index materials and topological photonics, *Nature Physics* (2020). DOI: [10.1038/s41567-020-01082-2](https://doi.org/10.1038/s41567-020-01082-2)

**Journal information:** *Nature Physics*  
<https://phys.org/news/2020-12-theoretical-approach.html>

# Adapting magnetometers for noisy, physically demanding environments

Researchers routinely measure magnetic fields to better understand a vast array of natural phenomena including geological movements, solar flares, neuronal communication in the brain, and molecular-scale chemical processes.



An illustration of the scale of magnetometers from nanometers to kilometers. Credit: Arne Wickenbrock

Many state-of-the-art magnetic field measurements are performed in shielded environments with carefully controlled conditions. Yet significant advances in magnetometer sensitivity have also been accompanied by serious attempts to bring these magnetometers into challenging working environments.

In *AVS Quantum Science*, researchers from the University of Washington, Johannes Gutenberg-Universität, and the University of California, Berkeley provide an overview of how the research community has achieved these sensitive measurements in extreme environments as well as outside of highly controlled environments. The researchers discuss ways in which various predominantly optically pumped magnetometer technologies have been adapted for use in a wide range of noisy and physically demanding environments.

"You will see some images and discussion of magnetometer deployments that are not commonly seen in standard scientific journal articles," said author Kai-Mei Fu. "We wanted to highlight all the things that can go 'wrong' in order to motivate the deployment of the tools and tricks the community has developed to mitigate these challenges."

While magnetometers with high sensitivity are attractive for measuring minute signals, experimenters must also contend with the environment in which the measurement will be made.

The researchers explore relevant magnetic noise sources that are ubiquitous in the laboratory, field, and urban environments, such as a car passing or an elevator moving. The researchers explore the common techniques to enhance the signal and reduce the noise, shedding light on emerging hybrid sensors in which correlating different sensor modalities may be particularly useful when dealing with challenging environments.

The researchers examine the physical challenges presented in practical, high-sensitivity magnetometry, particularly in one of the major areas of magnetometry, the study of materials. For these studies, sensors must be able to operate in extreme temperatures, from extreme heat to cryogenic cold, and in pressures ranging from very high to very low.

They also explore magnetometry at the cellular level, because significant interest has arisen in the use of magnetometry to study biological processes and biomolecular structures of living organisms, including magnetometry of the brain, nerves, and muscle.

"The current breadth of applications in optically pumped magnetometers is truly vast—from monitoring magnetic disturbances in near space to detecting neural activity," said Fu. "We hope that this review would provide the reader with a set of general and specific ideas of how to meet various diverse challenges arising in the way of real-life precision magnetic or other measurements."

**More information:** "Sensitive magnetometry in challenging environments," *AVS Quantum Science*, [aip.scitation.org/doi/10.1116/5.0025186](https://aip.scitation.org/doi/10.1116/5.0025186)  
<https://phys.org/news/2020-12-magnetometers-noisy-physically-demanding-environments.html>



Wed, 09 Dec 2020

## Magnetic bacteria as micropumps

By *Fabio Bergamin*

ETH scientists use magnetic bacteria to control liquids at the micro level. They are already thinking about using them in the human bloodstream for precision delivery of cancer drugs to a tumor.

Cancer drugs have side effects, so for many years, scientists have been exploring ways to transport the active substances to a tumor in the body as precisely as possible. That is the only place that drugs should take effect. One approach is to inject them into the bloodstream and control their transport in small vessels at tumor sites by locally altering the blood flow with tiny vehicles. Research laboratories have created microrobots whose shape and propulsion are inspired by bacteria and that are small enough to be inserted into blood vessels. These microvehicles can be powered from outside the body by a moving magnetic field.



Credit: [Unsplash/CC0 Public Domain](#)

Simone Schürle, professor at the Department of Health Sciences and Technology, is now going one step further: Instead of microrobots inspired by bacteria, she wants to use real bacteria that are magnetic. Researchers discovered such magnetotactic bacteria in the sea 45 years ago. These microorganisms absorb iron dissolved in the water; iron oxide crystals form in their interior and line up in a row. Like a compass needle, these bacteria align themselves with the Earth's magnetic field so they can navigate in the water in a directed manner.

### Precise control with magnetic fields

ETH Professor Schürle and her team investigated how to use a magnetic field to control these bacteria in the laboratory as a way to direct the flow of liquids in a controlled manner. In their experiments, they applied only relatively weak rotating magnetic fields to spin the bacteria along the desired directions. And with many bacteria in a swarm, it proved possible to move the fluid surrounding them. The bacteria produce an effect similar to that of a micropump, meaning they are able to move active substances present in the fluid in different directions, for example from the bloodstream into the tumor tissue. By using superimposed magnetic fields that locally reinforce or cancel each other out, this pumping activity can be confined to a small region with pinpoint accuracy, as Schürle's team has been able to show in simulations.

Moreover, the principle can be put to work outside the body to mix different liquids locally with each other in very small vessels without having to manufacture and control mechanical micropumps.

### **Dead or alive**

Their work is primarily focused on investigating the approach and describing how the bacteria can control the flow. Before such bacteria can be used in the human body, their safety must first be investigated. However, bringing bacteria into the body for medical reasons is an approach that science is already pursuing under the term "living therapeutics," albeit with other types of bacteria, such as *E. coli*.

It should also be possible to use non-natural bacteria for future medical applications. Synthetic biology can be used to construct bacteria that feature optimized functional properties and are safe for use in the human body, for example by not causing allergic reactions. Schürle can envisage treatments using bacteria that are killed before they are introduced into the body as well as treatments using living bacteria.

### **Fine control through self-propulsion**

It has also been known for several decades that certain types of anaerobic bacteria (which do not require oxygen to grow) preferably accumulate in cancer patients' tumors. In other words, these bacteria naturally prefer the low oxygen conditions in tumors over the rest of the body. While this was investigated in bacteria other than those used by Schürle's team, synthetic biology could be used to combine the advantages of several bacterial species. This might lead to the development of bacteria that approach the tumor powered by their own flagella (whip-like appendages) and can then be precisely transported deep into the tumor tissue using external magnetic forces.

**More information:** Nima Mirkhani et al. Living, Self-Replicating Ferrofluids for Fluidic Transport, *Advanced Functional Materials* (2020). DOI: [10.1002/adfm.202003912](https://doi.org/10.1002/adfm.202003912)

**Journal information:** [Advanced Functional Materials](https://phys.org/news/2020-12-magnetic-bacteria-micropumps.html)  
<https://phys.org/news/2020-12-magnetic-bacteria-micropumps.html>

## **COVID-19 Research News**



Wed, 09 Dec 2020

## **Researchers found new method to detect Covid-19 in less than five minutes**

*The researchers of University of Illinois Grainger College of Engineering claimed to have developed an ultrasensitive test using a paper-based electrochemical sensor which is capable of detecting the presence of the coronavirus in mere five minutes*

Illinois: The researchers of University of Illinois Grainger College of Engineering claimed to have developed an ultrasensitive test using a paper-based electrochemical sensor which is capable of detecting the presence of the coronavirus in mere five minutes.

As the Covid-19 pandemic continues to spread across the world, the researchers from various laboratories have been coming up with the different strategies that can help to track the virus.

The new study shows the possibility of detecting the virus through a rapid method with the use of a graphene biosensor which is adaptable to other viruses.

A team led by professor Dipanjan Pan reported their findings in *ACS Nano* which shows that a bioengineering graduate student, Maha Alafeef from the University of Illinois Grainger has co-

developed a rapid, ultrasensitive test using a paper-based electrochemical sensor that can detect the presence of the virus in less than five minutes.

“Currently, we are experiencing a once-in-a-century life-changing event. We are responding to this global need from a holistic approach by developing multidisciplinary tools for early detection and diagnosis and treatment for SARS-CoV-2,” said Alafeef.

The two broad categories of Covid-19 tests in the market either use reverse transcriptase real-time polymerase chain reaction (RT-PCR) and nucleic acid hybridization strategies to identify viral RNA, or focuses on the detection of antibodies. However, there could be a delay of a few days to a few weeks after a person has been exposed to the virus for them to produce detectable antibodies.

In recent years, researchers have had some success with creating point-of-care biosensors using 2D nanomaterials such as graphene to detect diseases. The main advantages of graphene-based biosensors are their sensitivity, low cost of production and rapid detection turnaround.

“The discovery of graphene opened up a new era of sensor development due to its properties. Graphene exhibits unique mechanical and electrochemical properties that make it ideal for the development of sensitive electrochemical sensors” said Alafeef.

There are two components to this biosensor, according to the study which is: a platform to measure an electrical read-out and probes to detect the presence of viral RNA. To create the platform, researchers first coated filter paper with a layer of graphene nanoplatelets to create a conductive film. Then, they placed a gold electrode with a predefined design on top of the graphene as a contact pad for electrical readout. Both gold and graphene have high sensitivity and conductivity which makes this platform ultrasensitive to detect changes in electrical signals.

Current RNA-based Covid-19 tests screen for the presence of the N-gene (nucleocapsid phosphoprotein) on the SARS-CoV-2 virus. In this research, the team designed antisense oligonucleotide (ASOs) probes to target two regions of the N-gene. Targeting two regions ensures the reliability of the sensor in case one region undergoes gene mutation. Furthermore, gold nanoparticles (AuNP) are capped with these single-stranded nucleic acids (ssDNA), which represents an ultra-sensitive sensing probe for the SARS-CoV-2 RNA.

The researchers showed that the hybridization of the viral RNA with these probes causes a change in the sensor electrical response. The AuNP caps accelerate the electron transfer and when broadcasted over the sensing platform, results in an increase in the output signal and indicates the presence of the virus.

The team tested the performance of this sensor by using Covid-19 positive and negative samples. The sensor showed a significant increase in the voltage of positive samples compared to the negative ones and confirmed the presence of viral genetic material in less than five minutes. Furthermore, the sensor was able to differentiate viral RNA loads in these samples. “Viral load is an important quantitative indicator of the progress of infection and a challenge to measure using existing diagnostic methods”, stated the researchers.

Not only this, but this platform has far-reaching applications due to its portability and low cost. The sensor, when integrated with microcontrollers and LED screens or with a smartphone via Bluetooth or wifi, could be used at the point-of-care in a doctor’s office or even at home.

<https://www.hindustantimes.com/health/researchers-found-new-method-to-detect-covid-19-in-less-than-five-minutes/story-9MxmLLR62nz4N02A2U7xxO.html>

## Large US study confirms Covid-19 complications: lung, kidney and cardiovascular issues

*A large study of patients in the United States who contracted Covid-19 confirms many complications of the disease, according to new research*

Washington: A large study of patients in the United States who contracted Covid-19 confirms many complications of the disease, according to new research.

The research was published in CMAJ (Canadian Medical Association Journal).

“Understanding the full range of associated conditions can aid in prognosis, guide treatment decisions and better inform patients as to their actual risks for the variety of Covid-19 complications reported in the literature and media,” writes Dr William Murk, Jacobs School of Medicine & Biological Sciences, University at Buffalo, Buffalo, New York, with co-authors from Action, Inc., HealthVerity, Inc. and the University of Toronto.

Using de-identified outpatient and inpatient medical claims from a United States health database, researchers identified 70 288 patients who had a Covid-19-related health visit between March 1 and April 30, 2020. More than half of all patients were admitted to hospital, and approximately 5% were admitted to the intensive care unit. The median age was 65 years, and 55.8 per cent were female. The authors looked at all possible diagnostic codes and identified those that increased in frequency after the onset of Covid-19.



The research was published in CMAJ (Canadian Medical Association Journal).(Pixabay)

The most common complications associated with Covid-19 were pneumonia, respiratory failure, kidney failure, and sepsis or systemic inflammation, consistent with other studies. The absolute risk of someone with Covid-19 having these serious conditions was 27.6 per cent for pneumonia, 22.6 per cent for respiratory failure, 11.8 per cent for kidney failure and 10.4% for sepsis or systemic inflammation.

The researchers also found associations with a range of other lung and cardiovascular conditions, such as collapsed lung, blood clotting disorders and heart inflammation, although the risk of these was relatively low. Contrary to the results of other studies, Covid-19 did not appear to be associated with a higher risk of stroke.

“This study provides estimates of absolute risk and relative odds for all identified diagnoses related to Covid-19, which are needed to help providers, patients and policy-makers understand the likelihood of complications,” write the authors.

<https://www.hindustantimes.com/health/large-us-study-confirms-covid-19-complications-lung-kidney-and-cardiovascular-issues/story-3ZR0rI4xBhXyJV9txpjbQL.html>

