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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

Fri, 09 Oct 2020 3:12PM

DRDO successfully flight tests Indigenously Developed Anti Radiation Missile (RUDRAM)

New generation Anti Radiation Missile (RUDRAM) was successfully Flight tested today onto a radiation target located on Wheeler Island off the coast of Odisha. The missile was launched from SU-30 MKI fighter aircraft.

The RUDRAM is first indigenous anti-radiation missile of the country for Indian Air Force (IAF), being developed by Defence Research and Development Organisation (DRDO). The missile is integrated on SU-30 MKI fighter aircraft as the launch platform, having capability of varying ranges based on launch conditions. It has INS-GPS navigation with Passive Homing Head for the final attack. The RUDRAM hit the radiation target with pin-point accuracy.

The Passive Homing Head can detect, classify and engage targets over a wide band of frequencies as programmed. The missile is a potent weapon for IAF for Suppression of Enemy Air Defence effectively from large stand-off ranges.

With this, the country has established indigenous capability to develop long range air launched anti-radiation missiles for neutralising enemy Radars, communication sites and other RF emitting targets.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1663083>



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संरक्षण मंत्रालय

Fri, 09 Oct 2020 3:12PM

डीआरडीओ ने स्वदेशी रूप से विकसित एंटी रेडिएशन मिसाइल (रुद्रम) का सफलतापूर्वक परीक्षण किया

नई पीढ़ी के एंटी रेडिएशन मिसाइल (रुद्रम) का आज ओडिशा के तट से दूर व्हीलर द्वीप पर रेडिएशन परीक्षण किया गया। इसका परीक्षण सुखोई-30 एमकेआई फाइटर एयरक्राफ्ट से किया गया है।

रक्षा अनुसंधान एवं विकास संगठन (डीआरडीओ) ने भारतीय वायु सेना (आईएफ) के लिए देश का पहला स्वदेशी एंटी रेडिएशन मिसाइल रुद्रम विकसित की है। इस मिसाइल को लॉन्च प्लेटफॉर्म के रूप में

సుఖోई एसयू-30 एमकेआई लड़ाकू विमान में एकीकृत किया गया है, इसमें लॉन्च स्थितियों के आधार पर अलग-अलग रेंज की क्षमता है। इसमें अंतिम हमले के लिए पैसिव होमिंग हेड के साथ आईएनएस-जीपीएस नेविगेशन है। 'रुद्रम' ने रेडिएशन लक्ष्य को पिनपॉइंट सटीकता से मारा।

पैसिव होमिंग हेड एक विस्तृत बैंड पर लक्ष्य का पता लगाने, वर्गीकृत करने और लक्ष्य को इंगेज करने (उलझाने) में सक्षम है। मिसाइल बड़े स्टैंड ऑफ रेंज से प्रभावी तरीके से दुश्मन के वायु रक्षा को रोकने के लिए आईएफ का एक शक्तिशाली हथियार है।

इसके साथ ही, देश ने दुश्मन रडार, संचार साइटों और अन्य आरएफ उत्सर्जक लक्ष्यों को बेअसर करने के लिए लंबी दूरी की हवा में लॉन्च की गई एंटी-रेडिएशन मिसाइल विकसित करने के लिए स्वदेशी क्षमता स्थापित कर ली है।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1663115>



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రక్షణ మంత్రిత్వ శాఖ

Fri, 09 Oct 2020 3:12PM

యాంటీ రేడియేషన్ క్షిపణి(రుద్రం)ని విజయవంతంగా

పరీక్షించిన డీ.ఆర్.డి.వో

కొత్తతరం యాంటీ రేడియేషన్ క్షిపణి (రుద్రం) ఒడిశా తీరంలోని వీలర్ ద్వీపంలో ఈ రోజు విజయవంతంగా పరీక్షించబడింది. ఈ క్షిపణిని ఎస్యూ-30 ఎంకే 1 యుద్ధ విమానం నుండి ప్రయోగించారు.

దేశంలోని మొట్టమొదటి స్వదేశీ రేడియేషన్ వ్యతిరేక క్షిపణి అయిన రుద్రంను భారత వైమానిక దళం కోసం రక్షణ పరిశోధన మరియు అభివృద్ధి సంస్థ (డీఆర్డీఓ) అభివృద్ధి చేసింది. ఎస్యూ-30 ఎంకే1 యుద్ధ విమానాలతో ప్రయోగానికి ఈ క్షిపణి అనువుగా ఉంటుంది. ప్రయోగించిన పరిస్థితుల ఆధారంగా వివిధ రకాల లక్ష్యాలను ఈ క్షిపణి చేదించగలదు. తుది దాడి కోసం ఈ క్షిపణి ఐఎన్ఎస్-జీపీఎస్ నావిగేషన్ వ్యవస్థను కలిగి ఉంటుంది. పిన్పాయింట్ ఖచ్చితత్వంతో రేడియేషన్ లక్ష్యాన్ని రుద్రం చేదించింది.

రుద్రం క్షిపణిలోని పాసివ్ హోమింగ్ హెడ్ అనే వ్యవస్థ ప్రీక్వెన్సీ ఆధారంగా లక్ష్యాలను గుర్తించడంతో పాటు వాటిని వర్గీకరించే విధంగా రూపకల్పన చేయబడింది. సుదూర లక్ష్యాలనుండి శత్రువుల ఎయిర్ డిఫెన్స్ వ్యవస్థను సమర్థవంతంగా తిప్పికొట్టడానికి భారత వైమానిక దళంలో ఇది శక్తివంతమైన ఆయుధంగా మారనుంది.

ఈ క్షిపణితో శత్రు రాడార్లు, ట్రాకింగ్, కమ్యూనికేషన్ వ్యవస్థలను తటస్థం చేయవచ్చు. సూదూరంగా ఉన్న లక్ష్యాలని చేదించడానికి ఈ వ్యవస్థను డీఆర్డీఓ దేశీయంగానే అభివృద్ధి చేసింది.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1663272>

India test-fires Rudram 1, its first anti-radiation missile to kill enemy radars

Rudram 1, the New Generation Anti-Radiation Missile, was test-fired at about 10.30 am, people familiar with the development said

By Shishir Gupta

New Delhi: India on Friday successfully test-fired Rudram 1, the tactical anti-radiation missile that the Indian Air Force can launch from its Sukhoi-30MKI fighter jets to take down enemy radars and surveillance systems. The missile has a launch speed of up to 2 Mach, twice the speed of sound, people familiar with the matter said.

The Defence Research and Development Organisation developed the new generation weapon. It was tested at the interim test range Balasore, off the coast of Odisha in the Bay of Bengal, at about 10.30 am.

“This is a huge step forward,” a senior government official said about the DRDO’s successful test firing. “The IAF will now have the capability to perform SEAD (Suppression of Enemy Air Defence) operations deep into enemy territory to destroy enemy air defence setup,” the official said.

This would allow the IAF’s strike aircraft to carry out their mission unhindered effectively. “This test demonstrates the capability of an Anti-Radiation Missile with large stand-off ranges,” a second official said.

The New Generation Anti-Radiation Missile, or NGARM, is integrated on Su-30MKI fighter aircraft. Its range depends on the height at which the fighter jet is flying. It can be launched from a height ranging from 500 metres to 15 km and can hit radiation emitting targets within a range of 250 km.

All radars and Electro Optical Tracking System tracked the launch and point of impact, a senior government official told Hindustan Times.

The tactical, air-to-surface anti-radiation missile is equipped with a passive homing head that tracks sources of radiation of a wide range of frequencies. It can lock into a target not only before launch but also after it has been launched.

The missile is comparable to the tactical air-to-surface missile AGM-88E Advanced Anti-Radiation Guided Missile that was inducted by the US Navy only in 2017 and can engage relocatable



Rudram 1 is comparable to the tactical air-to-surface missile AGM-88E Advanced Anti-Radiation Guided Missile inducted by the US Navy only in 2017 (Photo courtesy: DRDO)



Rudram 1 was successfully test-fired from a Sukhoi-30MKI fighter jet at about 10.30 am on Friday (Photo courtesy: DRDO)



Rudram 1, India’s new generation anti-radiation missile is integrated with Sukhoi-30 MKI. (Photo courtesy: DRDO)

Integrated Air Defence targets and other targets equipped with shutdown capability. This means that if the enemy shuts down the radar after the missile is launched, it will still hit the target.

Defence Minister Rajnath Singh tweeted his congratulations to the DRDO team that developed the supersonic-capable missile that can be launched at speeds ranging from 0.6 Mach to 2 Mach.

“The New Generation Anti-Radiation Missile (Rudram-1) which is India’s first indigenous anti-radiation missile developed by DRDO for Indian Air Force was tested successfully today at ITR, Balasore. Congratulations to DRDO & other stakeholders for this remarkable achievement,” Rajnath Singh said on Twitter.

<https://www.hindustantimes.com/india-news/india-test-fires-rudram-1-its-first-anti-radiation-missile-to-take-down-enemy-radars/story-SYP6qWQOXmZrK7ViSPG54K.html>

TIMESNOWNEWS.COM

Sat, 10 Oct 2020

India successfully tests Rudram 1: The features of the next-gen anti-radiation missile, explained

With a launch speed of up to Mach 2 – twice the speed of sound – the missile provides the nation's jet with a critical air-to-ground weapon that can take out enemy radars and surveillance systems

Key Highlights

- *The specialised weapon is aimed to provide tactical air superiority in warfare*
- *Missile guidance and navigation toward its target while the missile is on course take place through continuous inputs from sensors and passive homing seeker technology*
- *Suppression of radar system will enable India's jets to carry out missions without having to worry about facing threats from radar-guided surface-to-air missiles*

On Friday, India successfully tested the indigenously developed Rudram 1, a tactical anti-radiation missile capable of being launched from the Indian Air Force's Sukhoi-30MKI fighter jets. There are, reportedly, plans to integrate the missile on to India's Mirage and Tejas fighters as well.

With a launch speed of up to Mach 2 – twice the speed of sound – the missile provides the nation's jet with a critical air-to-ground weapon that can take out enemy radars and surveillance systems. This, however, is not the first time that the DRDO has tested the anti-radiation missile with a similar test being conducted as far back as January 2019.

The specialised weapon is aimed to provide tactical air superiority in warfare. Feasibility studies on India's next-generation anti-radiation missile (NGARM) began in 2012 with the intention of designing and configuring the missile fully indigenously.

In order to do this, the DRDO needed to master the development of crucial technologies including a wide-band passive seeker, a millimetric wave active-seeker, radome for the seekers and a dual-pulse propulsion system.

As the name itself suggests, the missile is designed to eliminate or suppress radiation-emitting sources such as fire control or surveillance radars. With a reported length of 5.5m, and weighing 600kg, the missile is also integrated with a millimetre wave (MMW) active seeker terminal guidance system.



Rudram 1, India's anti-radiation missile. | Photo Credit: Twitter

The seeker is essentially how the missile identifies and locates its target. It sends out radio frequency pulses that bounce off the intended target and rebound back to it. Once the signal has been processed, the range and position of the target can be determined.

Missile guidance and navigation toward its target while the missile is on course take place through continuous inputs from sensors and passive homing seeker technology. These inputs are processed by an on-board computer that generates autopilot commands, with a control system steering the missile towards the target.

Suppression of radar systems will enable India's jets to carry out missions without having to worry about facing threats from radar-guided surface-to-air missiles. The first anti-radiation missile – the AGM-45 Shrike – was developed by the United States. Since then, the US has developed several upgraded versions, with Russia and Brazil also having developed their own.

All these missiles, including India's, are reported to have a range of approximately 100km. It is also worth noting that the IAF already has the Russian-made Kh-31P anti-radiation missile in its arsenal.

<https://www.timesnownews.com/india/article/india-successfully-tests-rudram-1-the-features-of-the-next-gen-anti-radiation-missile-explained/664764>



Sat, 10 Oct 2020

Rudram missile: Know more about India's indigenously developed NGARM

Rudram has the ability to detect enemy radars on the ground. Once these missiles disarm enemy radars on the ground, it can help inflict more damage in the attacks that follow the first wave

Edited By Shankhyaneel Sarkar

New Delhi: India successfully test-fired Rudram 1, its first indigenous anti-radiation missile developed by the Defence Research and Development Organisation (DRDO) for the Indian Air Force, on Friday. A Sukhoi-30 fighter aircraft was used to test-fire the indigenously developed new generation anti-radiation missile (NGARM) off the country's east coast.

Rudram 1 can be integrated to IAF's Sukhoi-30 jets and used as its launch platform. Rudram 1 can be used to detect and hone in on a radio source, according to defence website defenceupdate.in. This gives Rudram 1 the ability to detect enemy radars on the ground. Once these missiles disarm enemy radars on the ground, it can help inflict more damage in the attacks that follow the first wave.

NGARM's primary guidance system is an on-board passive homing head (PHH) armed with broadband capability. These features allow it to choose and select a target among the range of emitters that it sees at that point of time. The new NGARMs with PHH operates in the D-J band and can detect radio frequency emission from 100km away.

Rudram 1 is a target seeking missile and contains a radar dome which is critical for missiles which can be used to target and destroy enemy based radars on the ground. Rudram can strike any range between 100-250 km.

Defence minister Rajnath Singh congratulated IAF and DRDO for its successful test. "The New Generation Anti-Radiation Missile (Rudram-1) which is India's first indigenous anti-radiation



Indian Air Force's Sukhoi-30 fighter aircraft fires the Rudram missile which was successfully test-fired off the east coast on Friday. (DRDO)

missile developed by DRDO for Indian Air Force was tested successfully today at ITR, Balasore. Congratulations to DRDO & other stakeholders for this remarkable achievement," the defence minister said.

<https://www.hindustantimes.com/india-news/rudram-missile-how-do-ngarms-work/story-C2mUYlqGY9hvU34D7lty2H.html>

THE ECONOMIC TIMES

Sat, 10 Oct 2020

India tests indigenously developed anti-radiation missile Rudram-1 with Mach 2 speed

Indigenous anti-radiation missile

According to a report by PTI, India on Friday successfully test fired a new generation anti-radiation missile which will be part of the tactical weaponry of the Indian Air Force, officials said. The missile, Rudram-1, is India's first indigenously developed anti-radiation missile that has a speed of Mach two or twice the speed of sound.

Arming the Sukhois

The missile is likely to be integrated with the Sukhoi fighter jets of the Indian Force once the missile is ready for induction, the officials said. The missile was test-fired at the integrated test range at Balasore in Odisha around 10:30 AM, officials said.

Missile capabilities

It has INS-GPS navigation with Passive Homing Head for the final attack. During the test, the RUDRAM hit the radiation target with pin-point accuracy. The Passive Homing Head can detect, classify and engage targets over a wide band of frequencies as programmed. The missile is a potent weapon for IAF for Suppression of Enemy Air Defence effectively from large stand-off ranges. With this, the country has established indigenous capability to develop long range air launched anti-radiation missiles for neutralising enemy Radars, communication sites and other RF emitting targets.

DRDO's moment in the sun

Defence Minister Rajnath Singh congratulated the Defence Research and Development Organisation (DRDO) on successful test firing of the missile. "New Generation Anti-Radiation Missile (Rudram-1) which is India's first indigenous anti-radiation missile developed by @DRDO_India for Indian Air Force was tested successfully today at ITR, Balasore. Congratulations to DRDO & other stakeholders for this remarkable achievement," he tweeted.

Strengthening the IAF

In May last year, the Indian Air successfully test fired the aerial version of the BrahMos missile from a Su-30 MKI fighter aircraft. The IAF is also integrating the Brahmos supersonic cruise



missile on over 40 Sukhoi fighter jets which is aimed at bolstering overall combat capability of the force.

<https://economictimes.indiatimes.com/news/defence/india-tests-indigenously-developed-anti-radiation-missile-rudram-1-with-mach-2-speed/strengthening-the-iaf/slideshow/78574638.cms>



Thu, 08 Oct 2020

एयर डिफेंस में अचीवमेंट: देश में बनी पहली एंटी रेडिएशन मिसाइल रुद्रम का टेस्ट कामयाब रहा, यह टारगेट को आवाज की रफ्तार से दोगुना तेजी से निशाना बना सकती है

भारत ने शुक्रवार को पहली स्वदेशी एंटी रेडिएशन मिसाइल रुद्रम-1 का सफल टेस्ट किया। इसे ओडिशा के बालासोर स्थित इंटीग्रेटेड टेस्ट रेंज (आईटीआर) से सुबह 10.30 बजे सुखोई-30 फाइटर जेट के जरिए छोड़ा गया।

इस मिसाइल को डिफेंस रिसर्च एंड डेवलपमेंट ऑर्गनाइजेशन (डीआरडीओ) ने इंडियन एयरफोर्स के लिए तैयार किया है। यह आधुनिक तकनीकों से लैस है। दुश्मन के रडार और सर्विलांस सिस्टम को चकमा दे सकती है। यह टारगेट को आवाज की रफ्तार से दोगुना तेजी से निशाना बना सकती है।



इसकी खासियत:

- यह ऐसी स्वदेशी पहली मिसाइल है, जो किसी भी तरह के सिग्नल और रेडिएशन को पकड़ सकती है। साथ ही मिसाइलें नष्ट कर सकती है।
- यह रेडियो फ्रीक्वेंसी छोड़ने या रिसीव करने वाले किसी भी टारगेट को निशाना बना सकती है।
- लॉन्च स्पीड 0.6 से 2 मैक यानी 2469.6 किलोमीटर प्रति घंटे से ज्यादा है।
- इसकी रेंज इस बात पर निर्भर करती है कि फाइटर जेट कितनी ऊंचाई पर है। इसे 500 मीटर से लेकर 15 किलोमीटर की ऊंचाई से लॉन्च किया जा सकता है। इस दौरान यह मिसाइल 250 किलोमीटर के दायरे में मौजूद हर टारगेट को निशाना बना सकती है।
- अगर दुश्मन ने रडार सिस्टम को शटडाउन कर दिया है, तो भी रुद्रम उसे निशाना बनाएगी।
- सीड ऑपरेशंस यानी Suppression of Enemy Air Defence को अंजाम दे सकती है। इस ऑपरेशन के तहत दुश्मन के एयर डिफेंस सिस्टम को पूरी तरह से नष्ट कर दिया जाता है।

यह लॉन्चिंग से पहले और उसके बाद भी टारगेट को लॉक कर सकती है। टेस्ट में इसके सभी रडार और इलेक्ट्रो ऑप्टिकल ट्रैकिंग सिस्टम पर नजर रखी गई। इसकी सभी तकनीकों का प्रदर्शन अच्छा रहा।

रक्षा मंत्री ने बधाई दी

रक्षा मंत्री राजनाथ सिंह ने इस उपलब्धि के लिए डीआरडीओ को बधाई दी। उन्होंने ट्वीट किया- न्यू जेनरेशन एंटी रेडिएशन मिसाइल (रुद्रम-1) का आज बालासोर के आईटीआर से सफल परीक्षण किया गया। डीआरडीओ और इसे तैयार करने में लगे दूसरे भागीदारों को इस अहम उपलब्धि के लिए बधाई।

<https://www.bhaskar.com/national/news/india-test-fires-first-indigenous-anti-radiation-missile-rudram-127795831.html>



Thu, 08 Oct 2020

भारत ने किया रुद्रम-1 का परीक्षण, दुश्मन के रडार को गिराने वाला पहला एंटी रेडिएशन मिसाइल

नई दिल्ली: भारत ने शुक्रवार को सफलतापूर्वक लड़ाकू विमान सुखोई-30 से रुद्रम-1 एंटी रेडिएशन मिसाइल का सफल परीक्षण किया। इस मिसाइल को डिफेंस रिसर्च एंड डेवलपमेंट ऑर्गेनाइजेशन ने तैयार किया है। यह मिसाइल हवा में भारतीय लड़ाकू विमान की मारक क्षमता को बढ़ाएगी और टैक्टिकल कैपेबिलिटी को भी बढ़ाएगी।

पूरे मामले से वाकिफ सूत्र ने बताया कि इस मिसाइल की लाउंच स्पीड आवाज से भी दोगुनी है। डीआरडीओ ने नई पीढ़ी के हथियार विकसित किए हैं। इसका सुबह साढ़े दस बजे ओडिशा तट पर परीक्षण किया गया।



डीआरडीओ के सफलतापूर्वक परीक्षण पर एक अधिकारी सूत्र ने बताया कि यह एक बड़ी सफलता है। उन्होंने कहा कि इससे भारतीय वायुसेना को दुश्मन के एयर डिफेंस सिस्टम को काफी अंदर जाकर उसे नष्ट करने की क्षमता हो गई है।

भारत में बनाई गई ये ऐसी पहली मिसाइल है, जो किसी भी ऊंचाई से दागी जा सकती है। ये मिसाइल किसी भी तरह के सिग्नल और रेडिएशन को पकड़ सकती है। साथ ही अपनी रडार में लाकर ये मिसाइल नष्ट कर सकती है।

इससे पहले, भारत ने देश में विकसित 'सुपरसोनिक मिसाइल असिस्टेड रिलीज ऑफ टॉरपीडो (स्मार्ट) प्रणाली का सोमवार को ओडिशा अपतटीय क्षेत्र स्थित एक परीक्षण केंद्र से सफल प्रायोगिक परीक्षण किया। रक्षा मंत्रालय ने एक बयान में कहा कि 'स्मार्ट प्रणाली पनडुब्बी' विध्वंसक युद्ध अभियानों के लिए है।

मंत्रालय ने कहा, "आज पांच अक्टूबर 2020 को 'सुपरसोनिक मिसाइल असिस्टेड रिलीज ऑफ टॉरपीडो (स्मार्ट) का सुबह 11 बजकर 45 मिनट पर ओडिशा के अपतटीय क्षेत्र स्थित व्हीलर द्वीप से सफल परीक्षण किया गया है। व्हीलर द्वीप को अब अब्दुल कलाम द्वीप कहा जाता है।"

परीक्षण रक्षा अनुसंधान एवं विकास संगठन (डीआरडीओ) ने किया। बयान में कहा गया कि परीक्षण सफल रहा और सभी मानक प्राप्त कर लिए गए। 'स्मार्ट प्रणाली पनडुब्बी' विध्वंसक अभियानों के लिए हल्के वजन की टॉरपीडो प्रणाली है। बयान में कहा गया कि यह परीक्षण और प्रदर्शन पनडुब्बी रोधी क्षमता स्थापित करने में काफी महत्वपूर्ण है।

रक्षा अनुसंधान एवं विकास संगठन (डीआरडीओ) के एक अधिकारी ने बताया कि रक्षा मंत्री राजनाथ सिंह ने इस परीक्षण के लिए डीआरडीओ के वैज्ञानिकों को बधाई दी। यह परीक्षण पनडुब्बी रोधी युद्ध कौशल में एक बड़ी उपलब्धि है। राजनाथ सिंह ने ट्वीट किया, "डीआरडीओ, भारत ने 'सुपरसोनिक मिसाइल असिस्टेड रिलीज ऑफ टॉरपीडो (स्मार्ट)' का सफल परीक्षण किया है जो पनडुब्बी रोधी युद्ध क्षमता में एक बड़ी उपलब्धि होगा।

<https://www.livehindustan.com/national/story-india-tests-rudram-1-first-anti-radiation-missile-to-fall-enemy-radar-3547032.html>



Thu, 08 Oct 2020

Defence Ministry, DRDO beef up India's missile arsenal amid Ladakh standoff with China

Apart from testing advanced versions of the Shaurya and BrahMos missile systems, the DRDO and Ministry of Defence have also tested the 'SMART' torpedo and the anti-radiation 'RUDRAM' missile amid the India-China military standoff in eastern Ladakh

By Abhishek Bhalla

New Delhi: India has ramped up its missile prowess by carrying out a series of tests to assess new capabilities over the last few weeks amid the India-China military standoff along the LAC in eastern Ladakh. The Defence Research Development Organisation (DRDO) has increased the frequency of testing of a number of missile systems over the past few weeks.

These tests come at a time when both India and China are currently engaged in an intense standoff along the Line of Actual Control (LAC). Multiple rounds of diplomatic and military talks have been held between the two countries in recent months to achieve disengagement and de-escalation in the region.

'SHAURYA' missile

In a crucial breakthrough to enhance India's nuclear prowess, DRDO on October 3 tested an advanced version of the Shaurya missile with a range of close to 1,000 km. The Shaurya is a potent surface-to-surface missile.

Shaurya was not the only missile system to be tested off late since the standoff with China started early May.

'SMART' torpedo

As a boost to India's anti-submarine warfare capabilities, SMART (Supersonic Missile Assisted Release of Torpedo) was tested from the APJ Abdul Kalam Island, off the coast of Odisha on October 5.

SMART is a missile-assisted release of lightweight anti-submarine torpedo system for anti-submarine warfare operations beyond the range of a torpedo.

"All the mission objectives including missile flight up to the range and altitude, separation of the nose cone, the release of Torpedo and deployment of Velocity Reduction Mechanism (VRM) have been met perfectly," DRDO said in a statement following the successful test.



RUDRAM missile (Photo Credits: DRDO)

'BRAHMOS' cruise missile

On September 30, a new version of the Brahmos supersonic surface-to-surface cruise missile with an extended range of 400 km up from 290 km was also test-fired.

After the successful launch, DRDO said it has paved the way for the serial production of the indigenous booster and other indigenous components of the powerful BrahMos Weapon System in recognition of the Atmanirbhar Bharat pledge.

The BrahMos is among weapon systems already deployed in strategic locations, keeping in mind the Chinese threat not just in Ladakh but also other sectors along the LAC.

Su-30 missile capabilities

The Indian Air Force (IAF) is also integrating the missile in Su-30 fighter jets to boost its capabilities. Over the course of the past five months, the IAF has deployed its critical assets to take on any Chinese belligerence over Ladakh.

During his annual press conference on Air Force Day, Air Chief Marshal RKS Bhadauria said the IAF has the capability to strike deep and hard if the need be.

'RUDRAM' anti-radiation missile

Adding to the list of recent missile tests is the new-generation anti-radiation missile 'RUDRAM'. It was tested onto a radiation target located on Wheeler Island, off the coast of Odisha on October 9.

The missile was launched from a Su-30 MKI fighter aircraft.

"This gives a great advantage to our fighting forces. If radars are taken away, it will give a free run to our aircraft. Our aircraft can go in and destroy enemy targets, particularly air defence systems," a former DRDO scientist, S Guruprasad told India Today.

In a statement, the DRDO stated, "This is an indigenously developed long-range air-launched anti-radiation missile that can destroy enemy radars and communication sites. The missile is a potent weapon for IAF for suppression of enemy air defence effectively from large stand-off ranges."

"This (RUDRAM) will provide a tacit advantage in the arena of suppression of enemy's air defence, what we call SEAD," Lt Gen (ret'd) Gurmit Singh added.

'NIRBHAYA' missile

As a counter to Chinese deployment of missile systems, India has pressed into action the Nirbhaya surface-to-surface missile with a reach of up to 1,000 km. The DRDO is likely to carry out another round of tests for the Nirbhaya missile in the coming days.

New Chinese missile sites have cropped up in areas bordering Sikkim, Arunachal Pradesh, Uttarakhand, and Ladakh.

The Akash Air Defence system is also in place at sensitive locations to counter any aerial threat.

'AGNI' missile series

While India has been enhancing its nuclear-capable 'Agni' missile series with Agni-5 having a range of more than 5,000 kms, China's nuclear Dongfeng series already has a reach of 12,000 km.

In a recent study, the Stockholm International Peace Research Institute said China has 320 nuclear warheads while India is estimated to have 150.

<https://www.indiatoday.in/india/story/defence-ministry-drdo-beef-up-india-s-missile-arsenal-amid-ladakh-standoff-with-china-1730139-2020-10-09>

India's missile scientists in top gear with six successful tests in five weeks

New and upgraded platforms tested for deployment from land, sea and air

By Pradip R Sagar

Amidst tensions in Ladakh along the border with China, India's missile programs have taken huge leaps in the past month. At least six separate weapons were successfully tested in the last five weeks by the Defence Research and Development Organisation (DRDO).

DRDO has successfully tested the Hypersonic Technology Demonstrator Vehicle (HSTDV) on September 8, the extended range variant of the BrahMos supersonic cruise missile on September 30, an anti-tank guided missile on September 23 and on October 1, a lighter version of the nuclear-capable Shaurya on October 3, the 'SMART' torpedo on October 5 and most recently, an anti-radiation missile today.

All these missile tests have kept the country's missile scientists on their toes—and official sources indicate many more tests are lined up in the days to come including that of the 800 km-range subsonic 'Nirbhay' cruise missile.

Latest in the series is the new generation Anti Radiation Missile (RUDRAM), which was successfully flight tested. This is the first indigenous anti-radiation missile of the country, design and developed by the DRDO.

"The RUDRAM was successfully flight tested onto a radiation target located on Wheeler Island off the coast of Odisha on the bay of bengal. The missile was launched from SU-30 Mk1 fighter aircraft. The RUDRAM hit the radiation target with pin-point accuracy," DRDO said in a statement. It is learned that with this, RUDRAM is ready for its induction in the Indian Air Force.

All of the weapons systems tested supplement India's capabilities in new ways.

On Monday, the supersonic missile assisted release of torpedo (SMART) system was tested, an anti-submarine warfare missile which is aimed to be operationalised in the Indian Navy in the coming days and which could prove a trump card against China's submarines.

The nuclear-capable 'Shaurya' missile test was carried out last week and is expected to be inducted into the Strategic Forces Command (SFC), which handles the country's tri-service nuclear arsenal. The newer missile is expected to be both lighter and easier to operate.

Late last month, a laser guided anti-tank guided missile was test fired from the Arjun tank as it undergoes technical evaluation trials with the indigenously-developed tank. The new missile employs a tandem HEAT warhead to defeat explosive reactive armour-protected vehicles.

The Brahmos Supersonic cruise missile with an indigenous booster and air frame is expected to have a longer range of over 400km—compared to the in-service BrahMos missile which has a range of up to 290km.

The successful test of the Hypersonic Technology Demonstrator Vehicle (HSTDV) on 7 September put India into the league of nations like US, Russia and China, which have such niche technologies within their arsenals.



Clockwise from left: The SMART air-launched torpedo, the extended-range variant of the BrahMos and the Arjun tank firing a laser-guided anti-tank missile | DRDO

Stating that the RUDRAM missile is integrated on the SU-30 MKI fighter aircraft as the launch platform, having capability of varying ranges based on launch conditions, DRDO said it has Inertial Navigation System (INS)-Global Positioning System (GPS) navigation with Passive Homing Head (PHH) for the final attack. The missile is a potent weapon for the Indian Air Force (IAF) for suppression of enemy air defence effectively from large stand-off ranges, it stated.

RUDRAM is developed by the DRDO's Hyderabad based laboratory, Defence Research and Development Laboratory (DRDL), which is mandated for the design and development of state-of-the-art missile Systems and technologies required for deterrence as well as for the defence of the country.

<https://www.theweek.in/news/india/2020/10/09/indias-missile-scientists-in-top-gear-with-six-successful-tests-in-five-weeks.html>



Sat, 10 Oct 2020

DNA Explained: Why ACM AKS Bhadauria said Indian Air Force is ready for two-front war against China, Pakistan

The entire world witnessed the Indian Air Force's strength on Indian Air Force Day on 8 October. Meanwhile, Air Force Chief RKS Bhadauria expressed confidence in the indigenous combat system. He also said that 83 aircraft of LCA Mark-1A would join the Air Force in the next five years

By Ravi Dubey

The entire world witnessed the Indian Air Force's strength on Indian Air Force Day on 8 October. Meanwhile, Air Force Chief RKS Bhadauria expressed confidence in the indigenous combat system. He also said that 83 aircraft of LCA Mark-1A would join the Air Force in the next five years. The Air Force chief said that the indigenously developed fifth-generation aircraft would be the main force of the Indian Air Force in the coming decade. The induction of indigenous fighter aircraft into the Air Force for the next decade will also increase 'self-reliance.' The Air Force plans to have 38 squadrons of fighter jets by 2030.

Work on indigenous warfare system on advanced and 6G technologies

Indian Air Force Chief Air Chief Marshal RKS Bhadauria said in a special conversation about the preparations for a future war that the Indian Air Force is developing an indigenous combat system, including hypersonic weapons 'Directed Energy Weapons, Smart Wingman Concept, alternatively manned platforms, drones, and 6G technologies. He said that by incorporating indigenous fighter aircraft into the Air Force by the second half of the coming decade, 'self-reliance' would also increase. We are committed to the indigenous development of the fifth-generation Advanced Medium Combat Aircraft (AMCA), the mainstay of the Indian Air Force fighter fleet.



Confidence expressed on fighter aircraft under 'Self-reliant India'

Bhadauria revealed that the government is expected to get approval for a deal of 114 multi-role fighter aircraft soon to meet the shortage of fighter jets until joining the fleet of fifth-generation

fighter planes (AMCA), after which the formal procurement process will begin. This will also give the squadron of fighter jets a facelift in the coming decade. Asked if Rafael had an idea to build two more squadrons, he called it 'very quickly.' He said that the Indian Air Force had placed its trust in the fighter aircraft Tejas LCA under 'Self-reliant India' in the future. He also said that drones are good for initial conflict but become susceptible during the full war.

Focus on filling squadron shortage

The Air Force needs at least 42 fighter squadrons for simultaneous 'two-front war' from China and Pakistan, but currently, the Air Force has only 30 squadrons operational. He said that the Air Force is working on a plan to increase the squadron of fighter jets to 38 in the next decade. This shortage of squadrons will be bridged by finalizing the deal for 114 fighter aircraft under the 'Make in India', which was included in the recently released Defense Acquisition Process (DAP) 2020. Air Chief Marshal Bhadoria has indicated that the Air Force is expected to get government approval for 114 fighter jets soon. The formal procurement process will begin.

Plans to build 38 squadrons by 2030

The IAF chief told about 38 squadrons of fighter jets to be built by 2030, including Mirage 2000-I3, MiG-29 UPG 4, Sukhoi-30 MKI 12, Tejas Mk 1 and 1A 6, Tejas Mk 2 K2. , 6 of Multi-Role Fighter Aircraft (MRFA), 2 of French Rafale, and three squadrons of Jaguar DARIN III. Air Force Chief Bhadoria has acknowledged that no matter how fast we move, the Indian Air Force will not reach its authorized 42 Squadron in the coming decade, but becoming a 36-38 Squadron will be achieved. He also said that despite lack of fighter squadrons, the Air Force is ready for the 'Two-Front War.'

They will be monitored in the coming year

Bhadauria said that the squadron is looking full forcefully on receiving the remaining Rafale and light combat aircraft LCA Mark-1 from France in the next three years. Along with this, apart from the current fleet, Sukhoi-30 MMI and MiG-29 aircraft from Russia will also meet the squadron shortage. The Mirage-2000, the old MiG-29, and the Jaguar fleet are also to be upgraded operationally during the same period. This will also increase the capacity of the Air Force. In the next five years, we will add 83 aircraft of LCA Mark-1A to our fleet. We are supportive of DRDO and HAL's efforts in indigenous production, and you will soon see the Basic Trainer Aircraft (HTT-40) and Light Combat Helicopter (LCH) being signed.

<https://www.dnaindia.com/india/report-dna-explained-why-acm-aks-bhadauria-said-indian-air-force-is-ready-for-a-two-front-war-against-china-and-pakistan-2848629>

Explained: India's K missile family, named after APJ Abdul Kalam

A look at what this family of missiles is, their strategic importance as a nuclear deterrent and their recent tests

By Sushant Kulkarni

Pune: A successful trial of the nuclear capable Shaurya missile was conducted by India, the news agency ANI reported Saturday. Shaurya is a land-based parallel of the submarine launched K-15 missile. These ballistic weapons belong to the K missile family — codenamed after late Dr APJ Abdul Kalam — which are launched from Arihant class of nuclear submarines.

A look at what this family of missiles is, their strategic importance as a nuclear deterrent and their recent tests.

The K Family of missiles

The K family of missiles are primarily Submarine Launched Ballistic Missiles (SLBMs), which have been indigenously developed by Defence Research and Development Organisation (DRDO) and are named after Dr Kalam, the centre figure in India's missile and space programmes who also served as the 11th President of India.

The development of these naval platform launched missiles began in the late 1990s as a step towards completing India's nuclear triad

— the capability of launching nuclear weapons from land, sea and air based assets.

Because these missiles are to be launched from submarines, they are lighter, smaller and stealthier than their land-based counterparts, the Agni series of missiles which are medium and intercontinental range nuclear capable ballistic missiles. While K family are primarily submarine-fired missiles to be fired from India's Arihant class nuclear powered platforms, the land and air variants of some of its members have also been developed by the DRDO.

Shaurya, whose user trial was conducted on Saturday, is a land variant of short range SLBM K-15 Sagarika, which has a range of at least 750 kilometers.

India has also developed and successfully tested multiple times the K-4 missiles from the family which has a range of 3500 km. It is reported that more members of K-family — reportedly to have been codenamed K-5 and K-6 — with ranges of 5000 and 6000 km are also under development. The early development trials of K-15 and K-4 missiles had begun in the early 2010s.

The strategic importance of SLBMs

The capability of being able to launch nuclear weapons submarine platforms has great strategic importance in context of achieving a nuclear triad, especially in the light of 'no first use' policy of India. The sea-based underwater nuclear capable assets significantly increases the second strike capability of a country and thus boosts its nuclear deterrence. These submarines can not only survive a first strike by the adversary but also can launch a strike in retaliation thus achieving Credible Nuclear Deterrence. The 2016 commissioned nuclear powered Arihant submarine and its class members which in the pipeline, are the assets capable of launching missiles with nuclear warheads.

The development of these capabilities is important in light of India's relations with the two neighbours China and Pakistan. With China having deployed many of its submarines, including



These submarines can not only survive a first strike by the adversary but also can launch a strike in retaliation thus achieving Credible Nuclear Deterrence. (File)

some which are nuclear powered and nuclear capable, this capacity building is crucial for India's nuclear deterrence. In November 2018, after INS Arihant became fully operational, Prime Minister Narendra Modi had tweeted, "In an era such as this, a credible nuclear deterrence is the need of the hour. The success of INS Arihant gives a fitting response to those who indulge in nuclear blackmail."

The recent tests

In the third week of January this year, DRDO conducted two successful tests of the K-4 missile from submerged platforms off the coast of Andhra Pradesh in a span of six days. These tests were a key step towards ultimately deploying K-4 on INS Arihant, which already has K-15 onboard. In the Saturday's test, Shaurya was examined for several advanced parameters compared to its earlier tests, according to sources.

Shaurya, like many of the modern missiles, is a canister-based system, which means that it is stored and operated from specially designed compartments. In the canister, the inside environment is controlled thus along with making its transport and storage easier, the shelf life of weapons also improves significantly.

While DRDO has been conducting these tests, there has not been any official communication from the agency about them, possibly because of classified nature of K family missile projects and their close link to the Advanced Technology Vehicle (ATV) project of which Arihant class vessels are part of. These recent tests of these systems can also be looked at as a strong message to China and Pakistan in light of the present situation in the region.

https://indianexpress.com/article/explained/explained-what-is-indias-k-missile-family-6701664/?utm_source=Taboola_Recirculation&utm_medium=RC&utm_campaign=IE

COVID-19: DRDO's Contribution

THE ECONOMIC TIMES

Sat, 10 Oct 2020

Indo-Israel rapid COVID-19 testing research to fructify in 'matter of days': Israeli envoy

Synopsis

Ambassador Ron Malka also said Israel would want India to become the manufacturing hub for this rapid testing kit and the two countries will also collaborate on vaccine development for this dreaded disease with India taking a key role in production given its "very strong relative advantage in manufacturing".

New Delhi: A game-changer rapid COVID-19 testing technology being jointly developed by India and Israel should be ready for rollout in "a matter of days" and it will be able to give test results in less than a minute by simply requiring an individual to blow into a tube, the Israeli envoy to India has said.

Ambassador Ron Malka also said Israel would want India to become the manufacturing hub for this rapid testing kit and the two countries will also collaborate on vaccine development for this dreaded disease with India taking a key role in production given its "very strong relative advantage in manufacturing".

He said the work on the rapid COVID-19 testing project is in a very advanced stage.



"I think it is a matter of days. What I hear from those involved in the process, it should not take more than 2-3 weeks to finalise that one reliable and accurate technology or a combination of more than one from amongst the four different technologies being analysed," Malka told PTI in an interview.

Indian and Israeli researchers have conducted trials after collecting a large number of samples in India for four different kinds of technologies, including a breath analyser and a voice test, that have the potential to detect COVID-19 rapidly.

There is also isothermal testing that enables identification of the novel coronavirus in a saliva sample and a test using poly-amino acids that seeks to isolate proteins related to COVID-19.

Malka said he has been told by the scientists that tens of technologies were tested to short-list these four technologies, which have now gone through different stages as per different demands to reach the last stage.

"I am optimistic as all threshold conditions have already been passed," he said.

The envoy said this new rapid test is going to be a game-changer and is "a shining example of how fruitful collaboration in science and technology between Israel and India can be."

"It will be good news for the entire world. Until we manage to immunise the entire population, this joint operation, which we had named 'open skies', would literally open the skies in terms of international travel and other economic activities as this can be used at airports and other places by requiring a person just to blow into a tube and the result would be available in 30-40-50 seconds," he said.

In addition, this will be very cheap cost-wise as it gives the result locally without the logistical baggage of sending the sample to laboratories, Malka said.

Asked about collaboration on vaccine development, Malka said the two countries were always sharing research and technologies.

Noting that India has a "very strong relative advantage in manufacturing", Malka said once the vaccine is ready, Israel is hopeful to get the advantage of that.

"We are helping and supporting each other," he added.

"We understand that once there is a reliable vaccine that is safe and effective, it will be mostly produced in India," Malka said.

Israel understands that when India will manufacture a vaccine, it will also take into consideration the needs of Israel, he added.

The Israeli Ambassador also thanked authorities in India for the help and assistance they provided after the virus outbreak to evacuate thousands of Israelis stranded all over India.

Indian Prime Minister Narendra Modi and Israeli Prime Minister Benjamin Netanyahu also spoke to each other recently on the collaboration in combating the pandemic, he noted.

During their telephonic conversation earlier this month the two leaders had assessed the progress in bilateral cooperation in the context of the COVID-19 pandemic, especially in the fields of research, field trials of diagnostic tools and vaccine development.

They agreed on the importance of close cooperation in these important areas not only for the benefit of the people of the two countries but also for the greater good of humanity.

Malka said healthcare has become an immediate priority area of collaboration between India and Israel due to the pandemic.

Asserting that healthcare will be one of the main pillars of collaboration between Israel and India going forward, Malka said he has also been working closely with Ayushman Bharat CEO Indu Bhushan to explore ways to collaborate on the mission.

Malka said Israel has always focussed on multi-use technologies and in the case of healthcare also it has been using some technologies used in security areas.

He said India was the obvious choice for collaboration when Israel's defence research organisation decided to focus on rapid COVID-19 testing technology.

The rapid testing is being jointly developed in cooperation with the Defense Research and Development Directorate of the Israeli Ministry of Defence, India's Defence Research and Development Organisation, Council of Scientific and Industrial Research and Principal Scientific Advisor, India -- coordinated by the ministries of foreign affairs of Israel and India.

The samples were collected when a multi-pronged mission from Israel visited India to cooperate on COVID-19 research and development around July-end and early August.

"The joint research (on rapid testing) is a very successful operation. It was something remarkable to analyse 25,000 samples in nine days. It shows the great potential of the collaboration, expanding the mutual commitment, chemistry and trust between the two countries. Otherwise, we could not have succeeded in such a challenging operation," Malka said.

If good results are obtained on rapid testing, the manufacturing hub for such COVID test kits would be India, he said.

He said that the special plane on which the Israeli research team had visited India had also brought advanced medical equipment developed especially for fighting COVID-19 in Israel.

Malka said he personally collected the useful equipment from leading hospitals in Israel and brought them with him on board the special plane.

"We also brought respirators at that time, though there was an export ban on them," the Israeli envoy said.

<https://economictimes.indiatimes.com/news/politics-and-nation/indo-israel-rapid-covid-19-testing-research-to-fructify-in-matter-of-days-israeli-envoy/articleshow/78572359.cms>

Defence News

Defence Strategic: National/International

Business Standard

Sat, 10 Oct 2020

Top army brass reviews security in Ladakh ahead of Corps Commander talks

The Corps Commander talks are taking place with a specific agenda of firming up a roadmap for disengagement of troops from the friction points in eastern Ladakh

New Delhi: The top military brass on Friday reviewed the security situation in eastern Ladakh as well as strategies for the seventh round of Corps Commander-level talks with the Chinese PLA which is scheduled on October 12, people familiar with the developments said.

The Corps Commander talks are taking place with a specific agenda of firming up a roadmap for disengagement of troops from the friction points in eastern Ladakh.

The top military brass reviewed the situation in eastern Ladakh and deliberated on key issues to be flagged at the talks on Monday, the sources said.

Army Chief Gen MM Naravane and several top military officials were present in the meeting.

At the talks, the two sides are also expected to look into further steps to maintain stability on the ground and avoid any action that may trigger fresh tension in the region, they said.

A senior official of the Ministry of External Affairs (MEA) is set to be part of the Indian delegation at the talks which will be led by Lt Gen Harinder Singh, the commander of the Leh-based 14 Corps of the Indian Army, the sources said.

Following the last round of military talks on September 21, the two sides announced a slew of decisions including not to send more troops to the frontline, refrain from unilaterally changing the situation on the ground and avoid taking any actions that may further complicate matters.

The military talks were held with a specific agenda of exploring ways to implement a five-point agreement reached between External Affairs Minister S Jaishankar and his Chinese counterpart Wang Yi at a meeting in Moscow on September 10 on the sidelines of a Shanghai Cooperation Organisation(SCO) conclave.

The pact included measures like quick disengagement of troops, avoiding action that could escalate tensions, adherence to all agreements and protocols on border management and steps to restore peace along the LAC.

Days after the military talks, the two sides held diplomatic talks under the framework of Working Mechanism for Consultation and Coordination (WMCC) on border affairs, but no concrete outcome emerged from the negotiation on September 30.

https://www.business-standard.com/article/current-affairs/top-army-brass-reviews-security-in-ladakh-ahead-of-corps-commander-talks-120100901500_1.html

THE ECONOMIC TIMES

Sat, 10 Oct 2020

Navy cancels Reliance Naval and Engineering Ltd's Rs 2,500-crore NOPV contract

Synopsis

The contract to build five warships was signed with the company in 2011, much before the Reliance Group took over the Gujarat-based shipyard from its erstwhile owner Nikhil Gandhi

New Delhi: The Indian Navy has cancelled Reliance Naval and Engineering Ltd's (RNEL) Rs 2,500-crore naval offshore patrol vessels (NPOVs) contract, owing to delay in delivery of the vessels, according to sources aware of the development. The contract was cancelled two weeks ago due to the delay in the delivery of the vessels, they said.

The contract to build five warships was signed with the company in 2011, much before the Reliance Group took over the Gujarat-based shipyard from its erstwhile owner Nikhil Gandhi.

The Reliance Group took over Pipavav Defence And Offshore Engineering Ltd in 2015 and later renamed it as Reliance Naval and Engineering Ltd (RNEL).

RNEL did not offer comments on the issue.

The cancellation of the NOPV contract has cast a shadow over the bidding process of RNEL, which is currently going through the debt resolution process in the National Company Law Tribunal (NCLT).

IDBI, the lead banker of the consortium of lenders of RNEL, had taken the company to the NCLT Ahmedabad due to the default in loan repayment.

RNEL has an outstanding debt of over Rs 11,000 crore.

In August, 12 companies had submitted expressions of interest (EOI) for RNEL.



IDBI, the lead banker of the consortium of lenders of RNEL, had taken the company to the NCLT Ahmedabad due to the default in loan repayment.

These included APM Terminals, United Shipbuilding Corporation (Russia), Hazel Mercantile Ltd, Chowgule Group, Interups (USA), Next Orbit Ventures, ARCIL, IARC, JM ARC, CFM ARC, Invent ARC and Phoenix ARC.

These companies are required to submit their final bids by October 31.

The sources said that out of the 12 companies, three major players with experience in the business, APM Terminals, United Shipbuilding Corporation (Russia), and Chowgule Group have opted out of the bid process of RNEL.

APM Terminal has conveyed to the resolution professional (RP) of RNEL that it is not interested in submitting any bid as the Gujarat Maritime Board's (GMB) approval is not for the terminal business and the company is not into the shipbuilding business.

Another company, United Shipbuilding of Russia, is also not keen on bidding because its management believes that pipeline of new defence naval business is not clear and the government has also cancelled the NOPV contract of RNEL. Hence, in the absence of any clear future visibility of the business, it does not make any sense to bid for RNEL shipyard.

Another company with experience in this sector, Chowgule Group, has reservations over the bid condition of furnishing a Rs 5 crore bid bond and Rs 75 crore personal guarantee, and hence, opted out of the process.

In the event of these three companies walking away, only nine asset reconstruction companies (ARCs) are left in the fray.

According to the sources, with these key companies walking away, the last date for bid submission is likely to be extended.

RNEL may meet the same fate as two other private shipyards -- ABG Shipyard and Bharati Shipyard.

Both, ABG Shipyard, with a debt of over Rs 19,000 crore, and Bharati Shipyard, with a debt of over Rs 13,000 crore, are already under liquidation, and lenders are likely to get less than Rs 800 crore and Rs 600 crore, respectively.

<https://economictimes.indiatimes.com/news/defence/navy-cancels-reliance-naval-and-engineering-ltds-rs-2500-crore-nopv-contract/articleshow/78576716.cms>



Sat, 10 Oct 2020

China's maritime challenge

The world's largest navy is aggressively expanding its presence in the Indian Ocean region. Inside India's plan to take on the Chinese plan

By Sandeep Unnithan

It's December 2025 and 'Exercise Sea Dragon' has begun. The world's largest navy has bided its time for decades and is now ready to project power beyond its shores. Two PLAN (People's Liberation Army-Navy) aircraft carrier battle groups, the Shandong and Fujian, with their entourage of nuclear-powered attack submarines, cruisers and destroyers, enter the Indian Ocean through the Malacca Straits, shadowed by Indian P-8I reconnaissance aircraft. 'Sea Dragon' is meant to test PLAN's responsiveness to maritime operations against a distant adversary, the official release says. Four Shang class submarines circle the east and west coast of India, two on either coast conducting 'barrier patrols', leaving no doubt as to who this distant adversary is. In Delhi, the Maritime Domain Awareness panels in the navy's maritime operations room paint a picture of the PLAN mission, an envelopment of the Indian subcontinent. No merchant ship or warship headed in or out, can sail without being targeted.

This hypothetical scenario could be straight out of an Indian Navy tactical exercise as the force contemplates the imminent entry of the world's largest navy into its backyard, the Indian Ocean region (IOR).

In its annual report to the US Congress, presented on September 1, the US defense department mentioned how PLAN, with 350 warships and submarines, is now numerically the world's largest battle force on water, outstripping the US navy's 296 warships. The PLAN now claims a substantial (but unclear) portion of the China's \$178.2 billion military budget. Over the past decade, it has added 117 major combatants, including submarines and landing platform dock ships, equivalent to an entire Indian navy. It has inducted two aircraft carriers and is building two more. Each combatant has brought in a quantum jump in capabilities with advanced anti-ship, anti-air and anti-submarine weapons and sensors. The PLA's first Type 055 class destroyer, commissioned this January, is armed with 112 vertical missile launchers, more than twice the missile load of an Indian destroyer. The PRC's 2019 defence white paper described the PLAN as speeding up transition of its tasks from 'defence on the near seas' to 'protection missions on the far seas'. Last December, it lengthened the pier on its first overseas base in Djibouti to accommodate aircraft carriers and nuclear submarines. Its 36th anti-piracy patrol, comprising three warships (ongoing since 2008), entered the Indian Ocean this year.



Photo: AP

The PLAN's IOR moves are ostensibly to allay China's 'Malacca Dilemma', the fact that over 80 per cent of its energy supplies are shipped through the narrow Malacca Straits. But in a climate of mistrust, borne out of Beijing's belligerence, it is looked at otherwise.

China's naval rise comes at a time when the Indian Navy is wrestling with budgetary issues and a slow accretion in force levels. Its share of the defence pie has shrunk from a high of 18.3 per cent in 2013 to 15 per cent this year. This fall, naval officials say, is the result of acquisition plans for multi-role helicopters and landing platform docks not fructifying. The navy will issue a Request for Proposal for building six Project 75I submarines which it hopes to start acquiring by 2026 onwards to replace an ageing fleet of a dozen submarines.

The navy's first indigenously built aircraft carrier, the 40,000-tonne INS Vikrant, will head out for sea trials early next year and will be inducted by October 2021. The navy regards plans for a second aircraft carrier, the 60,000 tonne IAC-2 which it wants to induct into service by 2035, as 'non-negotiable'. A budgetary freeze seems inevitable given the present state of the economy, and the service is looking at reprioritising its acquisitions, replacing assets like minesweeping warships in favour of unmanned platforms, cutting back the number of additional P-8Is from 10 to six and going in for indigenous solutions. It will soon have a single Maritime Theatre Command and commander, combining the Western, Eastern and Andaman and Nicobar Command. This restructuring, part of the government's plan for four or five integrated theatre commands instead of 17 single service commands, will allow it to save resources and add platforms like Su-30 MKI jets with ship-killing Brahmos missiles.

The force is tweaking its mission-based deployments (MBD), a 2016 strategy of positioning warships round-the-clock in six key maritime chokepoints of the Indian Ocean region, the Gulf of Aden, North Arabian Sea, Persian Gulf, northern and southern Indian Ocean and the Malacca Straits. Key to this strategy are the induction of assets like the eight MQ-9 Guardian drones and eight additional P8-I Poseidon long-range maritime surveillance aircraft from the US. The Guardian, for instance, can float 15 km above chokepoints for 30 hours at a stretch.

"We maintain effective domain awareness in our primary areas of interest and can deploy rapidly in case of any emergent situation," says Vice-Admiral G. Ashok Kumar, Vice-Chief of Naval Staff. "In order to facilitate maritime security, we also maintain combat-ready platforms on mission-based deployments, with additional forces in readiness."

The Maritime Lever

On July 20 this year, the US sent the USS Nimitz carrier strike group into the IOR for joint exercises with the Indian navy. It was a very visible symbol of support, a month after the bloody clashes between the Chinese PLA and Indian Army left over 20 Indian and an unspecified number of Chinese soldiers dead. This is the kind of coalitional leverage that India is building up with larger maritime powers to counter-balance a rising China.

Naval analysts say as Beijing makes creeping territorial claims in the Himalayas, the time has come for New Delhi to assert the Freedom of Navigation at Sea (FONAS) through 'global commons' like the South China Sea which China claims as its territorial waters. The government has so far been silent on this or the prospect of conducting joint FONAS patrols with the US navy. What it has worked on over the past few years is Security and Growth for All in the Region (SAGAR), the government's 2015 vision for cooperation with various countries in the IOR. The Indian navy aims to become what it calls 'preferred security partners' for littoral states by conducting EEZ (exclusive economic zone) patrols in their territorial waters.

A key aspect of increasing the reach of its aircraft and warships through the IOR are the logistics support agreements (LSA) with France, Singapore, the United States, Australia and, more recently, Japan (LSAs allow countries to use each other's bases for refuelling). New Delhi has also struck common cause with a close grouping alarmed by the rise of China, the Quadrilateral Security Dialogue, a grouping of India, Australia, the United States and Japan. 'The Quad', proposed in 2006 by former Japanese prime minister Shinzo Abe, had been shelved but was revived last year in the face of an assertive Beijing. An in-person October 6 meeting of the 'Quad', called at India's behest in August, saw the foreign ministers of the countries involved get together in Tokyo. The meeting was hugely symbolic as it comes at a time when all four have seen ties with Beijing plummet. While US secretary of state Mike Pompeo openly lashed out at China, the three other countries including India were ambivalent about naming the country responsible for drawing them closer. There is no evidence the Quad can be militarised into an Asian NATO with an 'attack on one is an attack on all' clause. In any event, it will be the maritime domain which is likely to see the greatest cooperation.

"Maritime forces have the unique ability to provide diplomatic leverage round-the-year, which armies and air forces can provide only when things get very tense between countries," says Rear Admiral Sudarshan Shrikhande, former assistant chief of naval staff (foreign cooperation and naval intelligence). The Malabar 2020 exercise between India, Japan and the US due next month will be closely watched for whether it includes the Australian navy. New Delhi has in the past been wary of riling Beijing by including them in the Malabar exercises. A senior government official says including Canberra would be a "political decision". One, which seems, will clearly be guided by what Beijing does next.

<https://www.indiatoday.in/magazine/special-report/story/20201019-china-maritime-challenge-1729901-2020-10-10>

Sat, 10 Oct 2020

Astronauts of the first Latin American Space Mission look to work with ISRO for future programs

LATCOSMOS is an initiative from EXA adopted by the International Astronautical Federation's Latin American and Caribbean Regional group committee, and as such, is a supra-national and private program

By Huma Siddiqui

For the first time in the history of Latin American Space travels, a crew of made up only Latin Americans will be going onboard. The first Latcosmos mission has been promoted by the Ecuadorian agency EXA, which will provide the funds for the first space trip. The crew which will participate is being commanded by Commander Ronnie Nader, Exa Ecuador, and Adolfo Chaves, TEC Costa Rica; Alberto Ramírez, UNAM Mexico and Margot Solberg, US.

Two astronauts – interacted with Financial Express Online and talked about their mission and how they can collaborate with Indian Space Research Organisation (ISRO) in the future.

Dr Adolfo Chaves Jiménez, Researcher Coordinator, Space Systems Engineering Laboratory (SETEC Lab) School of Electronics Costa Rica Institute of Technology, has been chosen to travel to Outer space as part of the first Latin American space mission in history.

Mission specialist astronaut, commander Ronnie Nader, Ecuadorian Civil Space Agency (EXA)/FAE, is the first person in history to achieve the two most significant milestones in astronautics for a country. He is the first astronaut and the father of its first satellites and at the same time is the only Ecuadorian representative to the International Astronautical Federation (IAF) General Assembly.

He is also the first and only Ecuadorian citizen to be elected as a member of the International Academy of Astronautics, and member of the American Association for the Advancement of Science (AAAS).

Following are excerpts of an interaction with Dr Adolfo Chaves Jimenez who talks about the mission and how ISRO and Costa Rica can work together in the space sector:

What is the Irazú Project (the first Central American satellite)?

I got in contact with the Central American Society for Aeronautics and Space (ACAE) because I wanted to participate in the project. They asked me to be their first project manager. Finally, with the help of a lot of people, the Costa Rica Institute of Technology (TEC) became the partner of ACAE, in charge of the technological development of the satellite.



Mission specialist astronaut, commander Ronnie Nader, Ecuadorian Civil Space Agency (EXA)/FAE

What is the significance of the mission which will be in a New Sheppard rocket, from Blue Origin?

The idea of the mission is to demonstrate that Latin America can undertake joint space missions. The support of EXA has been fundamental on this. Through the Latin American and the Caribbean Group (GRULAC) of the International Astronautical Federation, they are offering us this opportunity.

As a coordinator of the Space Systems Laboratory (SETEC-Lab) of the Tecnológico de Costa Rica (TEC), we will be part of the suborbital trip in the mission called ESAA-01 EX SOMINUS AD ASTRA. This is part of the Latcosmos-C program.

This is one of the many steps that many people of Costa Rica have taken to promote Space as a tool for development and inspiration.

Have you as a coordinator ever considered partnering with the Indian Space Research Organisation (ISRO)?

Absolutely! As a matter of fact, we (SETEC Lab) were the technical counterpart in the proposal for the creation of the Costa Rican Space Agency (AEC), right now in discussion in Congress. We hope when AEC is established, to open an agency-to-agency cooperation with ISRO, that would be even more beneficial than doing it only from a single university.

Would you like to visit ISRO and are there any plans to have cooperation with the Indian Space Agency and sharing best practices?

Absolutely. I admire the technical work of ISRO and believe it has earned its place as one of the leading space agencies in the world, not only through their achievements but also by leading the way in a very creative, practical form of work. We can learn a lot about India, and I believe a relationship with Costa Rica would be of common interest and benefit. Of course, I would love to visit!

How can the Indian Space Agency and your Space Systems Laboratory (SETEC-Lab), work together?

SETEC Lab is always looking for ways to use space engineering as a tool of development in Costa Rica. Costa Rica can add added value to the common interest with other nations due to its capabilities in biodiversity research (world-class laboratories in one of the most bio-diverse countries in the world), to its geographical location in order to give services to satellites, and to its work in environmental conservation, where many interests are common with countries such as India.

I believe cooperation with countries like India will generate win-win situations for the benefit of both countries.

Following are excerpts from an interaction with Ronnie Nader, father of the first Ecuadorian Satellites:

Are you the first-ever astronaut in your country? How did you get interested and where did you train?

Yes I am, I completed my training in 2007 in the Gagarin Cosmonaut Training Center in Russia under the auspices of the Ecuadorian Air Force and my government. I am also the father of the first Ecuadorian satellites.



What is the Latcosmos Mission and the purpose behind this? Who is funding this?

The purpose of the LATCOSMOS human spaceflight program is:

1. To demonstrate successful cooperation and teamwork between Latin Americans in human spaceflight;
2. To gather more advanced bio-metrical and biomedical data from these experiences than those demonstrated during the DAEDALUS, POSEIDON and ARPIA programs from EXA;
3. To learn how to develop and operate experiments and technology for human space flight.

And, the capital funding comes from EXA, after that the missions are self sustainable from the financial point of view.

This is the first time ever I heard of Space programme like this in the region. So what kind of Space programme you have in Ecuador?

LATCOSMOS is an initiative from EXA adopted by the International Astronautical Federation's Latin American and Caribbean Regional group committee, and as such, is a supra-national and private program.

The experiments are varied and they will be of use to the institutions in charge of them, just a few of them will belong to the crew's national institutions, the rest will be sold commercially to other parties around the world in order to make the mission financially sustainable.

You have been funding Startups in India. Why did you decide to do so?

Indian space sector is efficient and effective, produces good quality products and Indian engineers are very capable, that is why EXA has been looking at India as a provider of some products and services we need in order to reduce the costs of our technology exports, which are the main source of income of the Agency.

Have you considered working with the Indian Space Research Organisation (ISRO)?

Of course and we look forward to it, as Agency we have good relations with ISRO and the ISRO chairman and me we both serve as Academicians in the International Academy of Astronautics, so you can say we are colleagues.

More about Latcosmos

This emerged three years ago as an initiative of the Regional Group of Latin America and the Caribbean (Grulac) of the International Astronautical Federation (IAF). That organisation accepted TEC among its ranks in 2017, as the first university in Central America to achieve it. And the target areas of the interests include: Satellite in the classroom; Latin American experiments in space; and Latin Americans in space.

<https://www.financialexpress.com/lifestyle/science/astronauts-of-the-first-latin-american-space-mission-look-to-work-with-isro-for-future-programs/2101448/>

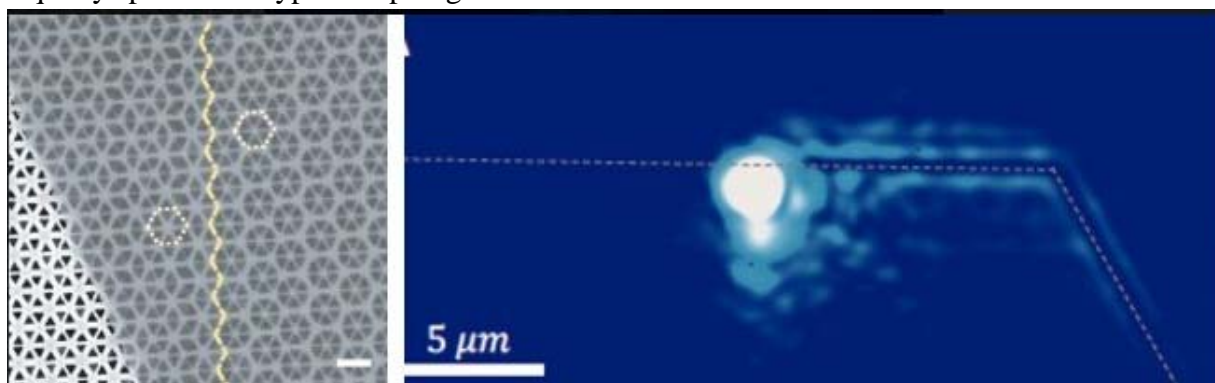
Engineers create helical topological exciton-polaritons, a new type of quasiparticle

By Evan Lerner

The understanding of quantum physics has involved the creation of a wide range of quasiparticles. These notional constructs describe emergent phenomena that appear to have the properties of multiple other particles mixed together.

An exciton, for example, is a quasiparticle that acts like an electron bound to an electron hole, or the empty space in a semiconducting material where an electron could be. A step further, an exciton-polariton combines the properties of an exciton with that of a photon, making it behave like a combination of matter and light. Achieving and actively controlling the right mixture of these properties—such as their mass, speed, direction of motion and capability to strongly interact with one another—is the key to applying quantum phenomena to technology, like computers.

Now, researchers at the University of Pennsylvania's School of Engineering and Applied Science are the first to create an even more exotic form of the exciton-polariton, one which has a defined quantum spin that is locked to its direction of motion. Depending on the direction of their spin, these helical topological exciton-polaritons move in opposite directions along the surface of an equally specialized type of topological insulator.



On the left, an image of the Agarwal group's device, a single layer of tungsten disulfide (WS2) on a periodically patterned photonic crystal. Strong coupling between the excitons of WS2 with the photonic crystal leads to the formation of exciton-photon polaritons with helical topological properties. On the right, the bright spot is circularly polarized light exciting helical topological exciton-polaritons, which have a particular spin and propagate forward, bending around sharp corners with no backscattering. Credit: University of Pennsylvania

In a study published in the journal *Science*, they have demonstrated this phenomenon at temperatures much warmer than the near-absolute-zero usually required to maintain this sort of quantum phenomenon. The ability to route these quasiparticles based on their spin in more user-friendly conditions, and an environment where they do not back-scatter, opens up the possibility of using them to transmit information or perform computations at unprecedented speeds.

The study was led by Ritesh Agarwal, professor in the Department of Materials Science and Engineering, and Wenjing Liu, a postdoctoral researcher in his lab. They collaborated with researchers from Hunan University and George Washington University.

The study also demonstrates a new type of topological insulator, a class of material developed at Penn by Charles Kane and Eugene Mele that has a conductive surface and an insulating core. Topological insulators are prized for their ability to propagate electrons at their surface without scattering them, and the same idea can be extended to quasiparticles such as photons or polaritons.

"Replacing electrons with photons would make for even faster computers and other technologies, but photons are very hard to modulate, route or switch. They cannot be transported around sharp turns and leak out of the waveguide," Agarwal says. "This is where topological

exciton-polaritons can be useful, but that means we need to make new types of topological insulators that can work with polaritons. If we could make this type of quantum material, we could route exciton-polaritons along certain channels without any scattering, as well as modulate or switch them via externally applied electric fields or by slight changes in temperature."

Agarwal's group has created several types of photonic topological insulators in the past. While the first "chiral" polariton topological insulator was reported by a group in Europe, it worked at extremely low temperatures while requiring strong magnetic fields. The missing piece, and distinction between "chiral" and "helical" in this case, was the ability to control the direction of flow via the quasiparticles' spin.

"To create this phase, we used an atomically thin semiconductor, tungsten disulfide, which forms very tightly bound excitons, and coupled it strongly to a properly designed photonic crystal via symmetry engineering. This induced nontrivial topology to the resulting polaritons," Agarwal says. "At the interface between photonic crystals with different topology, we demonstrated the generation of helical topological polaritons that did not scatter at sharp corners or defects, as well as spin-dependent transport."

Agarwal and his colleagues conducted the study at 200K, or roughly -100F without the need for applying any magnetic fields. While that seems cold, it is considerably warmer—and easier to achieve—than similar systems that operate at 4K, or roughly -450F.

They are confident that further research and improved fabrication techniques for their semiconductor material will easily allow their design to operate at room temperature.

"From an academic point of view, 200K is already almost room temperature, so small advances in material purity could easily push it to working in ambient conditions," says Agarwal. "Atomically thin, '2-D' materials form very strong excitons that survive room temperature and beyond, so we think we need only small modifications to how our materials are assembled."

Agarwal's group is now working on studying how topological polaritons interact with one another, which would bring them a step closer to using them in practical photonic devices.

More information: Wenjing Liu et al. Generation of helical topological exciton-polaritons, *Science* (2020). DOI: [10.1126/science.abc4975](https://doi.org/10.1126/science.abc4975) Wenjing Liu et al. Generation of helical topological exciton-polaritons, *Science* (2020). DOI: [10.1126/science.abc4975](https://doi.org/10.1126/science.abc4975)

<https://phys.org/news/2020-10-helical-topological-exciton-polaritons-quasiparticle.html>



Sat, 10 Oct 2020

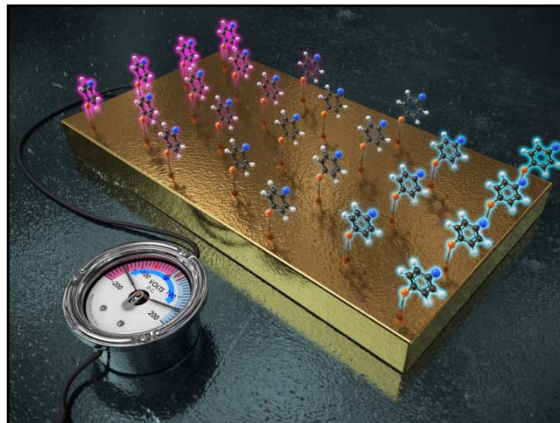
Replacing functional groups with a gold electrode to control reactivity of a molecule

By Bob Yirka

A team of researchers affiliated with several institutions in the Republic of Korea has found that it is possible to replace chemical functional groups with a gold electrode to control the reactivity of a molecule. In their paper published in the journal *Science*, the group describes attaching target molecules to a gold electrode to change the properties of immobilized molecules and how their technique performed when used to rate changes in the hydrolysis of certain esters.

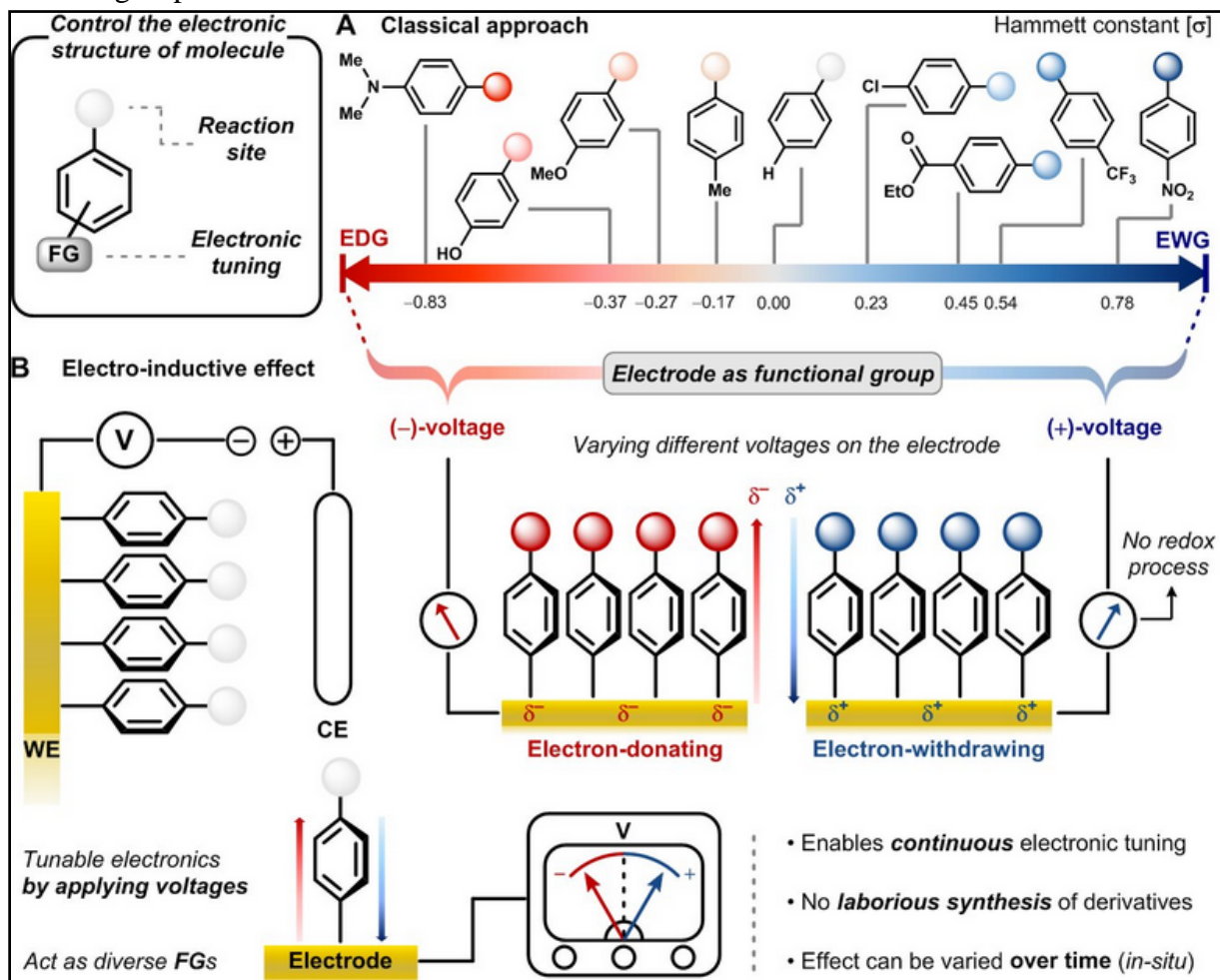
In chemistry, functional groups are assortments of atoms that together work to attach carbon skeletons in organic molecules. All organic molecules have their own unique functional groups, which play an important role in the formation of molecules. Functional groups can also donate or take away electrons when one molecule comes into contact with another, which is how many chemical reactions occur.

Chemists have found that they can tinker with functional groups to speed up or slow down reactions to suit their needs, and because of that, functional groups play an important role in chemical synthesis. Unfortunately, developing reactions to produce desired products using functional groups has proven to be slow and difficult work. In this new effort, the researchers have found a way to replace the use of functional groups with a gold electrode to make the work easier. They simply attached molecules to a gold electrode and turned on the electricity. The



technique allowed for more control over reactions by varying the amount of electricity supplied to the electrode. In such a capacity, the electrode was able to work as a "universal functional group" to inhibit or propel reactions when the researchers manipulated the amount of electricity applied to the electrode. The polarization effect of the applied potential was sufficient to exert an influence analogous to a tunable functional group.

IBS and KAIST researchers employed the gold electrode and attached the target molecules onto the electrode. Just like functional groups generate diverse electronic effects, one electrode fits all reactions as the single electrode can behave like multiple functional groups just with the switch of applied voltage. The application of (+) voltage on the electrode decreased the electron density at the reaction site. Conversely, when (-) voltage was applied, the electrode acted as an electron-donating group, increasing the electron density at the reaction site. Credit: IBS



Credit: IBS

The researchers demonstrated the utility of their technique by conducting hydrolysis and conversion experiments. They suggest the technique holds promise in other areas as well. They plan to try it with probes made of different materials to see if it might lead to better scalability.

More information: Heo et. al., Electro-inductive effect: Electrodes as functional groups with tunable electronic properties. *Science* (2020). DOI: [10.1126/science.abb6375](https://doi.org/10.1126/science.abb6375)

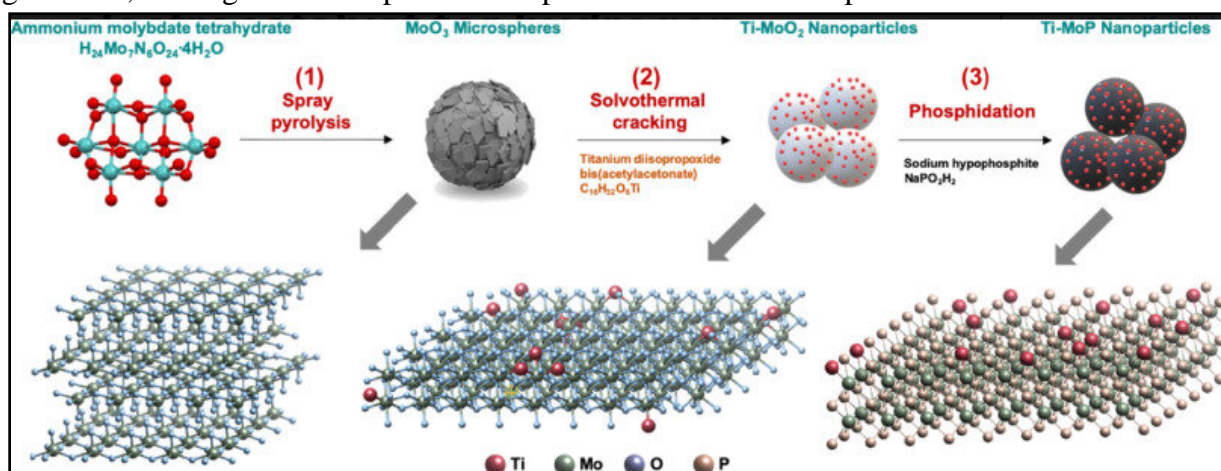
Journal information: *Science*
<https://phys.org/news/2020-10-functional-groups-gold-electrode-reactivity.html>



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Development of cost-efficient electrocatalyst for hydrogen production

The key to promoting the hydrogen economy represented by hydrogen vehicles is to produce hydrogen for electricity generation at an affordable price. Hydrogen production methods include capturing by-product hydrogen, reforming fossil fuel, and electrolyzing water. Water electrolysis in particular is an eco-friendly method of producing hydrogen, in which the use of a catalyst is the most important factor in determining the efficiency and price competitiveness. However, water electrolysis devices require a platinum (Pt) catalyst, which exhibits unparalleled performance when it comes to speeding up the hydrogen generation reaction and enhancing long-term durability but is high in cost, making it less competitive compared to other methods price-wise.



Schematic diagram of the step-by-step synthesis process for the preparation of Ti-MoP. Credit: Korea Institute of Science and Technology(KIST)

There are water electrolysis devices that vary in terms of the electrolyte that dissolves in water and allows current to flow. A device that uses a proton exchange membrane (PEM), for instance, exhibits a high rate of hydrogen generation reaction even with the use of a catalyst made of a transition metal instead of an expensive Pt-based catalyst. For this reason, there has been a great deal of research on the technology for commercialization purposes. While research has been focused on achieving high reaction activity, research on increasing the durability of transition metals that easily corrode in an electrochemical environment has been relatively neglected.

The Korea Institute of Science and Technology (KIST) announced that a team headed by Dr. Sung-Jong Yoo from the Center for Hydrogen-Fuel Cell Research developed a catalyst made of a transition metal with long-term stability that could improve hydrogen production efficiency without the use of platinum by overcoming the durability issue of non-platinum catalysts.

The research team injected a small amount of titanium (Ti) into molybdenum phosphide (MoP), a low-cost transition metal, through a spray pyrolysis process. Because it is inexpensive and relatively easy to handle, molybdenum is used as a catalyst for energy conversion and storage devices, but its weakness includes the fact that it corrodes easily as it is vulnerable to oxidation.

In the case of the catalyst developed by the research team at KIST, it was found that the electronic structure of each material became completely restructured during the synthesis process, and it resulted in the same level of hydrogen evolution reaction (HER) activity as the platinum catalyst. The changes in the electronic structure addressed the issue of high corrosiveness, thereby improving durability by 26 times compared to existing transition metal-based catalysts. This is expected to greatly accelerate the commercialization of non-platinum catalysts.

Dr. Yoo of KIST said, "This study is significant in that it improved the stability of a transition metal catalyst-based water electrolysis system, which had been its biggest limitation. I hope that this study, which boosted the hydrogen evolution reaction efficiency of the transition metal [catalyst](#) to the level of platinum catalysts and at the same time improved the stability will contribute to earlier commercialization of eco-friendly hydrogen energy production technology."

More information: Injoon Jang et al, Electron-deficient titanium single-atom electrocatalyst for stable and efficient hydrogen production, *Nano Energy* (2020).

[DOI: 10.1016/j.nanoen.2020.105151](https://doi.org/10.1016/j.nanoen.2020.105151)

<https://phys.org/news/2020-10-cost-efficient-electrocatalyst-hydrogen-production.html>



Sat, 10 Oct 2020

Researchers use artificial intelligence language tools to decode molecular movements

By applying natural language processing tools to the movements of protein molecules, University of Maryland scientists created an abstract language that describes the multiple shapes a protein molecule can take and how and when it transitions from one shape to another.

A protein molecule's function is often determined by its shape and structure, so understanding the dynamics that control shape and structure can open a door to understanding everything from how a protein works to the causes of disease and the best way to design targeted drug therapies. This is the first time a machine learning algorithm has been applied to biomolecular dynamics in this way, and the method's success provides insights that can also help advance artificial intelligence (AI). A research paper on this work was published on October 9, 2020, in the journal *Nature Communications*.

"Here we show the same AI architectures used to complete sentences when writing emails can be used to uncover a language spoken by the molecules of life," said the paper's senior author, Pratyush Tiwary, an assistant professor in UMD's Department of Chemistry and Biochemistry and Institute for Physical Science and Technology. "We show that the movement of these molecules can be mapped into an abstract language, and that AI techniques can be used to generate biologically truthful stories out of the resulting abstract words."

Biological molecules are constantly in motion, jiggling around in their environment. Their shape is determined by how they are folded and twisted. They may remain in a given shape for seconds or days before suddenly springing open and refolding into a different shape or structure. The transition from one shape to another occurs much like the stretching of a tangled coil that opens in stages. As different parts of the coil release and unfold, the molecule assumes different intermediary conformations.

But the transition from one form to another occurs in picoseconds (trillionths of a second) or faster, which makes it difficult for experimental methods such as high-powered microscopes and spectroscopy to capture exactly how the unfolding happens, what parameters affect the unfolding and what different shapes are possible. The answers to those questions form the biological story that Tiwary's new method can reveal.

Tiary and his team applied Newton's laws of motion—which can predict the movement of atoms within a molecule—with powerful supercomputers, including UMD's Deepthought2, to develop statistical physics models that simulate the shape, movement and trajectory of individual molecules.

Then they fed those models into a machine learning algorithm, like the one Gmail uses to automatically complete sentences as you type. The algorithm approached the simulations as a language in which each molecular movement forms a letter that can be strung together with other movements to make words and sentences. By learning the rules of syntax and grammar that determine which shapes and movements follow one another and which don't, the algorithm predicts how the protein untangles as it changes shape and the variety of forms it takes along the way.

To demonstrate that their method works, the team applied it to a small biomolecule called riboswitch, which had been previously analyzed using spectroscopy. The results, which revealed the various forms the riboswitch could take as it was stretched, matched the results of the spectroscopy studies.

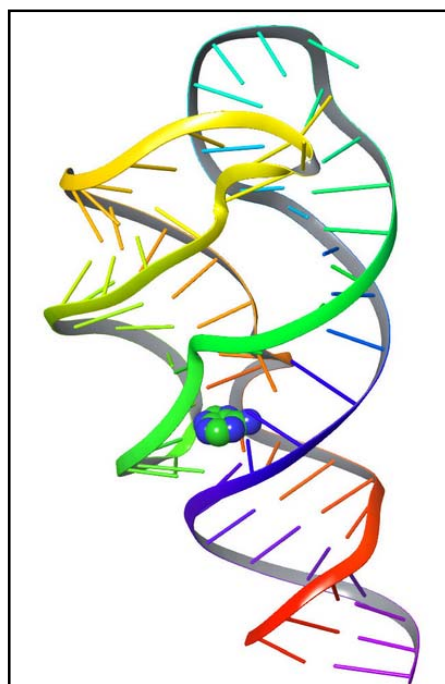
"One of the most important uses of this, I hope, is to develop drugs that are very targeted," Tiary said. "You want to have potent drugs that bind very strongly, but only to the thing that you want them to bind to. We can achieve that if we can understand the different forms that a given biomolecule of interest can take, because we can make drugs that bind only to one of those specific forms at the appropriate time and only for as long as we want."

An equally important part of this research is the knowledge gained about the language processing system Tiary and his team used, which is generally called a [recurrent neural network](#), and in this specific instance a long short-term memory network. The researchers analyzed the mathematics underpinning the network as it learned the language of molecular motion. They found that the network used a kind of logic that was similar to an important concept from statistical physics called path entropy. Understanding this opens opportunities for improving recurrent neural networks in the future.

"It is natural to ask if there are governing physical principles making AI tools successful," Tiary said. "Here we discover that, indeed, it is because the AI is learning path entropy. Now that we know this, it opens up more knobs and gears we can tune to do better AI for biology and perhaps, ambitiously, even improve AI itself. Anytime you understand a complex system such as AI, it becomes less of a black-box and gives you new tools for using it more effectively and reliably."

More information: "Learning molecular dynamics with simple language model built upon long short-term memory neural network," *Nature Communications* (2020). DOI: [10.1038/s41467-020-18959-8](https://doi.org/10.1038/s41467-020-18959-8)

Journal information: [Nature Communications](https://www.nature.com/articles/s41467-020-18959-8)
<https://phys.org/news/2020-10-artificial-intelligence-language-tools-decode.html>

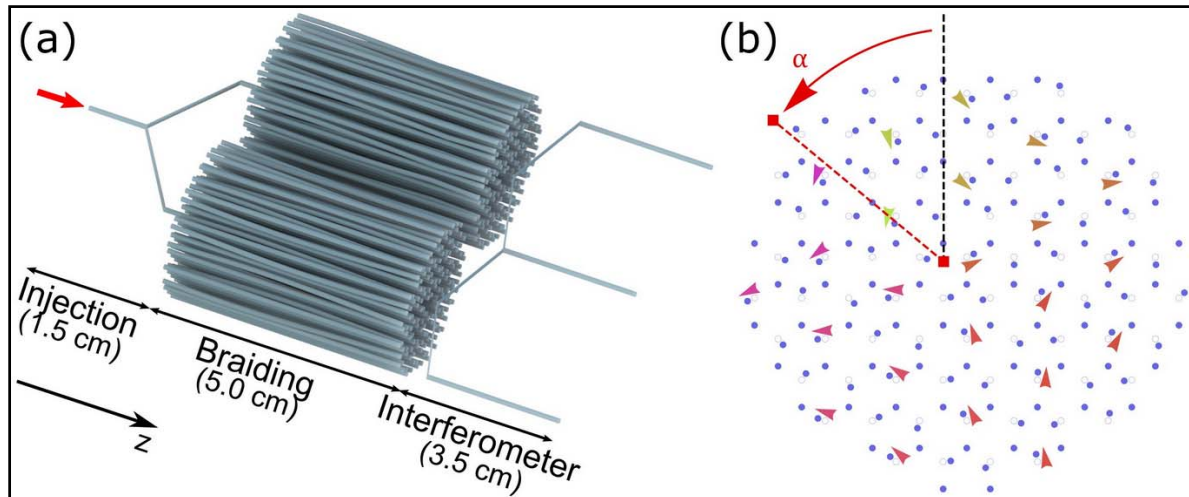


Scientists from the University of Maryland applied a language processing system to the movements of a riboswitch molecule pictured here, to understand how and when the molecule takes different forms. Credit: Zachary Smith/UMD

The first demonstration of braiding in photonic topological zero modes

By Ingrid Fadelli

Physics theory suggests that exotic excitations can exist in the form of bound states confined in the proximity of topological defects, for instance, in the case of Majorana zero modes that are trapped in vortices within topological superconducting materials. Better understanding these states could aid the development of new computational tools, including quantum technologies.



Schematic depiction of the structure that performs the braiding process with light. (a) Waveguide array structure, where light is braided opposite directions in the two arrays, and then interfered; (b) diagram showing the displacement of waveguide array coordinates required to perform the braiding operation, where α denotes the angle of a 'vortex at infinity' that is braided around the array. Credit: Noh et al.

One phenomenon that has attracted attention over the past few years is "braiding," which occurs when electrons in particular states (i.e., Majorana fermions) are braided with one another. Some physicists have theorized that this phenomenon could enable the development of a new type of quantum technology, namely topological quantum computers.

Researchers at Pennsylvania State University, University of California-Berkeley, Iowa State University, University of Pittsburgh, and Boston University have recently tested the hypothesis that braiding also occurs in particles other than electrons, such as photons (i.e., particles of light). In a paper published in *Nature Physics*, they present the first experimental demonstration of braiding using photonic topological zero modes.

"The idea was inspired by a well-known architecture for building a quantum computer; one that has been theoretically predicted but never experimentally realized," Mikael C. Rechtsman, one of the researchers who carried out the study, told Phys.org. "To perform operations in this previously theorized type of quantum computer, Majorana fermions are moved around one another—this is called braiding. In a previous theoretical study, some of my colleagues predicted that braiding is a general phenomenon that can be applied not only to electrons, but to photons, as well. In our new paper, we demonstrate this experimentally, using an array of waveguides that are similar to fiber optic cables."

Rechtsman and his colleagues measured the geometric phase of the braiding phenomenon by conducting an experiment in which two different braiding processes interfered with one another. In one of these processes, topological defects were braided clockwise, while in the other one, they were braided counterclockwise.

Interference is a feature of wave mechanics that is often used to study physical systems. This feature is responsible for countless wave-related phenomena, ranging from rainbow swirls on soap bubbles to gravitational waves.

"We observed that the light from the two opposite braiding processes interfered destructively, which confirmed our theoretical prediction that the processes have a relative braiding phase of π ," Thomas Schuster, another researcher involved in the study, told Phys.org. "Crucially, due to the particularly simple action of braiding, the measurement we collected allows us to extrapolate the behavior of any braiding process. In particular, it verifies that when performing multiple braids in a row, the order of the braiding matters."

Rechtsman, Schuster and their colleagues demonstrated the existence of a generalizable braiding process that they refer to as non-Abelian braiding, which is a simple manifestation of a feature that researchers have sought for in electronic systems for several years. Their results suggest that braiding may, in fact, be a common phenomenon that reaches beyond electrons and also applies to light, sound, water and potentially even seismic waves.

In addition to highlighting the possibility of using photonic lattices as a platform to study topological defects and their braiding, this study could inspire other research teams to examine braiding in the context of other phenomena that involve the production of waves. Rechtsman, Schuster and their colleagues now plan to continue investigating the braiding of photonic topological zero modes, along with other topological phenomena that could also be applied to light-related systems.

"Braiding is a topological phenomenon that has been traditionally associated with electronic devices," Rechtsman said. "We now hope to show that a whole class of topological phenomena can potentially be useful not only for electronic devices, but also photonic devices, such as lasers, medical imaging devices, telecommunications systems, and others. We also expect that this new type of topological physics could be applied to quantum information systems, particularly those based on photons."

More information: Jiho Noh et al. Braiding photonic topological zero modes, *Nature Physics* (2020). DOI: [10.1038/s41567-020-1007-5](https://doi.org/10.1038/s41567-020-1007-5)

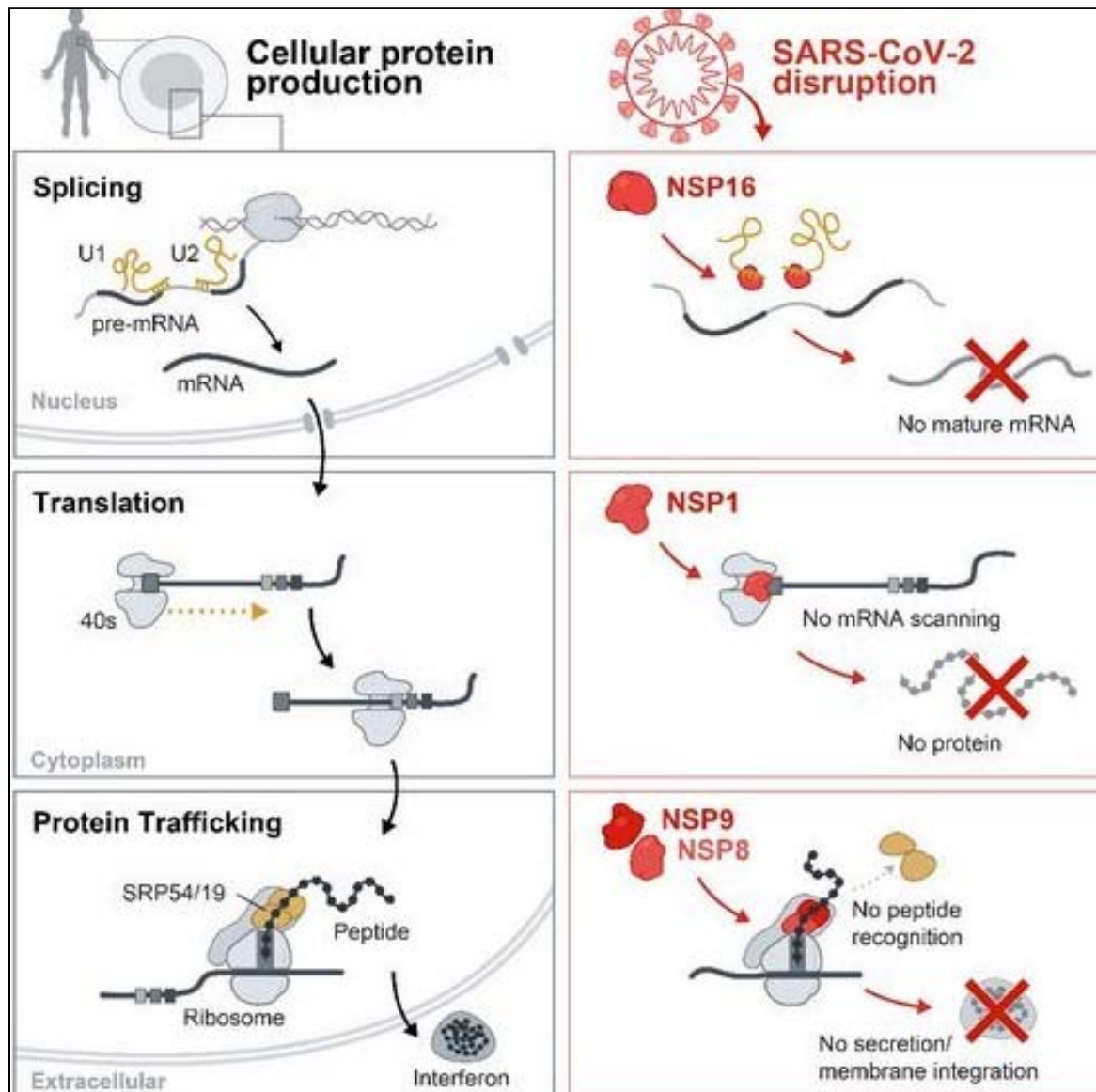
Thomas Iadecola et al. Non-Abelian Braiding of Light, *Physical Review Letters* (2016). DOI: [10.1103/PhysRevLett.117.073901](https://doi.org/10.1103/PhysRevLett.117.073901)

Journal information: [*Nature Physics*](#) , [*Physical Review Letters*](#)
<https://phys.org/news/2020-10-braiding-photonic-topological-modes.html>

How SARS-CoV-2 disables the human cellular alarm system

By Lori Dajose

As the world is more than half a year into the COVID-19 pandemic, doctors and researchers have a fairly good idea of what the main symptoms of the disease look like: cough, fever, shortness of breath, and fatigue, among others. But equally important to treating symptoms is understanding what the coronavirus that causes COVID-19, SARS-CoV-2, is doing inside human cells to make people so sick.



A graphic of healthy cellular protein production (left column), compared to how SARS-CoV-2 disrupts these processes (right column). The virus disrupts the processes of splicing, translation, and protein trafficking in order to prevent the cell from calling for help during an infection. Credit: Inna-Marie Strazhnik / Caltech

Like all viruses, SARS-CoV-2 breaks into a cell and hijacks its resources and machinery to create more viruses. Evolutionarily speaking, successful viruses are those that can effectively evade a cell's defenses, but refrain from killing the cell outright (after all, the virus needs the cell to remain alive to be able to reproduce).

Human cells (and, more broadly, mammalian cells) have built-in defense mechanisms to deal with viral infections. The presence of viral genetic material in a cell triggers a cascade of events that lead to the production and secretion of a group of proteins called interferon, which will try to shut down the infection and notify neighboring cells of the threat. Researchers have found that patients with severe COVID-19 symptoms also show low levels of interferon response, suggesting that the interferon response is crucial for combatting the virus. How does the virus suppress these normal defense mechanisms?

A team led by Caltech researchers has now pinpointed the mechanisms through which the SARS-CoV-2 virus incapacitates human cells, essentially disabling the cell's alarm system so that it cannot call for help or warn nearby cells of the infection. Understanding how the virus causes dysfunction at the cellular level gives new insights into how to fight it.

The research was conducted primarily in the laboratory of Mitchell Guttman, professor of biology and Heritage Medical Research Institute investigator. A paper describing the research appears online ahead of publication in the journal *Cell*.

The SARS-CoV-2 virus produces about 30 viral proteins. In this new research, the Guttman laboratory examined each of these and mapped out how they interact with the molecular components within human cells grown in a lab dish. They found that SARS-CoV-2 proteins attack three critical cellular processes to disrupt human protein production.

"Viruses are amazing," says Emily Bruce, faculty scientist at the University of Vermont and a co-first author on the paper. "Viruses and host cells are continually in an evolutionary arms race to outwit one another. SARS-CoV-2 has evolved intricate and specific ways to disable cells without killing them outright, so that the virus can still use the cell for its own purposes."

Some basic cell biology background first: The cell's nucleus houses its genetic material, written as DNA. This so-called genome can be thought of as a comprehensive instruction manual, with "chapters" that might be titled "How to Send a Signal" or "What to Do in Case of Viral Infection," for example. The rest of the cell contains the machinery that creates the proteins (such as interferon) that carry out these instructions.

The process for turning DNA instructions into useful proteins is called the "central dogma" of biology. The first step is transcription, through which a piece of DNA in the cell's nucleus is read and copied into a form (a molecule called mRNA) that can leave the nucleus and travel to the rest of the cell. Before export out of the nucleus, mRNA is often re-assembled and "matured" in a process called splicing (top row).

After the mRNA is exported out of the nucleus, a piece of cellular machinery called the ribosome attaches to the mature mRNA, reads it, and builds the corresponding protein through a process called translation (middle row).

Some of these proteins are designed to move outside the cell of origin to transmit messages to other cells, for example, to warn about the presence of a viral infection. In this situation, another piece of cellular machinery called the signal recognition particle comes into play; it works as a kind of transport system that helps proteins move from inside to outside of a cell. This is known as protein trafficking (bottom row).

The Guttman lab discovered that SARS-CoV-2 proteins interfere with this whole process at multiple stages. Some of the virus's proteins prevent mRNA from being fully spliced and properly assembled. Others plug up the ribosome so that it cannot form new proteins. Still other SARS-CoV-2 proteins interfere with the signal recognition particle and block protein transport.

The protein that plugs up the ribosome is called NSP1. Remarkably, the team found, NSP1 blocks human mRNA from entering the ribosome, but allows viral mRNA to pass through just fine. Viral mRNA contains a genetic signature at the beginning of each of its mRNAs that acts like an

access code that effectively hijacks the ribosome to make viral proteins but not human proteins. Because viral production depends on this signature, it could represent a potent target for anti-viral therapeutic development.

"Each of the processes that SARS-CoV-2 disrupts— splicing, translation, and protein trafficking—is so important for converting the human genetic material into proteins, and they are essential for human biology," says Guttman. "In fact, discovery of each of these processes has separately led to the awarding of a Nobel Prize. These are machines that are central to life. We cannot exist without them. SARS-CoV-2 has evolved in very specific ways to disable these cellular machines and disrupt their functions."

"Our study illustrates the importance of basic science research, and establishes a pipeline to address newly emerging RNA viruses in the future," says co-first author Abhik Banerjee, a graduate student in the Guttman laboratory. "Additionally, it illustrates the collaborative atmosphere of science at Caltech and elsewhere in the scientific community at its best. Here at Caltech, we have access to leaders in several keystone areas of biology, including professors Rebecca Voorhees (co-author on the published manuscript), Bil Clemons, and Shu-ou Shan in structural biology, all of whom were willing to discuss ramifications of our data and provide expertise in this relatively new area for us."

Mario Blanco, a research scientist in the Guttman laboratory, agrees.

"Our ability to interrogate the human RNA targets of SARS-CoV-2 proteins allowed us to identify these mechanisms without prior evidence," he says. "The methods and practices we developed here will allow us to apply these same processes to emergent diseases and even currently existing viruses where we lack a deep understanding of mechanism."

The paper is titled "SARS-CoV-2 disrupts splicing, translation, and protein trafficking to suppress host defenses."

More information: Abhik K. Banerjee et al. SARS-CoV-2 disrupts splicing, translation, and protein trafficking to suppress host defenses, *Cell* (2020). DOI: [10.1016/j.cell.2020.10.004](https://doi.org/10.1016/j.cell.2020.10.004)

Journal information: *Cell*

<https://phys.org/news/2020-10-sars-cov-disables-human-cellular-alarm.html>



Sat, 10 Oct 2020

Horse plasma can be used to treat Covid-19 patients, says ICMR study

Antibody-rich plasma obtained from horses can be used to treat patients infected with Covid-19, according to an Indian Council of Medical Research (ICMR) pre-print study, following which the apex medical research body has received regulatory approval to conduct clinical trials using the equine plasma on humans

Antibody-rich plasma obtained from horses can be used to treat patients infected with Covid-19, according to an Indian Council of Medical Research (ICMR) pre-print study, following which the apex medical research body has received regulatory approval to conduct clinical trials using the equine plasma on humans.

The study was published on Research Square.

In the study, 10 healthy horses between the ages of four and 10 years were injected with inactivated Sars-CoV-2 antigen subcutaneously (under the skin) at the Hyderabad-based Biologicals E Ltd, and after 21 days of immunisation, their plasma samples were tested. Sars-Cov-2 is the virus that causes Covid-19.

The plasma had Covid-19-specific high-quality antibodies with virus neutralising capacity, which is ideal for preventing infection. The results are in line with other studies on equine antisera that reported the generation of a high level of antibodies in horses against the receptor binding area of the virus's spike protein. A receptor-binding domain is a key part of a virus located on its spike domain that allows it to dock to body receptors to gain entry into cells and lead to infection. It is safe, and can be prepared in bulk at a low cost, the ICMR study shows.

“With Biologicals E we have developed horse sera which may be considered. We have completed some animal studies where we have a predictive dose... we have got clearance for a clinical trial,” said Dr Balam Bhargava, director general, ICMR.

The virus strain was isolated from the throat and nasal swab specimens of a Covid-19 positive patient at the maximum containment facility of ICMR-National Institute of Virology, Pune. Diseases for which equine sera has previously been tried include many viral and bacterial infections such as rabies, hepatitis B, vaccinia virus, tetanus, botulism and diphtheria. “...This study suggests promising efficacy and therapeutic potential of equine hyper immune sera against Sars-CoV-2. The quality control assessments of the different batches proved to have consistent nAb (antibody) titres (volume of antibodies produced)... that can demonstrate consistent and high neutralization activity,” says the paper.

“Further, in-vivo testing for efficacy of this indigenously developed, cost effective product will pave the way to clinical evaluation. Additionally, being a donor independent method, this may prove as an efficient alternative to convalescent plasma for treatment of Covid-19 patients,” the researchers say.

Virologists agree that animal antisera are a good option. “It does have advantages over convalescent plasma as the quality of convalescent plasma is entirely donor dependent. The quality will be different from one donor to the other. Use of antibodies that have been raised in large animals is common, and has worked successfully in the past. If an animal study has shown promise against Sars-Cov-2, then it is good news,” said T Jacob John, former head of the virology department at the Christian Medical College in Vellore, Tamil Nadu.

Animal-derived plasma can help overcome the challenge of limited availability of convalescent plasma from recovered patients, and find a cost-effective alternative to monoclonal antibodies (man-made proteins that act like human antibodies in the immune system) that are laborious and expensive to generate.

<https://www.hindustantimes.com/india-news/horse-plasma-can-be-used-to-treat-covid-19-patients-says-icmr-study/story-wTDhCOSUjBWqx4orMhr6DO.html>



A health worker takes a nasal swab to test for Covid-19 in New Delhi, India, Thursday, Oct. 8, 2020. (AP photo)

