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**Press Information Bureau
Government of India**

Ministry of Defence

Fri, 26 Sept 2020 6:56PM

AHSP transfer of Pinaka Weapon System from DRDO to DGQA

An important milestone was achieved today on 25 September 2020 when Authority Holding Sealed Particulars (AHSP) responsibility of Pinaka weapon system was handed over by DRDO to DGQA. AHSP transfer marks successful establishment of production of Pinaka rockets, Launchers, Battery Command Posts, Loader Cum Replenishment and Replenishment Vehicles as well as successful establishment of Quality Assurance processes. AHSP handing over took place at ARDE, Pune wherein the documentation required by various Production agencies, Quality Assurance agencies, Maintenance agencies and Users were formally handed over by ARDE, HEMRL and VRDE to CQA (A).

Pinaka is a free flight artillery rocket system having a range of 37.5 km. Pinaka rockets are launched from a multi barrel rocket launcher which has capability to launch salvo of 12 rockets in 44 seconds. The weapon system is designed and developed by Pune based DRDO lab, Armament Research & Development Establishment (ARDE) in association with HEMRL, VRDE and CAIR. Pinaka rockets and its ground systems are currently under bulk production at Ordnance Factories, BEML, BEL, Tata Power and L&T Defence.

Joining the event by video conferencing Dr G Satheesh Reddy, Secretary DD R&D and Chairman DRDO described the AHSP transfer as a landmark event in the development of Pinaka Rocket Systems and stated that the Pinaka Rocket Systems will go a long way in fulfilling the requirement of services.

Lt Gen Sanjay Chauhan, Director General of DGQA, Shri CS Vishwakarma, Chairman OFB, Lt Gen K Ravi Prasad, VSM and Director General of Artillery, Shri PK Mehta, Director General of Armament & Combat Engineering Cluster joined the event through video conferencing. Dr V Venkateswara Rao, Director ARDE, Shri KPS Murthy, Director HEMRL, Shri Sangam Sinha, Director VRDE, Shri AV Shinde, Officiating Controller CQA (A) and Smt MGP Dhanraj, DDG, Officiating Controller CQA (ME) were present for the event at ARDE.

<https://pib.gov.in/PressReleaseDetail.aspx?PRID=1659118>



पिनाक अस्त्रप्रणालीचे DRDO कडून DGQA कडे AHSP हस्तांतरण

25 सप्टेंबर 2020 रोजी, पिनाक अस्त्रप्रणालीची AHSP ऑथॉरिटी होल्डिंग सील्ड पार्टिक्युलर्स ही जबाबदारी DRDO अर्थात संरक्षण संशोधन आणि विकास संस्थेकडून DGQA कडे सोपविण्यात आल्यामुळे एक मैलाचा दगड पार झाला।

AHSP हस्तांतरणामुळे पिनाक अग्निबाण, प्रक्षेपक बॅटरी कमांड पोस्ट, आणि अशा अन्य महत्त्वाच्या सुविधांच्या स्थापना आणि निर्मितीवर तसेच गुणवत्ता हमी प्रक्रिया यशस्वीपणे स्थापित झाल्यावरही शिककामोर्तब झाले।

पुण्यात ARDE म्हणजे शस्त्रास्त्र संशोधन आणि विकास आस्थापनेत हा हस्तांतरण कार्यक्रम पार पडला। विविध उत्पादन संस्थांना आवश्यक असणारे दस्तऐवजही यावेळी सुपूर्द करण्यात आले।

पिनाक ही दारुगोळ्याने युक्त अशी फ्री फ्लाइंग पद्धतीची अग्निबाण प्रणाली असून तिची कक्षा 37.5 किलोमीटर इतकी आहे। पिनाक अग्निबाण, 44 सेकंदात 12 अग्निबाण सोडण्याची क्षमता असलेल्या बहु बॅरलयुक्त अग्निबाण प्रक्षेपकातून सोडले जातात।

पुण्यातील DRDO प्रयोगशाळा आणि ARDE यांनी संरक्षण क्षेत्रातील अन्य संस्थांच्या सहयोगातून या अस्त्रप्रणालीची रचना आणि विकास केला आहे। पिनाक अग्निबाण आणि त्याची भूमीलगतची प्रणाली यांचे सध्या, आयुध निर्मिती कारखाने, भारत इलेक्ट्रॉनिक, भारत अर्थमूव्हर, टाटा पॉवर आणि एल अँड टी डिफेन्स येथे मोठ्या प्रमाणावर उत्पादन सुरु आहे।

DRDO चे अध्यक्ष डॉ.जी.सतीश रेड्डी यांनी व्हिडीओ कॉन्फरन्सिंगच्या माध्यमातून या कार्यक्रमाला उपस्थिती लावली। AHSP हस्तांतरण हा पिनाक अग्निबाण प्रणालीच्या विकासापैकी महत्त्वाचा टप्पा असल्याचे मत त्यांनी यावेळी मांडले। संरक्षण सेवांच्या गरज भागविण्याच्या दृष्टीने ही प्रणाली मोठी कामगिरी बजावेल असा विश्वास त्यांनी यावेळी व्यक्त केला।

DGQAचे महासंचालक ले.ज. संजय चौहान, यांच्यासह संरक्षण क्षेत्रातील अन्य महत्त्वपूर्ण संस्थांचे वरिष्ठ अधिकारी यावेळी व्हिडीओ कॉन्फरन्सिंगच्या माध्यमातून उपस्थित होते। तर ARDE चे संचालक डॉ.व्ही.वेंकटेश्वर राव यांच्यासह अन्य अधिकारी प्रत्यक्ष उपस्थित होते।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1659172>

DRDO hands over Authority Holding Sealed Particulars of Pinaka rocket system

The AHSP transfer marks successful streamlining of production processes of Pinaka rockets, its launchers, battery command posts, loader-cum-replenishment and replenishment vehicles as well as successful establishment of quality assurance processes

By Sushant Kulkarni

Pune: In an important milestone in the induction of the Pinaka rocket system in the Armed forces, the Defence Research and Development Organisation (DRDO) handed over the Authority Holding Sealed Particulars (AHSP) of the system to the Directorate General of Quality Assurance (DGQA) of the Ministry of Defence on Friday.



At the ceremony, documentation required by various production agencies, quality assurance agencies, maintenance agencies and users were formally handed over by three DRDO facilities – ARDE, HEMRL and VRDE – to Controllerate of Quality Assurance (Ammuniti)

The handing over ceremony was held at Armament Research and Development Establishment (ARDE), a DRDO facility in Pune. The AHSP transfer marks successful streamlining of production processes of Pinaka rockets, its launchers, battery command posts, loader-cum-replenishment and replenishment vehicles as well as successful establishment of quality assurance processes.

At the ceremony, documentation required by various production agencies, quality assurance agencies, maintenance agencies and users were formally handed over by three DRDO facilities – ARDE, High Energy Material Research Laboratory (HEMRL) and Vehicles Research and Development Establishment (VRDE) – to Controllerate of Quality Assurance (Ammuniti).

The ceremony was held for Pinaka's mark-1 version, which is a free flight artillery rocket system having a range of 37.5 km. Pinaka rockets are launched from a multi-barrel rocket launcher that is capable of launching a salvo of 12 rockets in 44 seconds.

Explaining the importance of the AHSP handover, a DRDO scientist said, "The product was conceived, developed and tested by the DRDO from the beginning. Till date, the Army has four regiments of the system. But now, the production and other processes are at such a matured stage

that all its attributes can be handed over to the DGQA to handle. It's like after conceiving an idea and nurturing the product for a long time, its custody is handed over to its intended destination."

The Pinaka weapon system, named after God Shiva's bow, is designed and developed by ARDE in association with HEMRL, VRDE and Centre for Artificial Intelligence and Robotics (CAIR). Pinaka rockets and its ground systems are currently under bulk production at Ordnance Factories, BEML, BEL, Tata Power and L&T Defence.

"Joining the event by video conferencing, Dr G Satheesh Reddy, secretary, Department of Defence Research and Development and chairman, DRDO, described the AHSP transfer as a landmark event in the development of Pinaka Rocket Systems and said they will go a long way in fulfilling the requirement of services," a press release stated.

The Ministry of Defence recently announced that its acquisition wing has signed contracts with three Indian companies for supply of six regiments of Pinaka Rocket System, which will be deployed along the border with Pakistan and China.

<https://indianexpress.com/article/india/drdo-hands-over-authority-holding-sealed-particulars-of-pinaka-rocket-system-6611912/>

THE ECONOMIC TIMES

Sat, 26 Sept 2020

DRDO completes key process relating to Pinaka rockets, launchers and related equipment

Synopsis

The DGQA is responsible for ensuring quality specifications and standards of all defence equipment. "An important milestone was achieved today when Authority Holding Sealed Particulars (AHSP) responsibility of Pinaka weapon system was handed over by DRDO to DGQA," the defence ministry said in a statement.

New Delhi: The Defence Research and Development Organisation (DRDO) on Friday kick started a key process for production of Pinaka rockets, launchers and related equipment, officials said. They said the DRDO handed over to the Directorate General of Quality Assurance (DGQA) all relevant details for mass production of the Pinaka rocket systems.

The DGQA is responsible for ensuring quality specifications and standards of all defence equipment.

"An important milestone was achieved today when Authority Holding Sealed Particulars (AHSP) responsibility of Pinaka weapon system was handed over by DRDO to DGQA," the defence ministry said in a statement.

The AHSP is the authority responsible for collecting, collating and analysing key defence items in accordance with the laid down procedure.

Pinaka is a free flight artillery rocket system having a range of 37.5 km.

Pinaka rockets are launched from a multi barrel rocket launcher which has a capability to launch 12 rockets in 44 seconds. The weapon system is designed and developed by Pune-based DRDO lab, Armament Research and Development Establishment (ARDE).

<https://economictimes.indiatimes.com/news/defence/drdo-completes-key-process-relating-to-pinaka-rockets-launchers-and-related-equipment/articleshow/78323423.cms>



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Pinaka rockets are launched from a multi-barrel rocket launcher which has the capability to launch a salvo of 12 rockets in 44 seconds. Image Credit: Twitter(@SpokespersonMoD)

Pinaka is a free flight artillery rocket system having a range of 37.5 km. Pinaka rockets are launched from a multi-barrel rocket launcher which has the capability to launch a salvo of 12 rockets in 44 seconds. The weapon system is designed and developed by Pune based DRDO lab, Armament Research & Development Establishment (ARDE) in association with HEMRL, VRDE and CAIR. Pinaka rockets and its ground systems are currently under bulk production at Ordnance Factories, BEML, BEL, Tata Power and L&T Defence.

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Rocket Systems and stated that the Pinaka Rocket Systems will go a long way in fulfilling the requirement of services.

Lt Gen Sanjay Chauhan, Director General of DGQA, Shri CS Vishwakarma, Chairman OFB, Lt Gen K Ravi Prasad, VSM and Director General of Artillery, Shri PK Mehta, Director General of Armament & Combat Engineering Cluster joined the event through video conferencing. Dr V Venkateswara Rao, Director ARDE, Shri KPS Murthy, Director HEMRL, Shri Sangam Sinha, Director VRDE, Shri AV Shinde, Officiating Controller CQA (A) and Smt MGP Dhanraj, DDG, Officiating Controller CQA (ME) were present for the event at ARDE.

(With Inputs from PIB)

<https://www.devdiscourse.com/article/headlines/1227981-ahsp-responsibility-of-pinaka-weapon-system-handed-over-by-drdo-to-dgqa>

नवभारत टाइम्स

Sat, 26 Sept 2020

पिनाक रॉकेट सिस्टम: 44 सेकंड में 12 रॉकेट करेगा फायर, जमीनी जंग में दुश्मनों का सफाया तय

Pinaka missile system explained: 1980 के दशक में DRDO ने पिनाक मिसाइल सिस्टम विकसित करना शुरू किया था। इसका नाम भगवान शिव के धनुष के नाम पर रखा गया है।

By Deepak Verma

भारत ने पिनाक रॉकेट्स, लॉन्चर्स और जरूरी उपकरणों के बड़े पैमाने पर उत्पादन की तैयारी शुरू कर दी है। डिफेंस रिसर्च एंड डेवलपमेंट ऑर्गनाजेशन (DRDO) ने इस बारे में सारी जानकारी डायरेक्टर जनरल ऑफ क्वालिटी एश्योरेंस (DGQA) को सौंप दी है। देश के सारे डिफेंस उपकरणों की क्वालिटी और स्टैंडर्ड मॉटेन रहे, यह तय करना DGQA का काम है। पिनाक असल में एक फ्री फ्लाइट आर्टिलरी रॉकेट सिस्टम है जिसकी रेंज 37.5 किलोमीटर है। पिनाक रॉकेट्स को मल्टी-बैरल रॉकेट लॉन्चर से छोड़ा जाता है। लॉन्चर सिर्फ 44 सेकेंड्स में 12 रॉकेट्स दाग सकता है। भगवान शिव के धनुष 'पिनाक' के नाम पर डेवलप किए गए इस मिसाइल सिस्टम को भारत और पाकिस्तान से लगी सीमाओं पर तैनात करने के मकसद से बनाया गया है।

कैसे हुई पिनाक रॉकेट सिस्टम की शुरुआत?

पिनाक लंबी दूरी का आर्टिलरी सिस्टम है। इसे नजदीक से युद्ध होने से पहले दुश्मन को टारगेट करने के लिए यूज किया जाता है। इससे छोटी रेंज की आर्टिलरी, इन्फैंट्री और हथियारबंद वाहनों को निशाना बनाया जाता है। भारत के पास रॉकेट्स दागने के लिए 'Grad' नाम का रूसी सिस्टम हुआ करता था। यह अब भी इस्तेमाल होता है। इसके विकल्प के रूप में 1980 के दशक में DRDO ने पिनाक रॉकेट सिस्टम को डेवलप करना शुरू किया। 1990 के आखिरी दौर में पिनाक मार्क-1 के सफल टेस्ट हुए। भारत ने करगिल युद्ध में भी सफलतापूर्वक पिनाक सिस्टम का यूज किया था। बाद में पिनाक की कई रेजिमेंट्स बन गईं।

एक बैटरी में होते हैं छह लॉन्चर वेहिकल

पिनाक मूल रूप से मल्टी-बैरल रॉकेट सिस्टम है। इससे सिर्फ 44 सेकेंड्स में 12 रॉकेट दागे जा सकते हैं। पिनाक सिस्टम की एक बैटरी में छह लॉन्चर वेहिकल होते हैं, साथ ही लोडर सिस्टम, रडार और लिंक विद नेटवर्क सिस्टम और



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एक कमांड पोस्ट होती है। एक बैटरी के जरिए 1x1 किलोमीटर एरिया को पूरी तरह ध्वस्त किया जा सकता है। मार्क-I की रेंज करीब 40 किलोमीटर है जबकि मार्क-II से 75 किलोमीटर दूर तक निशाना साधा जा सकता है।

मार्क-II में क्या है खास?

पिनाक रॉकेट का मार्क-II वर्जन एक गाइडेड मिसाइल की तरह बनाया गया है। इसमें नेविगेशन, कंट्रोल और गाइडेंस सिस्टम जोड़ा गया है ताकि रेंज बढ़ जाए और सटीकता भी। मिसाइल का नेविगेशन सिस्टम सीधे इंडियन रीजनल नेविगेशन सैटेलाइट सिस्टम से जोड़ा गया है। ताजा अपग्रेड्स के साथ, मार्क-II 'नेटवर्क केंद्रित युद्ध' में अहम भूमिका निभा सकता है।

पिनाक क्यों है बेहतरीन?

आर्टिलरी गन्स के मुकाबले में रॉकेट्स की एक्युरेसी कम होती है। हालांकि मार्क-II में गाइडेंस और नेविगेशन सिस्टम लगने से वह कमी पूरी हो गई है। इसके साथ ही युद्ध के समय रॉकेट लॉन्चर्स को 'शूट एंड स्कूट' की रणनीति अपनानी पड़ती है। यानी एक बार टारगेट पर फायर करने के बाद वहां से हट जाना होता है ताकि वे खुद निशाना न बन जाएं। लॉन्चर वेहिकल की मैनुवरेबिलिटी बहुत अच्छी होनी चाहिए। पिनाक इस पैमाने पर खरा उतरता है।

<https://navbharattimes.indiatimes.com/india/pinaka-missile-system-explained-drdo-starts-production-of-rockets-launches-and-equipments/articleshow/78327667.cms?story=4>



Sat, 26 Sept 2020

पूर्वी लद्दाख में चीन से जारी तनाव के बीच देश में घातक पिनाक मिसाइल प्रणाली का उत्पादन शुरू

रक्षा अनुसंधान और विकास संगठन यानी डीआरडीओ ने पिनाक मिसाइल को बनाने संबंधी जरूरी प्रक्रिया की शुरुआत कर दी है। समाचार एजेंसी पीटीआइ के मुताबिक पिनाक के राकेट लांचर और संबंधित उपकरण बनाने का काम शुरू हो गया है।

नई दिल्ली: रक्षा अनुसंधान और विकास संगठन (Defence Research and Development Organisation, DRDO) ने पिनाक मिसाइल को बनाने संबंधी जरूरी प्रक्रिया की शुरुआत कर दी है। इस सिलसिले में पिनाक के राकेट, लांचर और संबंधित उपकरण बनाने का काम शुरू हो गया है। अधिकारियों ने शुक्रवार को बताया कि डीआरडीओ ने डायरेक्टोरेट जनरल ऑफ क्वालिटी एश्योरेंस (डीजीक्यूए) को पिनाक राकेट प्रणाली के व्यापक उत्पादन के लिए सभी संगत ब्योरे दे दिये हैं।

रक्षा मंत्रालय ने बताया कि अथारिटी होल्डिंग सील्ड पार्टिकुलर्स (एचएसपी) ने पूरी जिम्मेदारी का पालन करते हुए डीआरडीओ से डीजीक्यूए को पिनाक के उत्पादन का भार सौंपा है। एचएसपी वह विभाग है जो रक्षा उत्पादनों के निर्माण से पहले संकलन, समेकन और विश्लेषण के लिए जिम्मेदार है। पिनाक जमकर गोलाबारी करने वाली वह राकेट प्रणाली है जो 37.5 किलोमीटर की रेंज तक सटीक निशाना लगा सकती है।

इसे सेना के लिए स्वदेश में ही विकसित किया गया है।

इसका उत्पादन घरेलू सार्वजनिक और निजी रक्षा कंपनियों द्वारा किया जाता है। पिनाक राकेट को एक



मल्टी बैरल राकेट लांचर से संचालित किया जाता है। यह 44 सेकेंड में 12 राकेट दाग सकता है। रक्षा मंत्रालय ने बीते दिनों बीईएमएल लिमिटेड को उच्च क्षमता वाले 330 ट्रकों की आपूर्ति का ऑर्डर दिया था। बीईएमएल, रक्षा मंत्रालय की 'अनुसूची क' में आने वाली कंपनी है।

दरअसल इस प्रणाली को बीईएमएल के उच्च क्षमता वाले ट्रकों पर बांधा जाता है। ये ट्रक युद्ध क्षेत्र में भारतीय सेना को बढ़त उपलब्ध कराते हैं। इन ट्रकों का निर्माण कंपनी के केरल स्थित पलक्कड़ संयंत्र में होगा। रक्षा मंत्रालय को तीन साल के दौरान इनकी आपूर्ति की जाएगी। बीते दिनों लार्सन एंड टुब्रो (एलएंडटी) ने जानकारी दी थी कि उसकी रक्षा शाखा को भारतीय रक्षा मंत्रालय से पिनाक हथियार प्रणाली की आपूर्ति के लिए ठेका मिल चुका है।

<https://www.jagran.com/news/national-drdo-completes-key-process-relating-to-production-of-pinaka-missiles-20796588.html>

TIMESNOWNEWS.COM

Sat, 26 Sept 2020

Amid Ladakh face-off, government reaching out to arrange new equipment for IAF

The Defence Research and Development Organisation (DRDO)'s smart anti-airfield weapon—presumably, bombs to destroy runways and hangers—is also ready

By Srinjoy Chowdhury

New Delhi: With the Ladakh face-off continuing, the government is reaching out to arrange new equipment for the Indian Air Force (IAF).

The Defence Acquisition Council, headed by Defence Minister Rajnath Singh, and including the three service chiefs and Chief of Defence Staff, General Bipin Rawat, is expected to clear ground-based, high-frequency radios. About 160 are likely to be procured.

The Defence Research and Development Organisation (DRDO)'s smart anti-airfield weapon—presumably, bombs to destroy runways and hangers—is also ready.

The development trials are over and production issues will be discussed. Also under discussion is DRDO's unit repair vehicle for the Arjun tank. This is a small (only Rs 8 crore) but significant project.

The manufacture of ammunition for Pinaka multibarrelled rocket launchers is also on the agenda. The private sector will be invited to produce Pinaka ammunition while the Ordnance Factory Board will also make some. This has happened after the DRDO's developing a shell with better propellant.

<https://www.timesnownews.com/india/article/amid-ladakh-face-off-government-reaching-out-to-arrange-new-equipment-for-iaf/658099>



(Representational Image) | Photo Credit: ANI



Sat, 26 Sept 2020

India setting up a new complex to develop a 110 kn fighter jet engine; will power the future fighter aircraft of the IAF

With the Kaveri jet engine programme stalled due to technological challenges, the Defence Research and Development Organisation (DRDO) is planning to set up a new complex to develop jet engines for future Indian fighter aircraft.

This report in the *Economic Times* says that the complex may develop a completely new jet engine, one that can provide a thrust of 110 kilo newtons.

The engine, which may come up within seven years of starting work, will be used for the future class of Advanced Medium Combat Aircraft (AMCA), the fifth generation fighter currently in development for the Indian Air Force.



“The new engine complex is being set up as a national mission to develop a 110 kilo newton powered engine for the future class of AMCA and could produce the engine within seven years of starting work,” the report says.

This development comes at a time when the Comptroller and Auditor General of India has come down heavily on the government’s offset policy for defence procurement, saying that the transfer of technology to DRDO for reviving the stalled Kaveri engine programme, part of the deal, has not been completed.

“DRDO wanted to obtain Technical Assistance for the indigenous development of engine (Kaveri) for the Light Combat Aircraft. Till date, the Vendor has not confirmed the transfer of this technology,” the CAG says in its report.

It was not clear if the transfer will even take place, the CAG added.

In this respect, the *Economic Times* report says the new complex may receive French assistance in the development of the new jet engine and discussions for the same are currently on between the two sides.

<https://www.defenceaviationpost.com/2020/09/india-setting-up-a-new-complex-to-develop-a-110-kn-fighter-jet-engine-will-power-the-future-fighter-aircraft-of-the-iaf/>

Indigenous artillery gun may go back to drawing board after barrel burst

By Manu Pubby

Synopsis

The malfunction of the Advanced Towed Artillery Gun System (ATAGS), a 155 mm/52 calibre gun system designed and developed by the Defence Research and Development Organisation (DRDO), occurred during internal developmental firing at the Pokhran (Rajasthan) firing ranges on September 12, army officials told ET.

New Delhi: An indigenously developed artillery gun which suffered a barrel burst in field trials earlier this month injuring four Army personnel may need to go back to the drawing board, army officials told ET.

The malfunction of the Advanced Towed Artillery Gun System (ATAGS), a 155 mm/52 calibre gun system designed and developed by the Defence Research and Development Organisation (DRDO), occurred during internal developmental firing at the Pokhran (Rajasthan) firing ranges on September 12, army officials told ET.

The incident is being viewed as a setback to defence modernisation efforts, especially since the Army had put on the backburner a proposal last year to procure 400 artillery guns of the same type from Israeli defence manufacturer Elbit Systems, as the homemade one was still under development.

The remaining 1,180 guns were to be produced by the Ordnance Factory Board. The proposal was put on hold as the DRDO project was heading towards completion. The mishap has also come at a time when the gun system had successfully completed trials and production of the first 40 was to begin shortly. The gun barrel, manufactured by Bharat Forge Ltd, exploded right after a firing test that was being supervised by DRDO officials, sources said.

When contacted, a DRDO spokesperson said an inquiry committee has been set up to look into the cause of the accident. "As soon as the report comes, we can share details. Cause is not very clear at present," the spokesperson added.

While the cause of the accident would be revealed after a detailed inquiry, officials said it could have occurred due to the inferior quality of metallurgy or the barrel not meeting prescribed standards. An official told ET that design parameters will have to be brought back to the drawing board to ensure the gun has reliable technology that is safe for users.

The accident comes at a particularly difficult time, given the border standoff with China and the neighbouring country's continued collusion with Pakistan on its support for cross-border terrorism.

It also marks a further delay in the ATAGS project that was started in 2013, with production scheduled to begin in 2019. The project was delayed earlier during the development cycle, with issues cropping up in the gun system's recoil systems as well as delays in the manufacture of sub systems.

<https://economictimes.indiatimes.com/news/defence/indigenous-artillery-gun-may-go-back-to-drawing-board/articleshow/78324260.cms>



Representative image

India & Israel to co-develop hi-tech weapon systems

By Rajat Pandit

New Delhi: India and Israel now plan to further crank up their already expansive defence partnership by going in more co-development and coproduction projects of high-tech weapon systems and exporting them to other friendly countries. A new sub-group to promote such joint projects, under the overarching joint working group on defence cooperation headed by Indian defence secretary and his Israeli counterpart, was set up on Thursday. The main focus of the sub-working group (SWG) on defence industrial cooperation will be on transfer of technology, co-development and coproduction, technology security, Artificial Intelligence, innovation and joint export to third countries.

Israel has been among the top four arms suppliers to India for almost two decades now, notching military sales worth around \$1 billion every year. “With the Indian defence industry now also becoming stronger, the need was felt for the two countries to establish more R&D, co-development and co-production projects,” said a senior official on Friday.

“Israel is a world leader in missiles, sensors, cyber-security and various defence sub-systems,” he added. The SWG will be headed by Sanjay Jaju, joint secretary (defence industries production) in the Indian defence ministry and Eyal Calif, director Asia & Pacific from the Israeli one.

This comes at a time when the Indian armed forces are inducting the next-generation Barak-8 surface-to-air missile systems under three joint DRDO-Israeli Aerospace Industries (IAI) projects worth over Rs 30,000 crore.

Israeli companies like IAI, Rafael Advanced Defense Systems, Elbit and Elta Systems have also formed seven joint ventures with Indian companies. An MoU, for instance, was inked between the Kalyani Group and Rafael on Thursday.

The secretive bilateral military ties, which grew after Israel rushed emergency arms supplies to India during the 1999 Kargil conflict, have largely come out of the closet after the Modi government came to power in 2014.

BOOST TO STRATEGIC TIES

Israel among top 4 arms suppliers to India (apart from Russia, US & France). Annual sales worth over \$1 billion

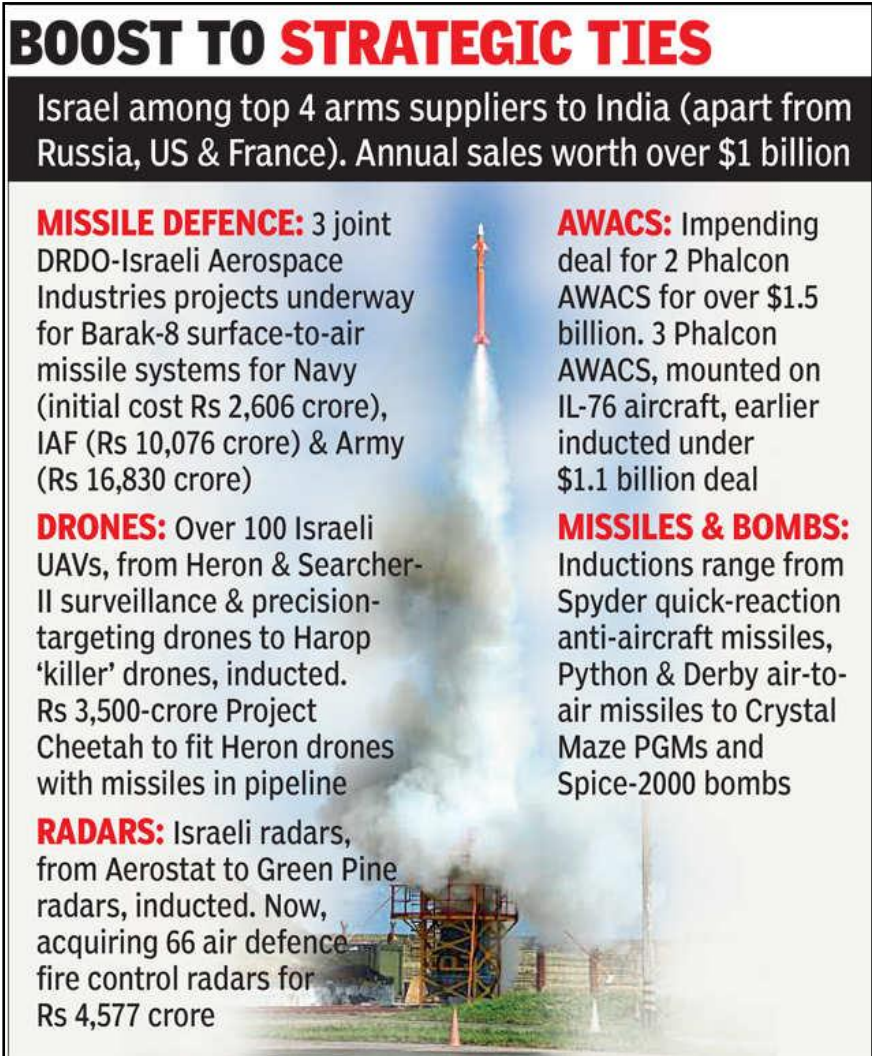
MISSILE DEFENCE: 3 joint DRDO-Israeli Aerospace Industries projects underway for Barak-8 surface-to-air missile systems for Navy (initial cost Rs 2,606 crore), IAF (Rs 10,076 crore) & Army (Rs 16,830 crore)

DRONES: Over 100 Israeli UAVs, from Heron & Searcher-II surveillance & precision-targeting drones to Harop ‘killer’ drones, inducted. Rs 3,500-crore Project Cheetah to fit Heron drones with missiles in pipeline

RADARS: Israeli radars, from Aerostat to Green Pine radars, inducted. Now, acquiring 66 air defence fire control radars for Rs 4,577 crore

AWACS: Impending deal for 2 Phalcon AWACS for over \$1.5 billion. 3 Phalcon AWACS, mounted on IL-76 aircraft, earlier inducted under \$1.1 billion deal

MISSILES & BOMBS: Inductions range from Spyder quick-reaction anti-aircraft missiles, Python & Derby air-to-air missiles to Crystal Maze PGMs and Spice-2000 bombs



The Indian armed forces have inducted a wide array of Israeli weapon systems over the years, which range from Phalcon AWACS (airborne warning and control systems) and Heron, Searcher-II and Harop drones to Barak anti-missile defence systems and Spyder quick-reaction anti-aircraft missile systems.

The acquisitions also include a host of Israeli missiles and precision-guided munitions, from Python and Derby air-to-air missiles to Crystal Maze and Spice-2000 bombs. The Spice-2000 penetration bombs, in fact, were used by Indian Mirage-2000s fighters to bomb the JeM facility at Balakot in Pakistan in February last year.

There are several other Indian defence deals in the pipeline for Israel. The IAF, for instance, is looking to seal the long-pending over \$1.5 billion deal to acquire two more “Phalcon” AWACS or “eyes in the sky”.

The Rajnath Singh-led defence acquisitions council last month also decided to fast-track ‘Project Cheetah’ to arm the Heron drones with laser-guided bombs, air-to-ground anti-tank missiles and other precision-guided munitions as well as advanced reconnaissance capabilities for around Rs 3,500-crore, as was reported by TOI.

<https://timesofindia.indiatimes.com/india/india-israel-to-co-develop-hi-tech-weapon-systems/articleshow/78327521.cms>

THEWEEK

Sat, 26 Sept 2020

Work of Satish Dhawan at IISc made Tejas jet, missiles, Gaganyaan possible

Satish Dhawan pioneered development of wind tunnels in the country

Homi Bhabha, Vikram Sarabhai, Satish Dhawan. These three names are arguably the first ones that come to mind for many Indians when they think of pioneers of post-independence scientific research in the country.

Satish Dhawan was the third director of ISRO, serving in the role from 1972 to 1984. His tenure as ISRO chief was a time when the organisation, literally, soared, as an Indian-designed rocket made a successful maiden launch of an indigenous satellite in 1980.

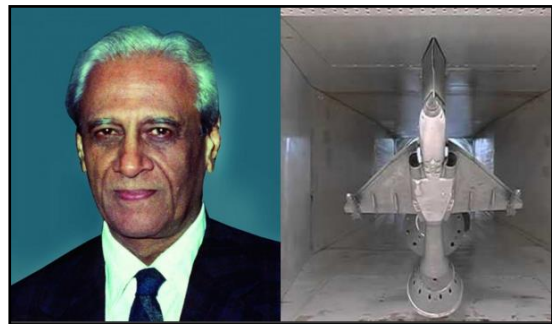
Dhawan’s birth centenary is being celebrated on Friday. Dhawan, who died in 2002, was also the director of the Indian Institute of Science in Bengaluru for a record 19 years from 1962. There is a popular anecdote that Satish Dhawan accepted the offer from then prime minister Indira Gandhi to head ISRO on condition that he was allowed to remain head of IISc.

Dhawan, who held a PhD in aeronautics and mathematics from Caltech in the US, became director of the Indian Institute of Science at a remarkably young age of 42. Dhawan oversaw a massive expansion at IISc. When he took charge as director of IISc, there were 11 departments at IISc; by the time he left in 1981, there were 40, according to a post on IISc’s *Connect* blog.

Dhawan specialised in research into fluid dynamics, the study of the flow of liquids and gases, which has numerous applications in multiple fields.

In addition to Dhawan’s pioneering work as chief of ISRO, he is also credited with creating the first supersonic wind tunnel in India.

S.P. Govinda Raju, a retired IISc scientist, in a research paper, described wind tunnel as a “an aerodynamic test facility. It is mostly used to study flow patterns around bodies and measure



A collage showing Satish Dhawan (ISRO) and an LCA Tejas in a wind tunnel (CSIR NAL)

aerodynamic forces on them. The bodies (called models) are usually scaled down but geometrically similar versions of bodies of interest like an airplane or an automobile. The results from wind tunnel tests can be 'scaled' to the actual velocity and actual body size using suitable scaling laws.”

Wind tunnels are, in simple terms, test facilities to finetune the design of any aerodynamic body to ensure it works as specified in the real world. It was under Dhawan’s stewardship that the first large-scale ‘open-circuit’ wind tunnel was opened at IISc in 1959. It was inaugurated by the then maharaja of Mysore. In 1973, India’s first hypersonic wind tunnel was opened at IISc, at a time when the country was ramping up development of its first space rockets and missiles.

The open-circuit wind tunnel was used to finetune the design of the Light Combat Aircraft Tejas fighter, long before it made its first flight in 2001. It has also been used to test the design of the Advanced Medium Combat Aircraft (AMCA), the country's first stealth aircraft, which is scheduled to fly around 2025.

In a 2017 article on IISc *Connect*, V. Surendranath, a senior scientist at IISc, described the work of the open-circuit wind tunnel. He said, “We have tested all sorts of objects: Chimneys, cooling towers, factories, launch vehicles, ships, and of course many aircraft. We have also provided our service to the LCA [Light Combat Aircraft], AMCA [Advanced Medium Combat Aircraft], ship development and other flight configurations.”

The country's first hypersonic wind tunnel at IISc was used by DRDO to develop the Agni ballistic missile's design. The hypersonic test facilities at IISc have also been used to validate design of India's hypersonic missile efforts.

In March 2020, *New Indian Express* reported a new task for the 61-year-old open-circuit wind tunnel at IISc: Testing the design of Gaganyaan, ISRO's maiden manned space mission.

Surendranath told *New Indian Express* "each phase in the Gaganyaan mission will be tested separately to its maximum safety limit and the operational capability (of the rocket) will be proven”.

As Indians feel pride at the sight of a soaring ISRO rocket or a menacing missile from DRDO, it is only apt to remember the foundations that Satish Dhawan, and his colleagues, laid to make them possible.

<https://www.theweek.in/news/india/2020/09/25/work-of-satish-dhawan-at-iisc-made-tejas-jet-missiles-gaganyaan-possible.html>

Sat, 26 Sept 2020

‘Rohtang tunnel will bring T-90 tanks, Army infantry combat vehicles closer to LAC’

The 9.2 km-long horseshoe-shaped single-tube, two-lane tunnel is the world's longest motorable tunnel at over 3,000 metre above the sea level.

Manali: One of the world's most challenging and a marvel of engineering motorways -- the Rohtang Pass highway tunnel -- in the Himalayas is strategic as it will bring the Indian Army with its T-90 tanks and infantry combat vehicles closer to the Line of Actual Control, project engineers said on Friday.

It is all set to be inaugurated by Prime Minister Narendra Modi on October 3.

The 9.2 km-long horseshoe-shaped single-tube, two-lane tunnel -- the world's longest motorable tunnel at over 3,000 metre above the sea level, is coming up under the 3,978 metre Rohtang Pass in the Pir Panjal range some 30 km from here in Himachal Pradesh.

"The all-weather tunnel can take any military traffic, even armoured vehicles," an official aware of the development told IANS.

However, the all-weather road to forward areas of Ladakh requires more tunnels, either at Shikunla or at the high passes located on the 475-km Manali-Leh road for round-the-year connectivity.

Considered a wonder of human perseverance, the Rohtang tunnel, a dream of former prime minister Atal Bihari Vajpayee and named after him posthumously, is going to be completed after 10 years of sheer hard work by the Border Roads Organisation (BRO) with an outlay of Rs 4,000 crore.

Talking exclusively to IANS, project Director Colonel Parikshit Mehra said the tunnel has manoeuvred one of the largest shear zones in the history of highway tunneling.

"A length of 587 m across the Seri-nullah or rivulet zone took us four years and the balance 8.4 km took almost the same time," he said.

Mehra, who did twin master's degree in tunneling, including the one from Austria, said during excavation the temperature inside the tunnel rose to 55 degrees Celsius before breakthrough and it hardly crossed 20 degrees after that.

On its vulnerability, he said, "The deep tunnels in general are not vulnerable to tectonic effects since they move as a rigid body with shock waves.

"However portal buildings are vulnerable to earthquakes and in our case earthquake loads have been considered in design."



Rohtang Tunnel | Photo Credit: IANS

On the decision to keep the main and escape tunnel within the same opening was with a viewpoint not to disturb a large extent of rock mass and restrict excavation to a specific area only, Colonel Mehra said.

Globally, the escape tunnel is built separately along the main tunnel.

And no wonder the working conditions were relatively short and tough too owing to climatic conditions. "The north portal of the tunnel was accessible only for five-six months in a year,' he said.

The tunnel construction, a blessing for the people of landlocked Lahaul-Spiti district who mark a new beginning in their lives this winter, was abandoned on numerous occasions, primarily due to the complex geology that included fracture zones and fault lines.

Colonel Mehra said all major works have been completed. Now cleaning and final touches are going on inside the tunnel.

He said for at least two years the BRO would regulate the movement of vehicles through the tunnel. Later, it would be handed over to the local civil authorities.

The tunnel will shorten the distance between this Himachal Pradesh tourist resort and Keylong, the headquarters of Lahaul-Spiti, by 46 km, shortening the travel time by nearly three hours.

With the maximum speed limit of 80 km per hour, the tunnel is expected to see traffic of 3,000 cars and 1,500 trucks a day.

The tunnel has consumed 12,252 metric tonnes of steel, 1,69,426 metric tonnes of cement and 1,01,336 metric tonnes of concrete, and excavated out 5,05,264 metric tonnes of soil and rocks by adopting the latest Austrian tunnelling method for construction.

The construction contract of the tunnel has been awarded to Strabag-Afcons, a joint venture between India-based Afcons Infrastructure and Austria's Strabag.

Chandigarh-based Snow and Avalanche Study Establishment (SASE) has designed mechanical structures to ensure the safety of motorists by countering avalanches on both ends of the tunnel that remain under snow even during peak summer.

Engineers of SASE, a Defence Research and Development Organisation (DRDO) laboratory, said self-escape snow galleries have been erected for the safety of motorists after studying the local dynamics of avalanches like force and velocity.

The tunnel's foundation stone was laid by United Progressive Alliance (UPA) chairperson Sonia Gandhi on June 28, 2010, in the Solang Valley near Manali, some 570 km from the national capital.

The completion of the Atal tunnel is a key element in the Defence Ministry's attempts to make the entire 475 km-long Manali-Keylong-Leh highway, used by the armed forces to reach forward areas in Ladakh bordering China and Pakistan, motorable almost round the year.

<https://www.timesnownews.com/india/article/rohtang-tunnel-will-bring-t-90-tanks-army-infantry-combat-vehicles-closer-to-lac/657925>

Amid tensions at LAC, IAF says, 'ready to undertake operations by day or night on both China, Pakistan fronts'

Amid tension along the LAC, the Indian Air Force has said it is fully prepared to conduct night or day operations on both China and Pakistan fronts

Key Highlights

- *IAF on Friday said it was ready for undertaking operations simultaneously on both the fronts*
- *The fighter aircrafts are operating during both day and night*
- *'We are able to undertake all types of missions even at nights from the forward base'*

New Delhi: In a signal to Pakistan and China, in case the two countries decide to join hands against India, the Indian Air Force said it is fully prepared to conduct night or day operations on both fronts.

Heavy air activity has been witnessed on the forward airbase during both day and night.

Pakistan is around 50 kilometres from the forward airbase and the strategic Daulat Beg Oldi is around 80 kilometres.

Rafale jets conduct 'familiarization' sorties over Ladakh

India has deployed its frontline fighters, helicopters and transport aircraft including the Su-30MKI and C-130J Super Hercules, Ilyushin-76 and the Anton-32 at a strategically located airbase near Khardungla pass.



India has deployed its frontline fighters, helicopters and transport aircrafts at forward airbase

With border tensions along the LAC, the fighter aircraft are operating during both day and night, the transport aircraft are continuously flying in and out of the airbase with troops, rations and ammunition to the troops located in bases in DBO and other areas in Eastern Ladakh.

Talking to ANI about the IAF's capability to undertake night operations in these tough terrains, a fighter pilot said, "Today, our warfare capabilities have grown, so much so that we are able to undertake all types of missions even at nights from the forward base."

Rafale fighter jets have already started conducting 'familiarization' sorties over Ladakh and this deployment of French-made jets comes less than 10 days after they were formally inducted into the IAF.

IAF's signal to Pakistan, China

Five Rafales which were inducted into services at the Ambala airbase on September 10 have started conducting sorties in Ladakh in the recent days. According to a report by TOI, Rafale pilots flew the jets from Ambala to Ladakh to familiarize themselves with the operational environment.

In June, the Pakistani airbases in the PoK came under IAF's radar after a Chinese refueller aircraft landed in Skardu, Gilgit-Baltistan region.

On Thursday, India said it is necessary to ensure stability on the ground while the two sides work towards ensuring complete disengagement of troops in all friction areas in eastern Ladakh.

<https://www.timesnownews.com/india/article/amid-tensions-at-lac-iaf-says-ready-to-undertake-operations-by-day-or-night-on-both-china-pakistan-fronts/658120>

चीन और पाकिस्तान से दोनों मोर्चों पर तैयार है भारतीय वायुसेना, सीमा पर सुखोई लड़ाकू विमान ने भरी उड़ान

भारतीय वायु सेना ने गुलाम कश्मीर (PoK) और चीन सीमा के पास एक फॉरवर्ड एयर बेस पर Su-30 MKI लड़ाकू विमान का संचालन किया। ऐसे समय में जब यह संदेह है कि चीन और पाकिस्तान दोनों भारत के खिलाफ एक साथ आ सकते हैं।

By Dhyanendra Singh

नई दिल्ली: भारत और चीन के बीच चल रहे तनाव के दौरान भारतीय वायुसेना सीमा पर अपनी चौकस नजर रखे हुए। भारतीय वायुसेना न सिर्फ चीन बल्कि पाकिस्तान पर भी नजरें गड़ाए हुए हैं। भारतीय वायु सेना ने गुलाम कश्मीर (PoK) और चीन सीमा के पास एक फॉरवर्ड एयर बेस पर Su-30 MKI लड़ाकू विमान का संचालन किया। ऐसे समय में जब यह संदेह है कि चीन और पाकिस्तान दोनों भारत के खिलाफ एक साथ आ सकते हैं, भारतीय वायु सेना दोनों मोर्चों पर एक साथ निपटने के लिए तैयार है।

भारतीय वायुसेना लड़ाकू विमानों और हेलीकॉप्टर के माध्यम से फारवर्ड एयरबेस से दोनों देशों पर पैनी नजर रखे हुए है। फारवर्ड एयरबेस जहां से पाकिस्तान 50 किलोमीटर के आसपास है और रणनीतिक दौलत बेग ओल्डी लगभग 80 किलोमीटर है।

श्योक नदी के पास बने फारवर्ड एयरबेस जहां खार-डूंग से गुजरते हुए SU -30 MKI और C-130J Super Hercules, आईयूशिन -76 (Ilyushin-76) और एंटोन -32 (Anton-32) सहित कई विमान लगातार अपनी उड़ाने भर रहे हैं।



चीन के साथ चल रहे संघर्ष के मद्देनजर लड़ाकू विमान दिन और रात सीमा पर गश्त लगा रहे हैं। परिवहन विमान लगातार वास्तविक नियंत्रण रेखा पर स्थित ठिकानों में सैनिकों, राशन और गोला-बारूद के साथ एयरबेस के भीतर और बाहर उड़ान भर रहे हैं।

कोई भी ऑपरेशन करने के लिए तैयार है भारतीय वायुसेना

पाकिस्तान के स्कार्दू एयरबेस से खतरे और चीन-पाकिस्तान के एक साथ आने की संभावना के बारे में समाचार एजेंसी एएनआइ द्वारा पूछे जाने पर फ्लाइट लेफ्टिनेंट के एक भारतीय वायुसेना पायलट ने कहा कि आधुनिक प्लेटफॉर्म के कारण भारतीय वायुसेना पूरी तरह से प्रशिक्षित है और कोई भी ऑपरेशन करने के लिए तैयार है।

किसी भी स्थिति से निपटने के लिए हम पूरी तरह प्रशिक्षित हैं और प्रेरित हैं। हम भारतीय वायुसेना के आदर्श वाक्य 'टच द स्काई विथ ग्लोरी' को जीते हैं। इन दुर्गम इलाकों में रात के संचालन के लिए भारतीय वायुसेना की क्षमता के बारे में बात करते हुए एक लड़ाकू पायलट ने कहा कि आज, हमारी युद्ध क्षमता बढ़ गई है, इतना है कि हम किसी भी स्थिति के दौरान रातों में भी सभी प्रकार के मिशन करने में सक्षम हैं।

<https://www.jagran.com/news/national-indian-air-force-said-ready-for-undertaking-operations-on-both-china-pakistan-fronts-20795302.html>

India, Japan ‘non-contact’ naval drills in Arabian Sea begin today

Just like the Indo-Australian drills, JIMEX-20 is being conducted in a “non-contact at-sea-only format”, in view of Covid-19 restrictions

New Delhi: India and Japan will kick off three-day maritime drills in the northern Arabia Sea from Saturday, an Indian Navy spokesperson said on Friday, days after India conducted an exercise with Australia in the Indian Ocean.

The India-Japan maritime bilateral exercise (JIMEX) is conducted biennially. Its last edition was conducted off the coast of Visakhapatnam in October 2018.

“JIMEX-20 will showcase a high degree of interoperability and joint operational skills through conduct of a multitude of advanced exercises, across the spectrum of maritime operations. Multi-faceted tactical exercises involving weapon firing, cross-deck helicopter operations and complex surface, anti-submarine and air warfare drills will consolidate the coordination developed by the two navies,” the navy said in a statement.

The drills come after Indian and Australian navies conducted a passage exercise in the eastern Indian Ocean Region (IOR) from September 23-24. A passage exercise is normally undertaken whenever an opportunity arises, in contrast to pre-planned maritime drills.

Just like the Indo-Australian drills, JIMEX-20 is being conducted in a “non-contact at-sea-only format”, in view of Covid-19 restrictions.

Indian warships Chennai, Teg, Tarkash and fleet tanker Deepak will represent the Indian Navy at JIMEX-20, while Japanese Maritime Self-Defense Force is sending its warships Kaga and Ikazuchi for the drills, the statement said, adding that P8-I long range maritime patrol aircraft, integral helicopters and fighter jets will also take part in the exercise.

“JIMEX-20 will further enhance the cooperation and mutual confidence between the two navies and fortify the long-standing bond of friendship between the two countries,” it added.

The stage is also set for Australia to be part of the next Malabar naval exercise conducted by India with the US and Japan. The next edition of Malabar, already delayed by the Covid-19 pandemic, is set to be held by the end of the year.

China has also been wary of the Quadrilateral security dialogue or Quad that was revived in late 2017 by India, the US, Australia and Japan, and these suspicions have increased since the four countries upgraded the forum to the ministerial level last year.

The navy has been on an operational alert in the Indian Ocean where scores of warships are ready for any task in the aftermath of the border row with China in the Ladakh sector. India has positioned warships along critical sea lanes of communications and choke points under its mission-based deployment and the vessels could be diverted for any mission.

Indian warships are deployed from as far as the Persian Gulf to the Malacca Strait and northern Bay of Bengal to the southeast coast of Africa.

<https://www.hindustantimes.com/india-news/india-japan-to-kick-off-naval-drills-in-arabian-sea-tomorrow/story-eVlxuU0r20ZVdkauQqZDQO.html>



The India-Japan maritime bilateral exercise (JIMEX) is conducted biennially. Its last edition was conducted off the coast of Visakhapatnam in October 2018. (Photo @JapaninIndia)

Sat, 26 Sept 2020

Four HUGIN AUVs for the Indian Navy

Kongsberg Maritime sold four HUGIN AUV systems to the Indian Defense Public Sector shipyard Garden Reach Shipbuilders & Engineers Limited (GRSE), located in Kolkata, India. This sale was conducted in collaboration with Kongsberg Maritime India, a subsidiary of Kongsberg Maritime.

The purchase, which also includes HiPAP 502 high-accuracy acoustic positioning and communication systems to support AUV operations, will be installed on the four Large Survey vessels currently in build for the Indian Navy. GRSE Chairman and Managing Director Rear Admiral (Ret'd) Vipin Saxena said: "We are pleased and look forward to making use of the HUGIN AUVs from KONGSBERG, which will augment the Indian Navy's capabilities for coastal and deep-water hydrographic surveys to aid maritime operations, and will act as a force multiplier."

The AUVs will be supplied with containers and launch and recovery systems, plus training and support.

<https://www.marinetechologynews.com/news/hugin-indian-605039>



Kongsberg Maritime's HUGIN AUV is a powerful tool for deep-water hydrographic surveys. Photo: Kongsberg

ISRO's Mangalyaan orbiter completes six years around Mars. Where's the science?

By Jatan Mehta

September 24 marks six years since the Indian Space Research Organisation's (ISRO's) Mangalyaan spacecraft – part of the Mars Orbiter Mission – entered into orbit around the red planet, making India the first Asian country to do so. Even more impressively, Mangalyaan was the country's first interplanetary mission. Combined with the cost-effectiveness for which it is lauded, Mangalyaan is often hailed as India's most successful space mission. But is it?

Prime Minister Narendra Modi has boasted that at around \$70 million, or Rs 450 crore, the mission was cheaper than the 2013 Hollywood film *Gravity*, and even an auto-rickshaw on a fare-per-kilometre basis. The media highlighted Mangalyaan's cost effectiveness as well, noting that NASA's Mars Atmosphere and Volatile Evolution (MAVEN) orbiter to Mars, launched around the same time, had cost about seven-times as much.

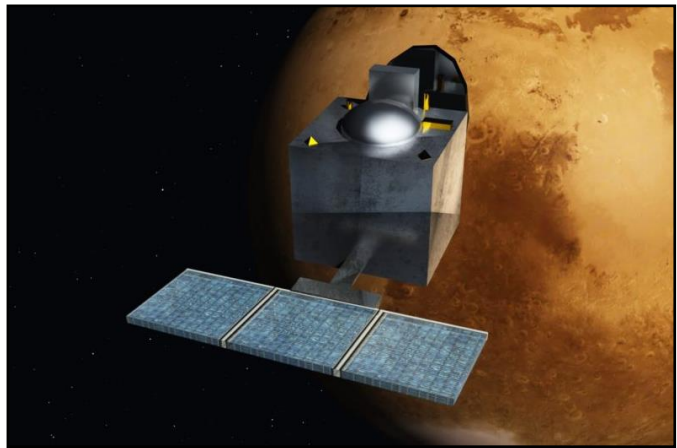
India's pride in the mission while downplaying others has continued to spread over the years, also taking the form of dramatised movies like *Mission Mangal* (2019). But what they all miss is looking at the scientific output. That is, what has Mangalyaan been doing in Mars orbit?

According to ISRO's official list of publications, there have been only 27 peer-reviewed papers relating to Mangalyaan after six years in orbit. In contrast, MAVEN has helped produce many seminal scientific results about the Martian atmosphere, with a repository of at least 500 papers, and growing. What's more concerning about Mangalyaan's short publications list is that about half of these papers are simply engineering descriptions of the mission, not scientific results from the mission.

Naysayers may dismiss the lack of science by arguing that Mangalyaan was a 'technology demonstration' mission, aimed at proving ISRO's interplanetary mission capabilities. That may be part of the story – but that is not how ISRO marketed the mission before and after launch, when it was vocal about the science goals.

ISRO has made data from Mangalyaan's five indigenous scientific instruments available on their data portal for five years now, and has explicitly welcomed the Indian science community to utilise the data and publish papers. In 2017, the organisation announced at the mission's dedicated science meet that 32 research teams across the country are exploring and analysing Mangalyaan data. And yet, there is a vacuum of scientific publications.

Perhaps the most notable 'failure' concerns the much-hyped methane sensor. The instrument was supposed to map the volume and distribution of methane around Mars with a sensitivity of a



An artist's illustration of the Mars Orbiter orbiting the red planet. Image: Nesnad/Wikimedia Commons.

few parts per billion, to help decide if this gas on the planet could be a sign of subsurface life. But two years after launch, the instrument was found to have a design flaw and so it couldn't detect methane at all. At that point, ISRO repurposed the methane sensor as an albedo mapper, which measures sunlight reflected from the surface to understand Mars's surface composition.

There also seem to be no published results from the Lyman alpha photometer. By looking for hydrogen escaping from Mars's atmosphere, it was supposed to tell us how much water Mars may have lost since its birth and at what rate. Notably, NASA's MAVEN spacecraft was also expected to deliver this result (by examining a variety of factors) – and which it did.

Urge to be first

The idea of rationalising Mangalyaan's poor scientific returns using the mission's low cost is challenged by another ISRO mission: Chandrayaan 1. At Rs 390 crore, it was cost effective the way Mangalyaan was – and an equally challenging endeavour given that it was India's first lunar orbiter.

Unlike Mangalyaan, however, Chandrayaan 1 welcomed global collaboration: about half the instruments came from foreign space agencies and universities. Notably, two NASA instruments confirmed the discovery of water on the Moon, cementing for Chandrayaan 1 an important place in history. And despite orbiting the Moon for less than a year, Chandrayaan 1 produced hundreds of publications and scientists are analysing its data to this day.

This is not to say ISRO can't build good science instruments but to point out that *collaboration* can be an effective way to expand the scope of a mission's scientific agenda without increasing the mission cost. For some reason, ISRO does not fly science instruments from universities and institutions within the country for its interplanetary missions. The only exception thus far was India's first space telescope, Astrosat, whose instruments were selected by the consensus of academic institutions around India.

However, Astrosat was not directly concerned with planetary exploration; and ISRO operates differently when it comes to the latter. ISRO has expressed an intention to change this method in future, as part of its space commercialisation initiative, by involving private players and academic institutions to a greater extent.

Both the missing collaborations and lack of scientific output from Mangalyaan's Indian instruments may have to do with the mission's low development time, of only 18 months. It is unclear why ISRO was in such a hurry to launch in 2013 and couldn't have targeted the launch opportunity in 2016 instead. The reason may be political – the urge to successfully orbit Mars before China or Japan does.

Had Mangalyaan been given enough time, it is possible the payload of scientific instruments wouldn't have been restricted to weighing 15 kg in all, and the output could have been substantially higher. One case in point is the Chandrayaan 2 orbiter, currently in orbit around the Moon. It carries state-of-the-art instruments, all indigenous, and is making the highest-resolution map of the Moon (yet) and quantifying water on its poles as we speak.

Another way the Mangalyaan mission's value could have been improved was if ISRO had equipped it with a standard relay device – one that every NASA Mars orbiter carries. These devices allow NASA to get more science data from surface missions than would be possible otherwise, by relaying data from instruments on the surface to Earth. The European Space Agency put one such device for NASA on their Trace Gas Orbiter, launched in 2016.

Missing space exploration roadmap

But more than the quality of the science instruments or mission-planning, Mangalyaan highlights the lack of an overarching philosophy guiding India's interplanetary missions. NASA has an elaborate process called the 'Decadal Survey' for which scientists from across the US present a priority list of space exploration destinations and scientific objectives once every decade. NASA uses the survey as a guide to build its missions, so the system therefore guarantees that each mission's scientific goals are achieved more often than not. China and the European Space Agency have similar processes in place for their missions.

Space exploration missions are inherently costly undertakings, and at this point, the value per rupee matters as much as the absolute cost, if not more. MAVEN highlights this adequately. The mission is part of NASA's larger Mars exploration program and is built with the express purpose of studying Mars's atmosphere and determining exactly how the red planet lost its water. Thanks to its clear objectives, MAVEN delivered big science while still costing NASA less than many of its other endeavours, even if it cost more than Mangalyaan.

Like NASA's other missions, MAVEN's findings feed directly into the agency's next steps in Mars exploration and will help plan future habitats, further cementing the value-proposition of such a model. India could benefit immensely from a formal planetary exploration framework that either doesn't exist or whose functioning is inept and unclear to the public.

ISRO plans to launch Mangalyaan 2 in 2024 with an upgraded orbiter, and with a scientific payload of 100 kg. The mission could also include a lander and a rover but it seems unlikely at the moment. Notably, Mangalyaan 2 will launch after the first Mars rover missions from China and the European Space Agency, and alongside NASA's ever present Mars fleet. Let us hope Mangalyaan 2 is an appropriate step forward in this journey.

<https://science.thewire.in/space/isros-mangalyaan-orbiter-completes-six-years-around-mars-wheres-the-science/>



Sat, 26 Sept 2020

Provably exact artificial intelligence for nuclear and particle physics

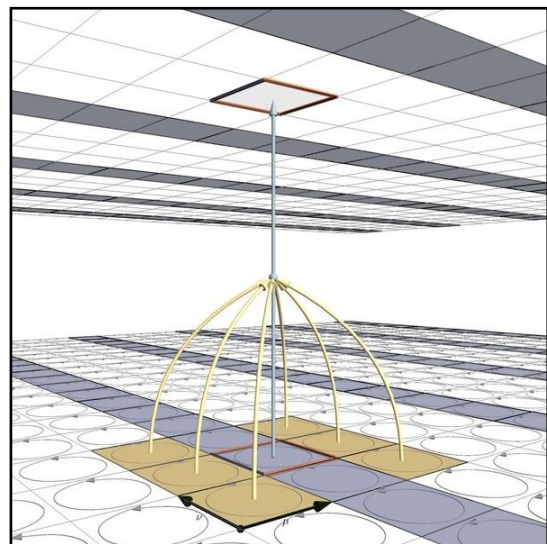
By Sandi Miller

The Standard Model of particle physics describes all the known elementary particles and three of the four fundamental forces governing the universe; everything except gravity. These three forces—electromagnetic, strong, and weak—govern how particles are formed, how they interact, and how the particles decay.

Studying particle and nuclear physics within this framework, however, is difficult, and relies on large-scale numerical studies. For example, many aspects of the strong force require numerically simulating the dynamics at the scale of 1/10th to 1/100th the size of a proton to answer fundamental questions about the properties of protons, neutrons, and nuclei.

"Ultimately, we are computationally limited in the study of proton and nuclear structure using lattice field theory," says assistant professor of physics Phiala Shanahan. "There are a lot of interesting problems that we know how to address in principle, but we just don't have enough compute, even though we run on the largest supercomputers in the world."

To push past these limitations, Shanahan leads a group that combines theoretical physics with machine learning models. In their paper "Equivariant flow-based sampling for lattice gage theory," published this month in *Physical Review Letters*, they show how incorporating the symmetries of physics theories into machine learning and artificial intelligence architectures can provide much faster algorithms for theoretical physics.



Artist's impression of the machine learning architecture that explicitly encodes gauge symmetry for a 2D lattice field theory. Credit: MIT-DeepMind collaboration.

"We are using machine learning not to analyze large amounts of data, but to accelerate first-principles theory in a way which doesn't compromise the rigor of the approach," Shanahan says. "This particular work demonstrated that we can build machine learning architectures with some of the symmetries of the Standard Model of particle and nuclear physics built in, and accelerate the sampling problem we are targeting by orders of magnitude."

Shanahan launched the project with MIT graduate student Gurtej Kanwar and with Michael Albergo, who is now at NYU. The project expanded to include Center for Theoretical Physics postdocs Daniel Hackett and Denis Boyda, NYU Professor Kyle Cranmer, and physics-savvy machine-learning scientists at Google Deep Mind, Sébastien Racanière and Danilo Jimenez Rezende.

This month's paper is one in a series aimed at enabling studies in theoretical physics that are currently computationally intractable. "Our aim is to develop new algorithms for a key component of numerical calculations in theoretical physics," says Kanwar. "These calculations inform us about the inner workings of the Standard Model of particle physics, our most fundamental theory of matter. Such calculations are of vital importance to compare against results from particle physics experiments, such as the Large Hadron Collider at CERN, both to constrain the model more precisely and to discover where the model breaks down and must be extended to something even more fundamental."

The only known systematically controllable method of studying the Standard Model of particle physics in the nonperturbative regime is based on a sampling of snapshots of quantum fluctuations in the vacuum. By measuring properties of these fluctuations, one can infer properties of the particles and collisions of interest.

This technique comes with challenges, Kanwar explains. "This sampling is expensive, and we are looking to use physics-inspired machine learning techniques to draw samples far more efficiently," he says. "Machine learning has already made great strides on generating images, including, for example, recent work by NVIDIA to generate images of faces 'dreamed up' by neural networks. Thinking of these snapshots of the vacuum as images, we think it's quite natural to turn to similar methods for our problem."

Adds Shanahan, "In our approach to sampling these quantum snapshots, we optimize a model that takes us from a space that is easy to sample to the target space: given a trained model, sampling is then efficient since you just need to take independent samples in the easy-to-sample space, and transform them via the learned model."

In particular, the group has introduced a framework for building machine-learning models that exactly respect a class of symmetries, called "gauge symmetries," crucial for studying high-energy physics.

As a proof of principle, Shanahan and colleagues used their framework to train machine-learning models to simulate a theory in two dimensions, resulting in orders-of-magnitude efficiency gains over state-of-the-art techniques and more precise predictions from the theory. This paves the way for significantly accelerated research into the fundamental forces of nature using physics-informed machine learning.

The group's first few papers as a collaboration discussed applying the machine-learning technique to a simple lattice field theory, and developed this class of approaches on compact, connected manifolds which describe the more complicated field theories of the Standard Model. Now they are working to scale the techniques to state-of-the-art calculations.

"I think we have shown over the past year that there is a lot of promise in combining physics knowledge with machine learning techniques," says Kanwar. "We are actively thinking about how to tackle the remaining barriers in the way of performing full-scale simulations using our approach. I hope to see the first application of these methods to calculations at scale in the next couple of years. If we are able to overcome the last few obstacles, this promises to extend what we can do with limited resources, and I dream of performing calculations soon that give us novel insights into what lies beyond our best understanding of physics today."

This idea of physics-informed machine learning is also known by the team as "ab-initio AI," a key theme of the recently launched MIT-based National Science Foundation Institute for Artificial Intelligence and Fundamental Interactions (IAIFI), where Shanahan is research coordinator for physics theory.

More information: Gurtej Kanwar et al. Equivariant Flow-Based Sampling for Lattice Gage Theory, *Physical Review Letters* (2020). [DOI: 10.1103/PhysRevLett.125.121601](https://doi.org/10.1103/PhysRevLett.125.121601)

Journal information: [Physical Review Letters](https://phys.org/news/2020-09-provably-exact-artificial-intelligence-nuclear.html)
<https://phys.org/news/2020-09-provably-exact-artificial-intelligence-nuclear.html>

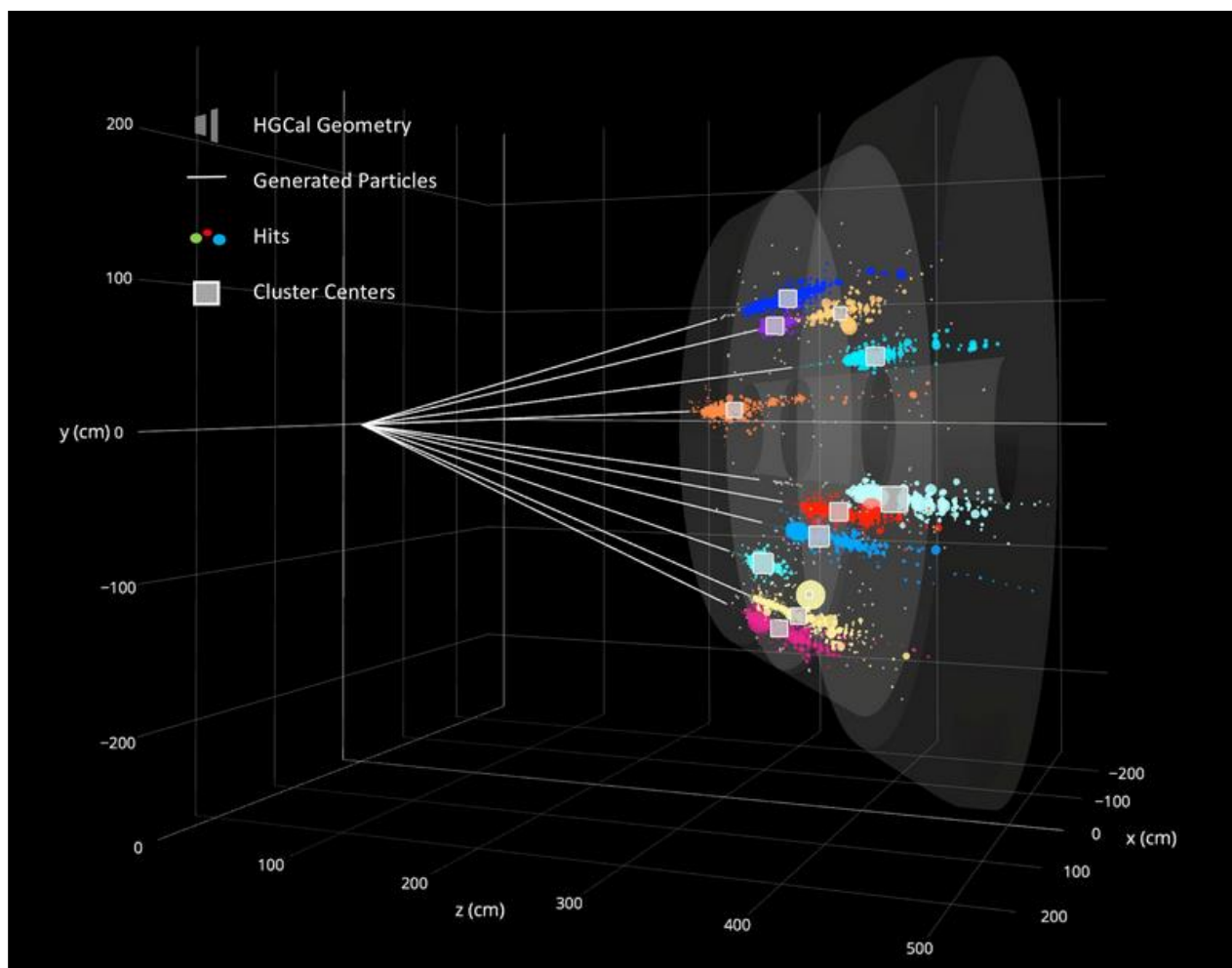


Sat, 26 Sept 2020

The use of graph neural networks to discover particles

By Zack Savitsky

Machine learning algorithms can beat the world's hardest video games in minutes and solve complex equations faster than the collective efforts of generations of physicists. But the conventional algorithms still struggle to pick out stop signs on a busy street.



The upgraded high-granularity calorimeter — a component of the CMS detector at the Large Hadron Collider — produces complicated images of particles generated from collisions. Researchers are working to implement graph neural networks to optimize the analysis of this data to better identify and characterize particle interactions of interest. Credit: Ziheng Chen, Northwestern University

Object identification continues to hamper the field of machine learning—especially when the pictures are multidimensional and complicated, like the ones particle detectors take of collisions in high-energy physics experiments. However, a new class of neural networks is helping these models boost their pattern recognition abilities, and the technology may soon be implemented in particle physics experiments to optimize data analysis.

This summer, Fermilab physicists made an advance in their effort to embed graph neural networks into the experimental systems. Scientist Lindsey Gray updated software that allows these cutting-edge algorithms to be deployed on data from the Large Hadron Collider at CERN. For the first time, these networks will be integrated into particle physics experiments to process detector data directly—opening the flood gates for a major jump in efficiency that will yield more precise insight from current and future detectors.

"What was a week ago just an object of research is now a widely usable tool that could transform our ability to analyze data from particle physics experiments," Gray said.

His work focuses initially on using graph neural networks to analyze data from the CMS experiment at the LHC, one of the collider's four major particle physics experiments.

Programmers develop neural networks to sift through mountains of data in search for a specific category or quantity—say, a stop sign in a photo of a crowded street.

Normal digital photographs are essentially a giant grid of red, green and blue square pixels. After being trained to recognize what a stop sign looks like, classic neural networks inspect the whole block of pixels to see whether or not the target is present. This method is inefficient, however, since the models have to process lots of irrelevant, obfuscating data.

Computer scientists have developed new classes of neural networks to improve this process, but the algorithms still struggle to identify objects in images that are more complex than just a two-dimensional grid of square pixels.

Take molecules, for example. In order to determine whether or not a chemical is toxic, chemists have to locate certain features like carbon rings and carboxyl groups within a molecule. The photographs of the chemicals taken with X-ray chromatography machines produce 3-D images of bonded atoms, which look slightly different every time they're viewed.

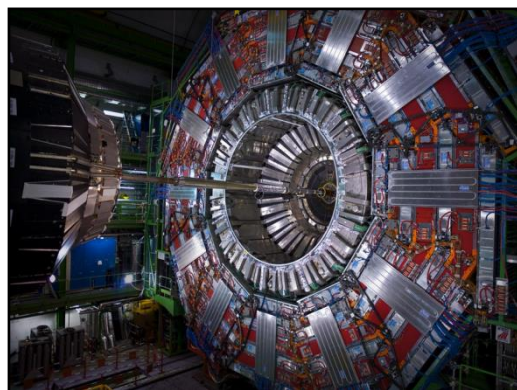
Since the data are not stored in a square grid, it's difficult for typical neural networks to learn to identify the toxic compounds. To get around this, chemists have started employing a new set of neural networks: graph neural networks, or GNNs.

Unlike these typical neural networks, GNNs are able to tell which pixels are connected to one another even if they're not in a 2-D grid. By making use of the "edges" between the "nodes" of data (in this case, the bonds between the atoms), these machine learning models can identify desired subjects much more efficiently.

Gray's vision is to bring these models and their enhanced target identification to streamline data processing for particle collisions.

"With a graph neural net, you can write a significantly better pattern recognition algorithm to be used for something as complex as particle accelerator data because it has the ability to look at relationships between all the data coming in to find the most pertinent parts of that information," he said.

Gray's research focuses on implementing GNNs into the CMS detector's high-granularity calorimeter, or HGCAL. CMS takes billions of images of high-energy collisions every second to search for evidence of new particles.



The CMS detector at the Large Hadron Collider takes billions of images of high-energy collisions every second to search for evidence of new particles. Graph neural networks expeditiously decide which of these data to keep for further analysis. Credit: CERN

One challenge of the calorimeter is that it collects so much data—enough pictures to fill up 20 million iPhones every second—that a large majority must be thrown away because of limitations in storage space. The HGCal's trigger systems have to decide in a few millionths of a second which parts of the data are interesting and should be saved. The rest get deleted.

"If you have a neural network that you can optimize to run in a certain amount of time, then you can make those decisions more reliably. You don't miss things, and you don't keep things that you don't really need," said Kevin Pedro, another Fermilab scientist working with Gray.

The HGCal detectors collect lots of different information at the same time about particle interactions, which produces some very complicated images.

"These data are weirdly shaped, they have random gaps in them, and they're not even remotely close to a contiguous grid of squares," Gray said. "That's where the graphs come in—because they allow you to just skip all of the meaningless stuff."

In theory, the GNNs would be trained to analyze the connections between pixels of interest and be able to predict which images should be saved and which can be deleted much more efficiently and accurately. However, because this class of neural net is so new to particle physics, it's not yet possible to implement them directly into the trigger hardware.

The graph neural network is well-suited to the HGCal in another way: The HGCal's modules are hexagonal, a geometry that, while not compatible with other types of neural networks, works well with GNNs.

"That's what makes this particular project a breakthrough," said Fermilab Chief Information Officer Liz Sexton-Kennedy. "It shows the ingenuity of Kevin and Lindsey: They worked closely to colleagues designing the calorimeter, and they put to use their unique expertise in software to further extend the capabilities of the experiment."

Gray also managed to write a code that extends the capabilities of PyTorch, a widely used open-source machine learning framework, to allow graph neural network models to be run remotely on devices around the world.

"Prior to this, it was extremely clunky and circuitous to build a model and then deploy it," Gray said. "Now that it's functional, you just send off data into the service, it figures out how to best execute it, and then the output gets sent back to you."

Gray and Pedro said they hope to have the graph neural networks functional by the time the LHC's Run 3 resumes in 2021. This way, the models can be trained and tested before the collider's high-luminosity upgrade, whose increased data collection capabilities will make GNNs even more valuable.

Once the networks are up and running in one place, it should be much easier to get them working in other experiments around the lab.

"You can still apply all of the same things we're learning about graph neural networks in the HGCal to other detectors in other experiments," Gray said. "The rate at which we're adopting machine learning in high-energy physics is not even close to saturated yet. People will keep finding more and more ways to apply it."

Provided by [Fermi National Accelerator Laboratory](https://phys.org/news/2020-09-graph-neural-networks-particles.html)
<https://phys.org/news/2020-09-graph-neural-networks-particles.html>

The realization of active microscale Marangoni surfers

By Ingrid Fadelli

Marangoni surfers are small particles that self-propel while straddling a fluid-fluid interface in a way similar to that in which a surfer moves on the surface of a wave. In recent years, self-propelling particles have become the focus of numerous physics studies, as they could serve as a model to study the motion of active Brownian objects with a broad range of velocities and interactions.

Researchers at ETH Zürich, Heinrich-Heine University in Düsseldorf and University College London (UCL) have recently realized active micrometric Marangoni surfers by applying laser light to Janus colloids absorbed at water-oil interfaces. Their paper, published in *Physical Review Letters*, builds on several previous studies exploring the use of light to control the motion of microswimmers.

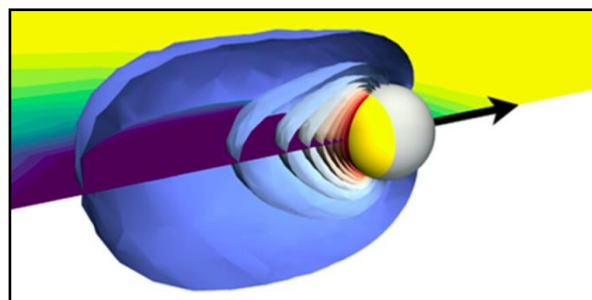
"This work came about through a continued effort to realize microswimmers that are more efficient and that can be easily controlled," Lucio Isa and Nick Jaensson, two of the researchers who carried out the study, told Phys.org. "Our results are based on an existing body of work that deals with controlling the motion of microswimmers using light and with the properties of microswimmers confined at fluid interfaces, which includes some of our previous work."

In one of their previous studies, Isa and his colleagues found that confining Janus particles at oil-water interfaces allowed these particles to self-propel via self-generated chemical gradients that sparked catalytic reactions. This effect closely resembles the one often observed in particles inside bulk suspensions.

In addition, the researchers observed that these particles could interact very strongly with each other due to the repulsive electrostatic forces that characterize objects trapped in interfaces. While this observation opened up exciting new possibilities for the study of strongly interacting active particles, catalytic swimmers are known to be particularly difficult to control using external factors. This is because their propulsion depends on the concentration of chemical fuel, which is hard to dynamically regulate.

"The solution to this problem came by coupling the generation of asymmetric temperature gradients by light-absorbing Janus particles and the well-known idea that at fluid interfaces, those generate surface tension gradients and, correspondingly, Marangoni flows that could be harnessed to propel the particles via spatially and temporally controlled illumination," Isa and Jaensson said.

Marangoni surfers are self-propelling particles, which means that they can convert external sources of energy (e.g., light) into directed motion by creating and sustaining an asymmetry in the properties of their surrounding environment (e.g., temperature profiles), in turn generating surface tension profiles. The name Marangoni is associated with the origin of this self-propelling quality, which is mediated by surface tension gradients and their corresponding fluid flows. The



Simulation results of a microscale Marangoni surfer straddling a liquid-liquid interface. The surfer has a golden cap, shown in yellow, that heats up due to laser light, which in turn induces "surfing" of the particle. The particle velocity is in the direction of the black arrow and can have a magnitude as high as 10'000 body-lengths per second. These incredible speeds are due to an intricate coupling between Marangoni stresses induced by both gradients of the temperature (depicted by the red to blue surfaces) and gradients of the surfactant concentration (depicted by the dark blue to yellow color of the interface). Credit: Nick Jaensson

manifestation of these fluid flows, which can be observed in several physical phenomena (e.g., tears of wine and propulsion of camphor boats), is known as the Marangoni effect.

"Marangoni surfers are important in physics because they constitute a new model system to study the active motion of self-propelling microscale objects with a huge dynamic range of velocities (up to 10,000 body lengths per second) and tunable interactions," Isa and Jaensson said. "The latter are mediated by the fluid interface, which also confines them in a two-dimensional plane without the presence of solid boundaries. Experimentally studying the collective motion of active particles in the absence of aggregation has been a challenge for the community and will pave the way to study two-dimensional materials such as crystals and glasses made exclusively of active components."

To realize microscale Marangoni surfers, Isa, Jaensson and their colleagues used a simple method that entails coating a particle monolayer (i.e., closely packed layer of particles) using a gold film via a technique known as sputter coating. Subsequently, they confined the particles at an oil-water interface by depositing a droplet of an aqueous suspension using a micro syringe.

Finally, the researchers illuminated the particles using a green laser. The light of this laser was absorbed by the particle's gold caps, generating an asymmetric temperature profile.

"The asymmetric temperature profile generated by the adsorption of the gold cap generates a surface tension gradient that propels the particles via Marangoni flows," Isa and Jaensson said. "In the presence of surface-active species, i.e., surfactants, the particle motion is also coupled to a concentration gradient, which generates a second surface tension profile. The balance between the two regulates propulsion."

Isa, Jaensson and their colleagues are among the first researchers to demonstrate active particles with an extremely wide range of possible propulsion velocities by harnessing Marangoni flows at the microscale. Moreover, the propulsion velocities of the particles they created can be easily regulated by simply controlling the surfactant concentration and illumination.

"The particles we demonstrated constitute a new model system that could be used to investigate the properties of a new class of active materials," Isa and Jaensson said. "We now plan to extend our studies, where we have essentially focused on characterizing the single-particle propulsion behavior and on elucidating its microscopic origins, to the case of the simultaneous control of assemblies of Marangoni surfers towards the realization of two-dimensional active materials."

More information: Kilian Dietrich et al. Microscale Marangoni Surfers, *Physical Review Letters* (2020). DOI: [10.1103/PhysRevLett.125.098001](https://doi.org/10.1103/PhysRevLett.125.098001)

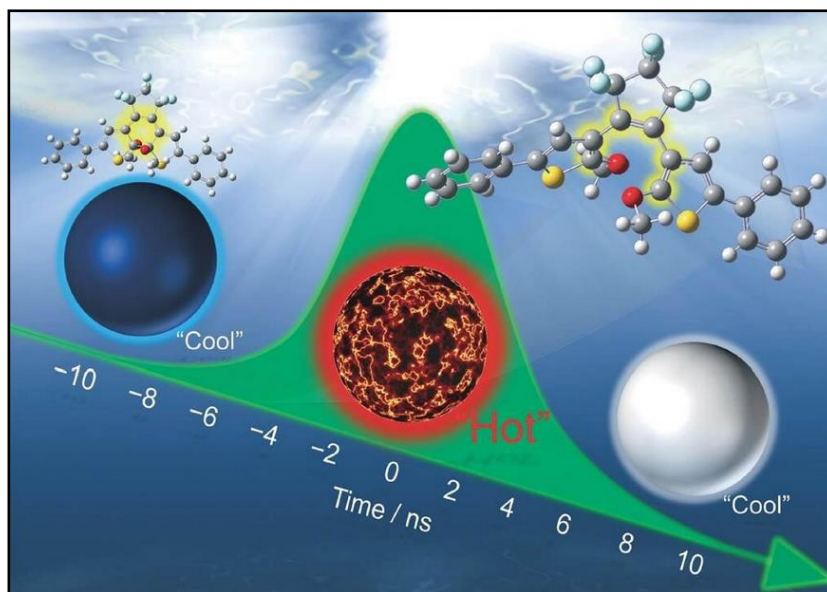
Kilian Dietrich et al. Active Atoms and Interstitials in Two-Dimensional Colloidal Crystals, *Physical Review Letters* (2018). DOI: [10.1103/PhysRevLett.120.268004](https://doi.org/10.1103/PhysRevLett.120.268004)

Journal information: *Physical Review Letters*
<https://phys.org/news/2020-09-microscale-marangoni-surfers.html>

Nanosecond laser-induced amplification of a photochromic reaction in a diarylethene nanoparticle

A research team in Ehime University found a drastically amplified ring-opening reaction yield in aqueous nanoparticle colloids of a photochromic diarylethene when induced by an intense nanosecond laser pulse, and clarified its amplification mechanism. The findings were published on July 4, 2020, in *Chemical Communications* and appeared on the back cover of the journal.

Organic molecules in a solid have a different environment from a molecule in solution because of the restricted molecular motions/vibrations and the electronically mutual interactions between neighboring molecules. The organic solids are expected to show different photochemical reactions and photophysical properties from the solution. Especially, light irradiation with high photon density such as an ultrashort pulse laser to the solid allows interactions between



multi-chromophore and multi-photons, leading to novel photochemical reactions which cannot be realized by conventional light irradiation.

Schematic illustration of the heating of the nanoparticle and the amplification of the photochemical reaction during nanosecond laser pulse excitation. Intense nanosecond 532-nm pulse laser excitation to aqueous nanoparticles colloids of a photochromic diarylethene induced drastic amplification of the ring-opening reaction yield. This mechanism was explained as a 'photosynergetic response' coupled with the nanoscale laser heating and the photochemical reaction in the nanoparticle. Credit: The Royal Society of Chemistry

In this study, researchers focused on a diarylethene derivative as an organic solid sample. Diarylethene derivatives, first synthesized by Prof. Irie at Kyushu University show a photoinduced reversible transformation between a colorless open form and a colored closed form. The chemical bond rearrangement during the photo-transformation rapidly induces not only the change of color but also of various physical and chemical properties such as fluorescence spectra, refractive indices, oxidation/reduction potentials, and chiral properties. Recently, many researchers in the world reported that diarylethene crystals showed photomechanical functions by utilizing their shape changes such as expansion/shrinkage, and bending and curling by light. Therefore, diarylethene derivatives have been attracting much attention as a next-generation photoenergy conversion material.

In this study, researchers prepared aqueous nanoparticle colloids of a closed-form diarylethene derivative by the reprecipitation method, and examined the ring-opening reaction yield from closed to open forms after irradiation of a single-shot nanosecond laser pulse (Excitation wavelength; 532 nm, Pulse duration; 6 ns). As a result, the reaction yield of the nanoparticles showed a third-order increase with the laser fluence, while that of the solution increased monotonously. That is, researchers found for the first time that the non-linear increase of the reaction yield by the

nanosecond laser pulse was observed only in the nanoparticle. The mechanism of the amplified ring-opening reaction could be explained by a "photosynergetic effect" coupled with nanoscale photothermal conversion and the photochemical reaction in a nanoparticle, on the basis of the results by the steady-state and time-resolved spectroscopies.

As distinct from the simple temperature effect, the nanoscale laser heating effect, i.e. photothermal conversion of the excited molecule and thermal conduction on the nanometer length scale, plays an important role. Briefly, one closed-form molecule excited by one photon in a ns pulse heated up surrounding molecules (generating a hot cluster consisting of plural molecules with high temperatures). When another molecule in the hot cluster absorbs another photon of the same pulse, the enhanced ring-opening reaction would take place under such a transient high-temperature condition.

This process depends on the mutual interaction between a multi-chromophore and a multi-photon, which can be induced by the combination of an organic solid with high molecular density and a ns laser pulse with a high photon density. These results will deepen understanding of the "photosynergetic response" characteristic of novel laser-induced reactions of solid photofunctional materials.

More information: Yukihide Ishibashi et al. Nanosecond laser photothermal effect-triggered amplification of photochromic reactions in diarylethene nanoparticles, *Chemical Communications* (2020). DOI: [10.1039/D0CC00884B](https://doi.org/10.1039/D0CC00884B)

Journal information: [Chemical Communications](https://pubs.rsc.org/en/content/articlelanding/2020/CC/C9CC08844B)

<https://phys.org/news/2020-09-nanosecond-laser-induced-amplification-photochromic-reaction.html>



Sat, 26 Sept 2020

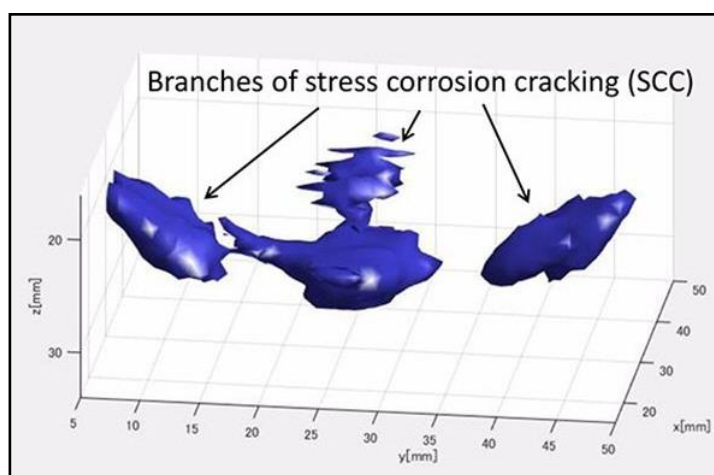
Piezoelectric and laser ultrasonic system takes 3-D ultrasound images of solids

A new system, developed by Tohoku University researchers in Japan in collaboration with Los Alamos National Laboratory in the US, takes 3-D images that can detect defects in metallic structures. The approach was published in the journal *Applied Physics Letters* and could enhance safety in power plants and airplanes.

Yoshikazu Ohara and colleagues at Tohoku University use non-destructive techniques to study structures, and wanted to find a way to produce 3-D images of structural defects. They developed a new technology, called the piezoelectric and laser ultrasonic system (PLUS), that combines the strengths of two different devices to produce high-resolution 3-D images of defects in metallic structures

"We believe that PLUS will pave the way for accurate evaluation of material strength, the identification of defects, and finding out how defects initially started to form," says Ohara.

Currently available "ultrasonic phased arrays" are a powerful tool for imaging internal defects in solids, but only in two dimensions. These devices are made of a piezoelectric one-dimensional



High-resolution 3-D imaging result of branched stress corrosion cracking. Credit: Yoshikazu Ohara, Tohoku University

array transducer with a limited number of individual elements—up to 128. Electrical pulses in the piezoelectric elements are converted to a mechanical vibration that emits ultrasonic waves into the material under investigation. Ultrasonic waves are reflected back from internal defects and converted into electric signals that can be translated into a 2-D image.

In PLUS, the waves generated in a material from a piezoelectric transducer with a single element are received by a laser Doppler vibrometer, which moves around the material's surface to get a good 2-D scan of the area. As a result of this process, it receives the scattered and reflected waves at a much larger number of "points" than those that can be received by a piezoelectric array transducer. The information received by the laser Doppler vibrometer is transmitted by an oscilloscope to a computer, where it is processed by an imaging algorithm and converted into a 3-D image.

"Ultrasonic phased arrays, which are on the cutting-edge of ultrasonic inspection, can only provide 2-D images because of their limited number of elements," says Ohara. "PLUS makes it possible to have thousands of elements as a result of incorporating the 2-D scan of a laser Doppler vibrometer in place of a piezoelectric array transducer."

Although tested only on defects in metallic materials, Ohara says their technology can be applied to other materials, including concrete and rock, simply by changing the phased array transmitter to one that emits a different range of ultrasound frequencies.

One drawback is the long data acquisition and processing time, which takes several hours. However, this can be shortened by adopting a high-speed analog-to-digital converter in place of the oscilloscope, using a more sensitive laser Doppler vibrometer, utilizing different imaging algorithms, and employing a graphical processing unit.

More information: Yoshikazu Ohara et al. Toward an ultra-high resolution phased-array system for 3D ultrasonic imaging of solids, *Applied Physics Letters* (2020). DOI: [10.1063/5.0021282](https://doi.org/10.1063/5.0021282)

Journal information: [Applied Physics Letters](https://phys.org/news/2020-09-piezoelectric-laser-ultrasonic-d-ultrasound.html)
<https://phys.org/news/2020-09-piezoelectric-laser-ultrasonic-d-ultrasound.html>



Sat, 26 Sept 2020

Physicists reveal connection between two nonperturbative parameters to help predict heavy meson production

By Liu Jia

Prof. Jia Yu from the Institute of High Energy Physics of the Chinese Academy of Sciences, and his collaborators, unveiled for the first time some deep connections between two fundamental nonperturbative parameters that characterize the intrinsic properties of heavy mesons—helpful for predicting heavy meson hard exclusive production processes with better accuracy. The study was published in *Physical Review Letters*, following up on a study published in *Physical Review D* in 2019.

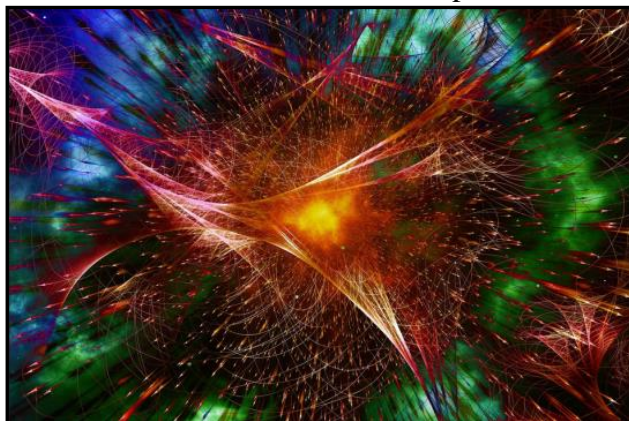
Quantum chromodynamics (QCD) is the fundamental theory to describe the strong interaction in nature, and heavy meson refers to a hadron composed of a heavy quark and a light antiquark bound by the strong force.

The study of the heavy hadron production mechanism is an important subject in the field of perturbative QCD. On the one hand, the heavy meson light-cone distribution amplitude (LCDA) defined in heavy quark effective theory (HQET) is the basic nonperturbative input parameter, which ubiquitously appears in predicting B meson exclusive decays, and plays a vital role in heavy

flavor physics. On the other hand, the collinear factorization theorem failed to tackle B meson exclusive production and instead utilizes the heavy meson LCDA defined in QCD, which is poorly constrained at present.

Over the past three decades, it was commonly believed that these two sets of nonperturbative B meson LCDAs were independent of each other.

Due to asymptotic freedom in QCD, physicists have realized that, although these two nonperturbative functions have drastically different ultraviolet behavior, they possess identical infrared behavior. Then they proposed a novel factorization theorem to link these two set of functions together: The QCD LCDA of B meson can be expressed as a convolution between the HQET LCDA of B meson and a perturbatively calculable short-distance coefficient.



Credit: Pixabay/CC0 Public Domain

This factorization program not only helps to cleanly separate the physical effects affiliated with three important energy scales intrinsic to hard exclusive B production processes, but expedites the resummation of large logarithms. The novel theorem also employs the HQET LCDA of B meson as the input parameter, which has already been extensively studied in innumerable B meson decay channels, so that one can greatly improve the accuracy of theoretical predictions.

More information: Saadi Ishaq et al. Factorization Theorem Connecting the Light-Cone Distribution Amplitudes of Heavy-Flavor Mesons in QCD and Heavy-Quark Effective Theory, *Physical Review Letters* (2020). DOI: [10.1103/PhysRevLett.125.132001](https://doi.org/10.1103/PhysRevLett.125.132001)

Saadi Ishaq et al. W radiative decay to heavy-light mesons in HQET factorization through $O(\alpha_s)$, *Physical Review D* (2019). DOI: [10.1103/PhysRevD.100.054027](https://doi.org/10.1103/PhysRevD.100.054027)

Journal information: *Physical Review Letters* , *Physical Review D*
<https://phys.org/news/2020-09-physicists-reveal-nonperturbative-parameters-heavy.html>

Business Standard

Sat, 26 Sept 2020

Highly effective Covid-19 antibodies found, may lead to passive vaccine

Unlike in active vaccination, passive vaccination involves the administration of ready-made antibodies, which are degraded after some time

Berlin: Scientists have identified highly effective antibodies against the novel coronavirus, which they say can lead to the development of a passive vaccination for COVID-19.

Unlike in active vaccination, passive vaccination involves the administration of ready-made antibodies, which are degraded after some time.

However, the effect of a passive vaccination is almost immediate, whereas with an active vaccination it has to build up first, the researchers said.

The research, published in the journal *Cell*, also shows that some SARS-CoV-2 antibodies bind to tissue samples from various organs, which could potentially trigger undesired side effects.

The scientists at the German Center for Neurodegenerative Diseases (DZNE) and Charité - Universitätsmedizin Berlin isolated almost 600 different antibodies from the blood of individuals who had overcome COVID-19, the disease triggered by SARS-CoV-2.

By means of laboratory tests, they were able to narrow this number down to a few antibodies that were particularly effective at binding to the virus.

The researchers then produced these antibodies artificially using cell cultures.

The so-called neutralising antibodies bind to the virus, as crystallographic analysis reveals, and thus prevent the pathogen from entering cells and reproducing, they said.

In addition, virus recognition by antibodies helps immune cells to eliminate the pathogen. Studies in hamsters -- which, like humans, are susceptible to infection by SARS-CoV-2 -- confirmed the high efficacy of the selected antibodies.

If the antibodies were given after an infection, the hamsters developed mild disease symptoms at most. If the antibodies were applied preventively -- before infection -- the animals did not get sick, said Jakob Kreye, coordinator of the research project.

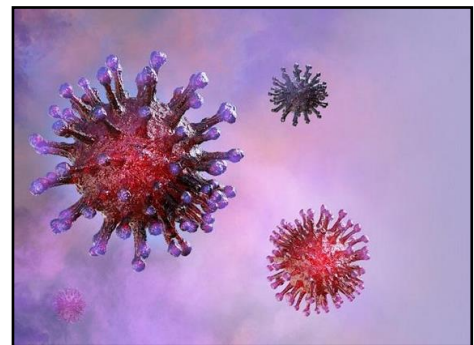
The researchers noted that treating infectious diseases with antibodies has a long history.

For COVID-19, this approach is also being investigated through the administration of plasma derived from the blood of recovered patients.

With the plasma, antibodies of donors are transferred, they said.

"Ideally, the most effective antibody is produced in a controlled manner on an industrial scale and in constant quality. This is the goal we are pursuing," said Momsen Reincke, first author of the research.

Three of our antibodies are particularly promising for clinical development, explained Harald Pruss, a research group leader at the DZNE and also a senior physician at Charité Universitätsmedizin Berlin.



However, the effect of a passive vaccination is almost immediate, whereas with an active vaccination it has to build up first, the researchers said. Photo: Shutterstock

"Using these antibodies, we have started to develop a passive vaccination against SARS-CoV-2," Pruss said.

In addition to the treatment of patients, preventive protection of healthy individuals who have had contact with infected persons is also a potential application, the researchers said.

How long the protection lasts will have to be investigated in clinical studies, they said.

This is because, unlike in active vaccination, passive vaccination involves the administration of ready-made antibodies, which are degraded after some time, Pruss said. In general, the protection provided by a passive vaccination is less persistent than that provided by an active vaccination, the researchers said.

However, the effect of a passive vaccination is almost immediate, whereas with an active vaccination it has to build up first, they said.

It would be best if both options were available so that a flexible response could be made depending on the situation, Pruss added.

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

https://www.business-standard.com/article/current-affairs/highly-effective-covid-19-antibodies-found-may-lead-to-passive-vaccine-120092501004_1.html



Sat, 26 Sept 2020

Hydroxychloroquine in COVID-19 Patients – Not Associated With Dangerous Heart Rhythms

Short-term hydroxychloroquine treatment is not associated with lethal heart rhythms in patients with COVID-19 who are risk assessed prior to receiving the drug. That's the finding of research published today (September 25, 2020) in *EP Europace*, a journal of the European Society of Cardiology (ESC).^[1]

"This was the largest study to assess the risk of dangerous heart rhythms (arrhythmias) in COVID-19 patients treated with hydroxychloroquine," said study author Dr. Alessio Gasperetti of Monzino Cardiology Centre, Milan, Italy and University Hospital Zurich, Switzerland. "In our cohort, there was a low rate of arrhythmias and none were associated with hydroxychloroquine."



The study began when there was very little experience using hydroxychloroquine to treat patients with COVID-19. Current evidence suggests that it is ineffective in patients with advanced disease but there is debate around its effectiveness in the early phase.^[2,3] This study was not designed to test the effectiveness of hydroxychloroquine in COVID-19 but rather to examine cardiac safety.

Hydroxychloroquine is known to cause an electrical change in the heart in some patients. It is called QT prolongation because of the pattern on the electrocardiogram (ECG). This electrical pattern is linked with an increased risk of deadly heart rhythms.

Hydroxychloroquine has been used for decades to treat lupus and rheumatoid arthritis and prevent malaria. But the COVID-19 pandemic is the first time the drug has been used in large numbers of acutely ill patients with multiple health conditions and possibly receiving other QT-prolonging drugs. The scale of the pandemic raises the likelihood of inherited heart problems that

predispose patients to arrhythmias. In addition, changes in blood electrolytes, which can trigger arrhythmias, can occur in those needing treatment in an intensive care unit (ICU).

This study was conducted to assess ECG changes and arrhythmias in COVID-19 patients treated with hydroxychloroquine in different clinical settings.

A total of 649 COVID-19 patients were enrolled from seven institutions between 10 March and 10 April 2020. The average age was 62 years and 46% were men. A risk calculator was used to assess the likelihood of QT prolongation and decide the treatment setting. All patients had an ECG before starting treatment and at least one follow-up measurement.

In all centers, patients took 200 mg hydroxychloroquine twice a day (i.e. a total of 400 mg per day). More than half of patients (58.6%) took a loading dose on the first day, meaning they received 400 mg twice on that day (i.e. a total of 800 mg).

Hydroxychloroquine was administered early after symptom onset in three different care settings: 126 (19.4%) patients were managed at home, 495 (76.3%) were hospitalized in a medical ward, and 28 (4.3%) patients were treated in ICU. In line with real-world practice, 30% of patients received two QT-prolonging drugs, and 13.6% received three (including hydroxychloroquine).

A significant QT interval prolongation was observed in the overall cohort, but the magnitude of the increase was modest and similar across care settings. The most important determinants of QT prolongation during hydroxychloroquine treatment were fever at admission and baseline QT length.

Over a median follow-up of 16 days, there were no lethal arrhythmias. A total of seven patients (1.1%) had a serious ventricular arrhythmia, but none were deemed related to QT prolongation or to hydroxychloroquine treatment.

Dr. Gasperetti said: “Hydroxychloroquine treatment was associated with QT prolongation, as expected, but the change was small. There was no connection between the drug and the occurrence of arrhythmias. The study shows that hydroxychloroquine administration, alone or in combination with other potentially QT-prolonging drugs, is safe for short-term treatment of COVID-19 patients at home or in hospital, provided that they undergo risk assessment and ECG monitoring by a physician.”

References:

1. “Arrhythmic safety of hydroxychloroquine in COVID-19 patients from different clinical settings” by Alessio Gasperetti, Mauro Biffi, Firat Duru, Marco Schiavone, Matteo Ziacchi, Gianfranco Mitacchione, Carlo Lavalle, Ardan Saguner, Antonio Lanfranchi, Giacomo Casalini, Marco Tocci, Davide Fabbricatore, Francesca Salghetti, Marco Valerio Mariani, Mattia Busana, Alfonso Bellia, Chiara Beatrice Cogliati, Pierluigi Viale, Spinello Antinori, Massimo Galli, Nazzareno Galiè, Claudio Tondo and Giovanni Battista Forleo, 25 September 2020, *EP Europace*.
[DOI: 10.1093/europace/euaa216](https://doi.org/10.1093/europace/euaa216)
2. “Observational Study of Hydroxychloroquine in Hospitalized Patients with Covid-19” by Joshua Geleris, M.D., Yifei Sun, Ph.D., Jonathan Platt, Ph.D., Jason Zucker, M.D., Matthew Baldwin, M.D., George Hripcsak, M.D., Angelena Labella, M.D., Daniel K. Manson, M.D., Christine Kubin, Pharm.D., R. Graham Barr, M.D., Dr.P.H., Magdalena E. Sobieszczyk, M.D., M.P.H. and Neil W. Schluger, M.D., 18 June 2020, *New England Journal of Medicine*. [DOI: 10.1056/NEJMoa2012410](https://doi.org/10.1056/NEJMoa2012410)
3. “A Randomized Trial of Hydroxychloroquine as Postexposure Prophylaxis for Covid-19” by David R. Boulware, M.D., M.P.H., Matthew F. Pullen, M.D., Ananta S. Bangdiwala, M.S., Katelyn A. Pastick, B.Sc., Sarah M. Lofgren, M.D., Elizabeth C. Okafor, B.Sc., Caleb P. Skipper, M.D., Alanna A. Nascene, B.A., Melanie R. Nicol, Pharm.D., Ph.D., Mahsa Abassi, D.O., M.P.H., Nicole W. Engen, M.S., Matthew P. Cheng, M.D., Derek LaBar, Pharm.D., Sylvain A. Lothier, M.D., Lauren J. MacKenzie, M.D., M.P.H., Glen Drobot, M.D., Nicole Marten, R.N., Ryan Zarychanski, M.D., Lauren E. Kelly, Ph.D., Ilan S. Schwartz, M.D., Ph.D., Emily G. McDonald, M.D., Radha Rajasingham, M.D., Todd C. Lee, M.D., M.P.H. and Kathy H. Hullsiek, Ph.D., 6 August 2020, *New England Journal of Medicine*. [DOI: 10.1056/NEJMoa2016638](https://doi.org/10.1056/NEJMoa2016638)
<https://scitechdaily.com/research-shows-cardiac-safety-of-hydroxychloroquine-in-covid-19-patients-not-associated-with-dangerous-heart-rhythms/>

