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समाचार पत्रों से चयित अंश Newspapers Clippings

A Daily service to keep DRDO Fraternity abreast with DRDO Technologies, Defence Technologies, Defence Policies, International Relations and Science & Technology

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Wed, 22 Sept 2021

India completely "Atmanirbhar" in missile technology, Says DRDO Chairman

Speaking at an online event hosted by JNU, he asserted that if a country has to become "Atmanirbhar", "we need to work on advanced technology"

New Delhi: India has achieved "complete self-reliance" in missile technology and the most advanced missiles can now be developed in the country, DRDO Chairman G Satheesh Reddy said today.

Delivering a lecture during an online event hosted by the JNU, he also asserted that if a country has to become prosperous and "Atmanirbhar" (self-reliant), "we need to work on advanced technology" and that is where the role of academic institutions will come in a "big way".

Mr Reddy recalled the decades of 1980s and 90s in the evolution of the Defence Research and Development Organisation (DRDO) and hailed the role of scientists, including former president APJ Abdul Kalam, known as the "Missile Man" of India, who worked on missile technologies that provided a "quantum jump" in development of advanced systems and platforms.

He mentioned the five missiles -- Prithvi, Agni, Akash, Trishul Nag -- developed by India under the Integrated Guided Missile Development Programme (IGMDP).

"We developed Prithvi, Agni, Akash, Trishul, Nag under the IGMDP. Agni was also a technology demonstrator for the country in going out of the atmosphere and returning to the atmosphere.

"And, then we joined a select club of countries with ballistic missiles which can intercept an enemy missile and kill it. And, then many more missiles with long-range and more capabilities," he said.

"Today I can confidently say that we are having complete "Atmanirbharta" in missile technology, and we can develop the most advanced missiles in the country," Mr Reddy said.

He also spoke about the anti-satellite (A-SAT) test that India conducted in March 2019, shooting down one of its satellites in space with an A-SAT missile to demonstrate this complex capability, joining the elite club of countries -- the US, Russia and China -- which have such capabilities.

The lecture on "Defence Technologies for India's National Security" was organised by the School of Engineering of the JNU, and its vice chancellor M Jagadesh Kumar, several faculty and students also attended the online event.



G Satheesh Reddy said India can now develop the most advanced missiles. File

Mr Reddy, who is secretary, Department of Defence R&D, also asserted that in the last six-seven years, he has seen various students and innovators, going beyond ICT, and choosing subjects like material science that will be important in the sector of defence technologies.

He pitched for academic institutions to play a larger role in achieving the vision of "Atmanirbhar Bharat".

"Today, if our country has to be self-reliant, if we have to become 'Atmanirbhar' and prosperous, we need to work on advanced technology and that is where the role of academic institutions will come in a big way," Mr Reddy said.

He spoke of the centres of excellence that have come up at various IITs, and opportunities for students to work as a junior research fellow and a senior research fellow at DRDO.

In the advanced technology domain, he said, some of the areas in which DRDO is working include anti-drone systems, artificial intelligence, cyberspace, secure systems and communications.

<https://www.ndtv.com/india-news/india-completely-atmanirbhar-in-missile-technology-says-drdo-chairman-2548960>

नवभारत टाइम्स

Wed, 22 Sept 2021

भारत मिसाइल प्रौद्योगिकी में पूरी तरह से 'आत्मनिर्भर' है: डीआरडीओ प्रमुख

नयी दिल्ली: रक्षा अनुसंधान एवं विकास संगठन (डीआरडीओ) के प्रमुख जी सतीश रेड्डी ने मंगलवार को कहा कि भारत ने मिसाइल प्रौद्योगिकी में "पूर्ण आत्मनिर्भरता" हासिल कर ली है और अब देश में बेहद उन्नत मिसाइलों को विकसित किया जा सकता है।

जवाहरलाल नेहरू विश्वविद्यालय (जेएनयू) की ओर से आयोजित एक ऑनलाइन कार्यक्रम में रेड्डी ने कहा कि अगर एक देश को समृद्ध और 'आत्मनिर्भर' बनना है, तो "हमें उन्नत प्रौद्योगिकी पर काम करने की जरूरत है" और शिक्षण संस्थानों की इसमें बड़ी भूमिका है।

रेड्डी ने 1980 और 90 के दशक में डीआरडीओ के विकास को याद किया और मिसाइल प्रौद्योगिकियों पर काम करने वाले पूर्व राष्ट्रपति एपीजे अब्दुल कलाम, जिन्हें भारत के 'मिसाइल मैन' के रूप में जाना जाता है, सहित अन्य वैज्ञानिकों की भूमिका की सराहना की।

उन्होंने एकीकृत निर्देशित मिसाइल विकास कार्यक्रम (आईजीएमडीपी) के तहत भारत द्वारा विकसित पांच मिसाइलों - पृथ्वी, अग्नि, आकाश, त्रिशूल और नाग का जिक्र किया।

उन्होंने कहा, "हमने आईजीएमडीपी के तहत पृथ्वी, अग्नि, आकाश, त्रिशूल, नाग का विकास किया।"

रेड्डी ने कहा, "और फिर हम बैलेस्टिक मिसाइलों वाले उन चुनिंदा देशों में शामिल हो गए जो दुश्मन की मिसाइल को रोक सकते हैं और उसे मार सकते हैं। और, फिर लंबी दूरी और अधिक क्षमताओं वाली कई और मिसाइलें बनीं।"

उन्होंने कहा, "आज मैं पूरे विश्वास के साथ कह सकता हूँ कि हमारे पास मिसाइल प्रौद्योगिकी में पूर्ण आत्मनिर्भरता है और हम देश में बेहद उन्नत मिसाइल विकसित कर सकते हैं।"

उन्होंने उपग्रह रोधी (ए-सैट) परीक्षण के बारे में भी बात की है जिसमें मार्च 2019 में भारत ने ए-सैट मिसाइल से अंतरिक्ष में अपने एक उपग्रह को मार गिराया गया था और अपनी इस क्षमता का प्रदर्शन

किया था। इसके बाद बाद भारत अमेरिका, रूस तथा चीन जैसे देशों के प्रतिष्ठित क्लब में शुमार हो गया था जिनके पास ऐसी क्षमता है।

जेएनयू के इंजीनियरिंग स्कूल ने 'भारत की राष्ट्रीय सुरक्षा के लिए रक्षा प्रौद्योगिकी' पर व्याख्यान का आयोजन किया था जिसमें विश्वविद्यालय के कुलपति एम जगदीश कुमार, संकाय के कई सदस्यों एवं विद्यार्थियों ने ऑनलाइन हिस्सा लिया।

<https://navbharattimes.indiatimes.com/india/india-is-completely-self-reliant-in-missile-technology-drdo-chief/articleshow/86407555.cms>



Wed, 22 Sept 2021

भास्कर एक्सप्लेनर: भारत कल करेगा अग्नि-5 का टेस्ट; इस मिसाइल से क्यों घबराया हुआ है चीन? क्या है इसकी खासियत? जानें सब कुछ

लेखक: आबिद खान

भारत 23 सितंबर को अग्नि-5 मिसाइल का यूजर टेस्ट करने जा रहा है। न्यूक्लियर हथियारों को ले जाने में सक्षम इस मिसाइल का ये 8वां टेस्ट होगा। 5000 किलोमीटर तक रेंज की इस मिसाइल की जद में चीन के कई शहर भी आ जाएंगे। मीडिया में मिसाइल के टेस्ट की खबरों के बीच अपनी विस्तारवादी नीतियों के लिए कुख्यात चीन भी शांति और सुरक्षा की बातें करने लगा है। भारत ने इसी साल जून में अग्नि प्राइम का भी टेस्ट किया था और अग्नि-6 पर भी काम कर रहा है।

इस मिसाइल के सेना में शामिल होने के बाद भारत दुनिया के उन एलीट देशों में शामिल हो जाएगा, जिनके पास न्यूक्लियर हथियारों से लैस इंटर कॉन्टिनेंटल बैलिस्टिक मिसाइल (ICBM) है।

आइए समझते हैं, अग्नि-5 की खासियत क्या है? क्या पाकिस्तान और चीन के पास भी इस तरह की मिसाइल है? मिसाइल के टेस्ट को लेकर चीन ने क्या कहा है? और चीन UNSC के किस प्रस्ताव की बात कर रहा है?

अग्नि-5 की ताकत क्या है?

• अग्नि-5 भारत की पहली और एकमात्र इंटर कॉन्टिनेंटल बैलिस्टिक मिसाइल है, जिसे रक्षा अनुसंधान एवं विकास संगठन (DRDO) ने बनाया है। ये भारत के पास मौजूद लंबी दूरी की मिसाइलों में से एक है।

• इस मिसाइल की रेंज 5 हजार किलोमीटर है। अग्नि-5 बैलिस्टिक मिसाइल एक साथ कई हथियार ले जाने में सक्षम है।



अग्नि-5 की खासियत	
■ लंबाई	17 मीटर
■ चौड़ाई	2 मीटर
■ वजन	50 टन
■ रेंज	5,000 किलोमीटर
■ टाइप	इंटर कॉन्टिनेंटल बैलिस्टिक मिसाइल (ICBM)
■ डिजाइनर	DRDO
■ वॉरहेड कैपेसिटी	1.5 टन
■ मैक्सिमम स्पीड	29 हजार kmph

- ये मल्टीपल इंडिपेंडेंटली टार्गेटेबल रिपट्री व्हीकल (MIRV) से लैस है। यानी एक साथ मल्टीपल टार्गेट के लिए लॉन्च की जा सकती है।
- यह मिसाइल डेढ़ टन तक न्यूक्लियर हथियार अपने साथ ले जा सकती है। इसकी स्पीड मैक 24 है यानी आवाज की स्पीड से 24 गुना ज्यादा।
- अग्नि-5 के लॉन्चिंग सिस्टम में कैनिस्टर तकनीक का इस्तेमाल किया गया है। इस वजह से इस मिसाइल को कहीं भी आसानी से ट्रांसपोर्ट किया जा सकता है।
- अग्नि-5 मिसाइल का इस्तेमाल भी बेहद आसान है, इस वजह से देश में कहीं भी इसकी तैनाती की जा सकती है।



मिसाइल	रेंज (किलोमीटर में)	पहला टेस्ट
अग्नि 1	700	22 मई 1989
अग्नि 2	2,000	11 अप्रैल 1999
अग्नि 3	3,000	9 जुलाई 2006
अग्नि 4	4,000	10 दिसंबर 2010
अग्नि 5	5,000	19 अप्रैल 2012

इस मिसाइल का थोड़ा सा इतिहास भी जान लीजिए

ये अग्नि सीरीज की 5वीं मिसाइल है। 19 अप्रैल

2012 को उड़ीसा में इसका पहला टेस्ट किया गया था, जो सफल रहा था। जनवरी 2015 में मिसाइल का पहला कैनिस्टर टेस्ट किया गया था। तब मिसाइल को रोड मोबाइल लॉन्चर से लॉन्च किया गया था। 10 दिसंबर 2018 को मिसाइल का आखिरी टेस्ट किया गया। खास बात ये है कि अब तक मिसाइल के 7 टेस्ट किए जा चुके हैं, सभी सफल रहे हैं। अग्नि-5 को 2020 में ही सेना में शामिल करने की तैयारी थी, लेकिन कोरोना की वजह से टेस्ट में देरी हो गई।

क्या पाकिस्तान-चीन के पास इस तरह की मिसाइल है?

- पाकिस्तान की गौरी-2 मिसाइल की रेंज 2300 किलोमीटर और शाहीन-2 मिसाइल की रेंज 2500 किलोमीटर है। पाकिस्तान शाहीन-3 पर भी काम कर रहा है, जिसकी रेंज 2700 किलोमीटर तक हो सकती है।
- चीन के पास भारत के मुकाबले ज्यादा रेंज और आधुनिक तकनीक की मिसाइल है। चीन की डीएफ-31 मिसाइल की रेंज 8000 किलोमीटर और डीएफ-41 मिसाइल की रेंज 12000 किलोमीटर है।

मिसाइल के टेस्ट को लेकर चीन ने क्या कहा?

अग्नि-5 के टेस्ट के बारे में चीनी विदेश मंत्रालय के प्रवक्ता झाओ लिजान ने कहा है कि दक्षिण एशिया में शांति, सुरक्षा और स्थिरता बनाए रखने में सभी का साझा हित है। उन्होंने कहा कि हमें उम्मीद है कि सभी पक्ष इस दिशा में रचनात्मक प्रयास करेंगे। लिजान ने कहा कि भारत न्यूक्लियर हथियार ले जाने में सक्षम बैलिस्टिक मिसाइलों का विकास नहीं कर सकता है। इस बारे में संयुक्त राष्ट्र सुरक्षा परिषद (UNSC) के प्रस्ताव 1172 में पहले ही स्पष्ट नियम हैं।

चीन UNSC के किस प्रस्ताव की बात कर रहा है?

चीन UNSC के प्रस्ताव 1172 के बारे में बात कर रहा है। सुरक्षा परिषद का प्रस्ताव 1172 जून 1998 में किए गए परमाणु परीक्षण के बाद लागू किया गया था। प्रस्ताव में भारत और पाकिस्तान के परमाणु कार्यक्रम को बंद करने और दोनों देशों से और परमाणु परीक्षणों से परहेज करने को कहा गया था। इसमें दोनों देशों से न्यूक्लियर हथियार ले जाने में सक्षम बैलिस्टिक मिसाइलों के डेवलपमेंट को रोकने का आग्रह भी किया गया था। हालांकि भारत इस प्रस्ताव को मानने के लिए बाध्य नहीं है।

अभी किन-किन देशों के पास है ICBM?

फिलहाल दुनिया के मुट्ठीभर देशों के पास ही इंटर कॉन्टिनेंटल बैलिस्टिक मिसाइल (ICBM) हैं। इनमें रूस, अमेरिका, चीन, फ्रांस, इजराइल, ब्रिटेन और उत्तर कोरिया शामिल हैं। भारत इस ताकत से लैस होने वाला दुनिया का 8वां देश होगा।

<https://www.bhaskar.com/db-original/explainer/news/agni-5-missile-range-vs-pakistan-china-india-nuclear-weapons-intercontinental-ballistic-missile-128951242.html>

COVID 19: DRDO's Contribution



Wed, 22 Sept 2021

तीसरी लहर को देखते हुए 1055 बेड की जिले में है व्यवस्था

गुमला: झारखंड विधानसभा की प्राक्कलन समिति का दो दिवसीय दौरा के तहत मंगलवार को गुमला आगमन हुआ। समिति के सभापति दीपक बिरुआ तथा सदस्य लंबोदर महतो ने गुमला परिसर में जिले में विभिन्न विभागों द्वारा संचालित योजनाओं की विस्तृत समीक्षा की। बुधवार को समिति द्वारा स्थल अध्ययन के तहत संचालित योजनाओं का भौतिक निरीक्षण किया जाएगा। समीक्षा के दौरान स्वास्थ्य विभाग को कोविड की संभावित तीसरी लहर से बचाव व रोकथाम हेतु पूर्व तैयारी का निर्देश दिया गया। जिसपर सिविल सर्जन डॉ राजू कच्छप द्वारा जानकारी दी गई कि जिले में कोविड-19 से प्रभावित होने वाले मरीजों के समुचित ईलाज हेतु 1055 बेड उपलब्ध हैं, जिसमें से 742 बेड जिला अस्पताल में तथा शेष 313 बेड प्राइवेट अस्पतालों में व्यवस्थित किए गए हैं। वहीं सरकारी अस्पतालों में सामान्य बेडों की संख्या 220 है तथा प्राइवेट अस्पतालों में सामान्य बेडों की संख्या 154 है। इसके साथ ही 552 ऑक्सीजन युक्त बेड सरकारी अस्पतालों में व 32 प्राइवेट अस्पतालों में उपलब्ध हैं। कोविड से बचाव हेतु अब तक गुमला जिले में 07 लाख 28 हजार निर्धारित लक्ष्य के विरुद्ध 04 लाख 55 हजार लोगों को प्रथम डोज व 01 लाख 03 हजार 822 लोगों को द्वितीय डोज दिया गया है। जिले में कोविशील्ड के 1615 वायल व कोवैक्सीन के 1232 वायल उपलब्ध हैं। जिले में डीआरडीओ के माध्यम से पीएसए प्लांट की अदिष्ठापना अपने अंतिम चरणों में है। जिले में 09 सामुदायिक स्वास्थ्य केंद्र तथा 14 सामुदायिक स्वास्थ्य केंद्र हैं। इसके साथ ही पथ प्रमंडल, विशेष प्रमंडल, शिक्षा विभाग, खनन,नगर परिषद, आपूर्ति, कृषि, पशुपालन, सहकारिता, जिला समाज कल्याण, वन पर्यावरण, भवन निर्माण प्रमंडल, पेयजल एवं स्वच्छता प्रमंडल, श्रम नियोजन प्रशिक्षण विभाग, परिवहन विभाग, ऊर्जा विभाग के कार्यों की भी समीक्षा कर आवश्यक दिशा-निर्देश दिए गए।

बैठक में समिति के सभापति दीपक बिरुआ सहित सदस्य लंबोदर महतो, उप विकास आयुक्त संजय बिहारी अंबष्ठ, वन प्रमण्डल पदाधिकारी श्रीकांत, परियोजना निदेशक आईटीडीए इंदु गुप्ता, अपर समाहन्ता सुधीर कुमार गुप्ता, सिविल सर्जन डॉ.राजू कच्छप, सदर अनुमंडल पदाधिकारी रवि आनंद समेत संबंधित विभागों के पदाधिकारी व कार्यपालक अभियंता उपस्थित थे।

<https://www.jagran.com/jharkhand/gumla-gumla-news-22041965.html>

Centre names Air Marshal VR Chaudhari as next IAF Chief

Chaudhari is currently serving as IAF's vice chief. Chaudhari will take over the top job at a critical time when the armed forces are working out the details of the theaterisation model

By Rahul Singh

New Delhi: The Union government on Tuesday announced that Air Marshal Vivek Chaudhari will take over as the next chief of the Indian Air Force (IAF) after Air Chief Marshal RKS Bhadauria retires on September 30.

Chaudhari is currently serving as IAF's vice chief.

The government has followed the seniority principle in appointing Chaudhari to the top job. He will be most senior IAF officer the day Bhadauria retires. An experienced pilot, Chaudhari has logged more than 3,800 hours of flying on a variety of fighter planes such as MiG-21, MiG-29 and Sukhoi-30.

He also flew air defence missions during the 1999 Kargil war with Pakistan.

He was commissioned into the air force's fighter stream in December 1982. Before taking charge of his current appointment as vice chief, Chaudhari was the Air Officer Commanding-in-Chief of the operationally critical Western Air Command (WAC). He commanded WAC at a time when the IAF was inducting its new Rafale fighter jets at Ambala, and operationalising them at the earliest was a top priority amid the border row with China in the Ladakh sector.

He earlier held the appointment of IAF deputy chief at the Air Headquarters in Delhi and steered a raft of key procurements to sharpen IAF's combat edge.

As deputy chief, he was closely associated with the Rafale programme -- he was the head of the bilateral high-level group monitoring the progress of the fighter jet project in France.

He has commanded important fighter bases in his military career including a front-line base in Kashmir.

Chaudhari will take over the top job at a critical time -- the armed forces are working out the details of the theaterisation model to best utilise the military's resources, and he will also oversee several key projects to sharpen the IAF's combat potential.

"He has his work cut out for him and I am sure he will do a great job," said former IAF chief Air Chief Marshal Fali Major (retd).

The current theaterisation model, which has the full backing of the government, seeks to set up four new integrated commands for synergy in operations -- two land-centric theatres, the Air Defence Command, and the National Maritime Theatre Command.



Air Marshal VR Chaudhari
(Ministry of Defence via Wikimedia Commons)

The air force has had some reservations about the model that came out in the open in July, when Bhadauria argued at an event that it was critical to first get the structure right. Speaking separately at the same event, chief of defence staff General Bipin Rawat gave out details of the theaterisation plan and brushed aside IAF's reservations.

Asset split, leadership and dilution of the powers of the chiefs are key concerns for the IAF on the theaterisation move, as previously reported by HT.

Chaudhari takes over months ahead of the scheduled induction of a key weapons system being imported from Russia to strengthen India's air defence architecture. India is set to begin the induction of the S-400 Triumf air defence missile systems ordered from Russia for ₹39,000 crore in October 2018. India is buying five S-400 missile systems capable of destroying a variety of aerial threats, including enemy fighter jets and missiles, at a range of 400km, with the first deliveries expected by the year-end.

Chaudhari's appointment also comes at a time when the indigenous (light combat aircraft) Mk-1A jet project is set to enter a critical phase. State-run plane maker Hindustan Aeronautics Limited (HAL) has set a March 2022 deadline to carry out the first flight of the fighter jet.

In February 2021, the defence ministry awarded a ₹48,000 crore contract to HAL for 83 LCA Mk-1A jets for the IAF. The first Mk-1A aircraft will be delivered to the air force by March 2024, with the rest slated to join its combat fleet by 2029.

Also, the government recently cleared some key projects that are expected to make progress during Chaudhari's term as IAF chief. Earlier this month, the Cabinet Committee on Security (CCS) cleared the much-delayed purchase of 56 C-295 medium transport aircraft to replace the IAF's ageing fleet of Avro-748 planes. The C-295 project is estimated to be worth ₹22,000 crore.

CCS also cleared a Defence Research and Development Organisation (DRDO) proposal to develop new airborne early warning and control (AEW&C) aircraft for the IAF using Airbus jets bought from Air India. The project is estimated to be worth around ₹11,000 crore.

<https://www.hindustantimes.com/india-news/centre-names-air-marshal-vr-chaudhari-as-next-iaf-chief-101632248357601.html>

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Indian Army Chief General MM Naravane meets Italian Envoy; Discusses Bilateral Cooperation

Indian Army Chief General MM Naravane met with Ambassador of Italy to India Vincenzo De Luca in New Delhi and discussed the future bilateral cooperation

By Anchal Nigam

Indian Army Chief General MM Naravane on September 21 met with Ambassador of Italy to India Vincenzo De Luca in New Delhi and discussed the future bilateral cooperation in the defence and defence industry. While sharing images from the meeting, the Additional Directorate General of Public Information-Indian Army said on Twitter on Tuesday that Luca called on Naravane and discussed the matters of mutual interest.

Additionally, the Embassy of Italy in India called the meeting between the Indian army chief and Italian envoy “fruitful” and added that both discussed the future of bilateral cooperation in the defence industry. The meeting came after in July, the Indian Army chief visited Italy during his visit to Italy and UK. The aim of his visit was to further elevate the bilateral strategic expansion.



India, Italy sign disaster risk reduction pact

Meanwhile, in the wake of increasing natural disasters, the Union Cabinet led by Prime Minister Narendra Modi agreed to the Memorandum of Understanding (MoU) in the field of Disaster Risk Reduction and Management between India and Italy. As per media reports, the collaboration will establish a system wherein both the nations will be benefitted from the Disaster management mechanisms of each other. It would also help in enhancing the areas of preparedness, response and capacity building for managing disasters such as forest fires, earthquakes, tsunamis, among several others.

Earlier, on August 27, Prime Minister Narendra Modi spoke with Italian counterpart Mario Draghi to discuss the crisis which were unfolding in Afghanistan at the time as the Taliban had just taken over the country.

As per the official statement released by the government regarding the conversation between the two leaders, “They strongly condemned the horrific terror attack at the Kabul International Airport yesterday and emphasised the need to ensure the safe repatriation of stranded people...The two leaders also discussed other important issues on the G20 agenda, such as climate change. In this context, they exchanged views on other forthcoming multilateral engagements too, such as COP-26.”

“The two leaders agreed to remain in touch on bilateral and global issues, especially on the situation in Afghanistan,” it added.

<https://www.republicworld.com/india-news/general-news/indian-army-chief-general-mm-naravane-meets-italian-envoy-discusses-bilateral-cooperation.html>

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Naravane discusses 'Issues of Mutual Interest' with Bangladesh Army's Quarter Master Gen

Indian Army Chief General MM Naravane on Tuesday, 21 September, met Lieutenant General Mohammad Saiful Alam, Quarter General, Bangladesh Army

By Bhavya Sukheja

Indian Army Chief General MM Naravane on Tuesday, 21 September, met Lieutenant General Mohammad Saiful Alam, Quarter General, Bangladesh Army. In a Twitter post, the Indian Army informed that Naravane and Saiful Alam discussed “issues of mutual interest” at South Block, New Delhi.

The meeting between Naravane and Saiful Alam comes after Chief of Army Staff of Bangladesh Army General SM Shafiuddin Ahmed visited India earlier this month. According to ANI, during his visit, he held talks with India’s top military brass on strengthening defence cooperation between the two countries. Ahmed also held talks with Chief of Defence Staff General Bipin Rawat on issues of bilateral defence cooperation.



In New Delhi, General SM Shafiuddin Ahmed paid tribute at the National War Memorial to the Indian soldiers who died in the Independence war. Shafiuddin Ahmed received the guard of honour at the South Block in the national capital.

India-Bangladesh relation

Meanwhile, India is observing Swarnim Vijay Varsh celebrations to mark 50 years of its victory over Pakistan and the liberation of Bangladesh in the 1971 war. It is worth mentioning that India and Bangladesh are involved in many activities and projects. The two nations share a great rapport and the relationship between the two have also strengthened over the last year.

Recently, Bangladesh established the Bangabandhu Media Centre at the Press Club of India. On the direction of the central government, the Indian Council of Cultural Relations (ICCR) established the Bangabandhu chair, promoting research and developmental studies related to Bangladesh. Moreover, for the last so many years, India has been proactively in touch with neighbouring Bangladesh on various issues including construction projects, health assistance to Bangladesh, financial assistance, and more.

<https://www.republicworld.com/world-news/rest-of-the-world-news/naravane-discusses-issues-of-mutual-interest-with-bangladesh-armys-quarter-master-gen.html>

Caught in the cross-currents

The submarine subterfuge that has left France fuming didn't target the enemies of the new troika of America, Britain and Australia, instead, it has struck at historic alliances

By Charu Sudan Kasturi

Submarines are devices of deception. They're meant to hide their true positions and quietly torpedo the enemy's vessels. In the ongoing diplomatic stand-off between the United States of America, the United Kingdom and Australia on the one hand and France on the other over nuclear submarines, they've lived up to that reputation of stealth.

But there's one big twist that India must note. The submarine subterfuge that has left France fuming didn't target the enemies of the new troika of America, Britain and Australia, dubbed Aukus. It has, instead, struck at historic alliances: Nato and the US-France partnership that has stood the test of time since the American War of Independence.



To be sure, there are elements of the Aukus deal that suit India's strategic interests well. As a part of the new alliance, the US and the UK will sell Australia nuclear-powered submarines. That represents a definite and deeper commitment from both Washington and London to the security of the Indo-Pacific region, where they — and other countries, including Australia — share India's worries about China's increasingly expansionist inclinations.

India isn't part of any security alliance but has significantly ramped up its multilateral partnerships in a part of the world that New Delhi considers its extended neighbourhood. It has trilaterals with the US and Japan, and separately with Japan and Australia. And then there's the so-called Quad — a grouping of India, the US, Japan and Australia. Leaders of the four Quad countries will meet at a physical summit for the first time later this week on September 24 in Washington.

New Delhi's active participation in the Quad has riled Beijing in recent years. China sees the initiative — and other such multilateral platforms — as efforts aimed at containing its rise. The new Aukus alliance could take away some of the heat from the Quad, a scenario that India wouldn't mind.

So what's the problem?

India has long seen itself as a central pillar of any security architecture in the region. The Quad reinforced that conviction in South Block. But while India was informed in advance about the formation of the new Aukus alliance, senior officials have confirmed to this writer that New Delhi was not told about the plan to supply Canberra with nuclear submarines.

And frankly, New Delhi can hardly expect any better if the US kept its oldest ally, France, in the dark. The nuclear submarine deal with Australia torpedoed a 2016 deal under which Paris was to supply Canberra with submarines. A seething France has withdrawn its ambassadors from Washington and Canberra and is keeping the US president, Joe Biden, waiting for a phone call from its president, Emmanuel Macron.

The message is clear: to the US game plan in the Indo-Pacific, even close friends like India and old allies like France matter only so much. They're merely cogs in the wheel of a grand strategy, each serving a purpose, but not worthy of being treated as an equal, trusted partner.

There are other reasons to worry too. The deal with Australia — and the strike against the Paris-Canberra submarine pact — comes at a time when Macron and a few other leaders in the European

Union have been arguing for greater strategic freedom from the US. Some experts have suggested that Washington's move is a response to those voices in Europe.

If that's the case, what does this mean for India — a country that since independence in 1947 has fiercely guarded its strategic autonomy, refusing to get drawn into the orbit of any major power? That's an approach that all Indian governments have followed. Is the Biden administration sending a subtle message to India too — that the search for autonomy could carry costs?

Then there's the confusion that too many cooks breed. When India, Japan, the US and Australia work together in the Quad, what do they additionally gain through sub-groupings like the one between India, the US and Japan, and between India, Japan and Australia? After all, Japan and Australia are treaty partners of the US. India needs to be careful that it ends up with more than just a soup of overlapping trilaterals that could work more effectively if they were consolidated.

And finally, New Delhi must stay cautious so that it doesn't get caught up in the crossfire emanating from tiffs involving its friends. France is India's oldest strategic partner, a country that has stood by New Delhi when America, Australia and others wouldn't. Even more importantly, France has the largest security presence in the Indo-Pacific region of all European nations, with bases in Djibouti and in overseas territories like Mayotte, Reunion and the French Southern and Antarctic Lands.

It makes sense for India to partner closely with France for security in the region. Indeed, it has a trilateral with France and... oops, Australia. What happens to that partnership now? Will France agree to continue with it? Will India need to play peacemaker between France and Australia? We'll know soon.

Yes, submarines are devices of deception. But perhaps this time, they've also helped bring to the surface some of the troubling realities of the crowded rush of global powers into the Indian Ocean. India needs to make sure it isn't the target of any torpedoes.

<https://www.telegraphindia.com/opinion/nuclear-submarines-caught-in-the-cross-currents/cid/1831665>



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Where does India stand in the Indo-Pacific Nuclear Tinderbox?

With more nations building their nuclear arsenal, the Indo-Pacific is becoming a high-risk place
By Manoj Joshi

The new Australia-UK-US (AUKUS) alliance is the latest warning of the looming threat of war in the Indo-Pacific region. In the middle of this month, we saw competing missile tests conducted by North and South Korea, there have been successive and deliberate intrusions into Taiwan's Air Defense Identification Zone (ADIZ) by the People's Liberation Army Air Force (PLAF), and, most recently, the Chinese have issued a veiled warning against India's planned Agni-V missile test and have been spotted constructing hundreds of new silos to house their long-range nuclear armed missiles in Gansu and Inner Mongolia.

The hostility between the US and China is no longer constrained. Within a week of telling Xi Jinping over the telephone on September 9 that the US wanted to maintain the "guardrails" on the relationship to ensure "competition does not veer into conflict", the United States sharply escalated the situation by entering into a new security alliance on September 15. Though China was not mentioned, it is clear that the US aim is to pose a challenge to Chinese naval activity, especially in the southern Pacific Ocean.



A Slew of Security Pacts

The US, Australia, the UK, New Zealand and Canada have a long-standing and dense secret alliance called the UKUSA Agreement. There is also an old non-binding and partially functional Australia-New Zealand-US (ANZUS) security pact, and an even looser Five Power Defence Arrangements (FPDA) linking Australia, New Zealand, UK along with Malaysia and Singapore. Though it has gained headlines because of the nuclear propelled submarine (boomer) decision, the new AUKUS is not simply an arms sales agreement, but a military pact whose full details have not been fully disclosed and whose longer-term implications are not yet clear.

The US has always been most reluctant to share its submarine technology with anyone. However, it has made some exceptions for the UK. And now, the two have roped in Australia into their system. Though the UK conducted 12 nuclear weapons tests in Australia, it has kept the Aussies out of all nuclear issues and Canberra is a signatory to the Non-Proliferation Treaty (NPT) as a non-nuclear weapon state.

Technically, the NPT does not prohibit the export of nuclear propulsion technology, but states have been careful in dealing with it. In the case of India's *INS Arihant*, for example, the Russians set up a "research" reactor in the Kalpakkam Atomic Power Station; India's task was to successfully copy it for the *Arihant*.

Non-Proliferation Commitments

The Americans and British are not going to pretend to be scrupulous on this point. But there is one issue of concern. Unlike the VM-4 reactor for the *Arihant*, which uses uranium enriched at around 20 per cent to 30 per cent, modern US-UK reactors used highly enriched uranium at about 95 per cent, which is also ideal for making a nuclear weapon. It remains to be seen as to how the US-UK work the Australian deal to meet their own non-proliferation commitments.

There has been some talk about the Chinese now targeting Australia in their nuclear scheme of things. But these are somewhat overstated. In contrast to the US and the UK, China retains a "no first use" pledge in relation to nuclear weapons. Second, the profile of its arsenal is such that it can, at best, have a retaliatory capability as compared to the massive US arsenal that could, theoretically, be used for a first strike.

Tensions are high all through the Indo-Pacific, especially its northeast quadrant. Here we have an officially recognised nuclear weapons power — China — as well as an unofficial one, North Korea, which has made it a point to threaten its southern neighbour and Japan with its nuclear weapons and missiles. China has a small maritime dispute with South Korea and a major one over the Senkaku (Diaoyu) islands with Japan.

Tensions over Taiwan

In mid-September, North Korea said it tested a strategic cruise missile that could easily evade the network of ballistic missile defences that the South Koreans, Japanese and Americans have established. The South Koreans did some messaging of their own through a successful test of a submarine-launched ballistic missile. South Korea has no nuclear weapons, but the betting is that prolonged tensions with North Korea could possibly push South Korea, and possibly even Japan, over the nuclear threshold. The experience of the Trump years has rattled both countries and this could have consequences for nuclear proliferation in the future.

Another major point of tension is Taiwan. China claims sovereignty over the island and has not ruled out the use of force in achieving unification. Aggressive Chinese actions, including flying fighter jets into its air defence space, are part of Beijing's tough tactics.

Temperatures have been rising perceptibly for other reasons as well. In recent months, the Japanese have hinted that they could play a role in defending Taiwan. Last month, President Biden also declared that the US would defend it if it were attacked, but the Americans later backtracked. The official US-Japanese position on defending the island is ambiguous, and these statements have only enraged Beijing which claims sovereignty over the island republic and has not ruled out the use of force in asserting it.

Old Quarrels Getting Nastier

Far off in another part of the Indo-Pacific, there has been the manufactured controversy over the first user trials of the Indian Agni V missile, expected on September 23. The missile, with a range of some 5,000 km, has already been tested several times earlier. This time around, the Chinese responded to the news by citing the UN Security Council Resolution 1172, issued after India's 1998 nuclear weapons test. Foreign Ministry spokesman and "wolf warrior" Zhao Lijian noted that the 1998 resolution, which is still operative on paper, had called on India and Pakistan to "stop their nuclear weapons development programmes, to refrain from weaponisation ... to cease development of ballistic missiles capable of delivering nuclear weapons..."

No doubt this was a statement for the record. The Chinese, who helped Pakistan make nuclear weapons in the 1980s, tested their first weapon in 1990 in their Xinjiang range, and who have helped advance their nuclear weapon and ballistic missile programme since then, are hardly in a position to be seen as serious critics of Indian activities.

Related to AUKUS is India's own nuclear-propelled submarine programme. India has two ballistic missile submarines (SSBN), the *Arihant* and *INS Arighat*, and is building several more. Further, it is planning to build six nuclear-propelled attack submarines (SSN).

One thing is certain — with more nations coming up with nuclear-propelled and conventional submarines and new missiles, the Indo-Pacific is becoming a high-risk place. Old quarrels are getting nastier. There seem to be few signs that any of the parties — the US, China, North and South Korea, India, Australia and Japan — are willing to back off. All that can be said is that with two official nuclear powers, and two unofficial ones, the consequences of any conflict could be so destructive that they would change the future of the world.

(The writer is a Distinguished Fellow, Observer Research Foundation, New Delhi. This is an opinion piece and the views expressed above are the author's own. The Quint neither endorses nor is responsible for the same.)

<https://www.thequint.com/voices/opinion/where-does-india-stand-in-the-indo-pacific-nuclear-tinderbox#read-more>



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Why would China want Russian attack helicopters for new amphibious warships?

The Ka-52K is a derivative of the Ka-52, which is in service with Russian military

Over the last week, news organisations covering China reported that the People's Liberation Army Navy (PLAN) was considering buying up to 36 Ka-52K attack helicopters from Russia.

The helicopters would be deployed off the Type-075 class of landing helicopter dock (LHD), a category of ships that can deploy helicopters and land vehicles. The PLAN has so far launched three Type-075 class warships. These vessels are believed to displace over 40,000 tonnes, making them among the largest amphibious warships outside of the US Navy. They can deploy helicopters to carry troops and cargo and also carry tanks and other vehicles for beach assaults.

On Monday, *The South China Morning Post* quoted Zhou Chenming, a researcher, as saying, "The People's Liberation Army has studied the possibility of buying Russian Ka-52Ks for quite a long time. The Type 075 landing helicopter dock needs a heavy attack helicopter." Zhou is an expert with the Yuan Wang military science and technology institute in Beijing. "The Ka-52K is the Russian Navy's first ship-borne attack helicopter with folding blades and wings with higher take-off weights, which can save space and fulfill the needs of the PLA's Type 075 LHD," Zhou explained.

The publication quoted a source as saying China could not produce a "heavy armed helicopter" to meet the needs of the Type-075.

The Ka-52K is a derivative of the Ka-52 attack helicopter, which is in service with the Russian military. The Ka-52 and Ka-52K use the characteristic 'coaxial' rotor design of the Kamov helicopter family, with two sets of rotors, one on top of the other; such helicopters typically lack a tail rotor found on most other helicopters.



Two Ka-52s | Rosoboronexport

Helicopters with coaxial rotors are considered more agile and have improved payload carriage capacity for the same weight. The Ka-52K was unveiled to the public in 2015; the Russian defence ministry ordered 32 helicopters of the type that year. The Ka-52K differs from its land-based counterpart in having a more powerful radar that allows it to detect targets up to 200km away, enabling it to fire heavy anti-ship missiles, which have a range of over 100km. This is a capability not found on other attack helicopters, which can carry only short-range missiles to attack ships.

Heavier and deadlier missiles

The Ka-52K retains the Ka-52's capability to carry anti-tank missiles and has a 30mm gun to destroy lightly armoured targets on the ground or in the air. The capability to carry both long-range anti-ship missiles and shorter-range anti-tank weapons would make the Ka-52K an asset in the event of conflict with Taiwan, which has a sizeable navy and land-based defences to deter a Chinese invasion.

The Ka-52K is significantly heavier than China's indigenous Z-10 helicopter, which has a maximum take-off weight of around 7 tonnes. As the Ka-52K weighs around 12 tonnes, it can carry a heavier payload of weapons and also more armour to protect the crew from enemy fire. Both the Ka-52K and Z-10 are twin-engine helicopters.

More powerful engines

However, the early variants of the Z-10 were believed to be incapable of carrying a heavy weapons load due to the poor performance of their WZ-9 engines. Media reports claimed the inadequate engine performance was one of the reasons why Pakistan rejected the Z-10 in favour of the Turkish-built T-129 attack helicopter. The WZ-9 engine is believed to have a power output of 1,300HP, nearly half the 2,500HP capacity of the Klimov VK-2500 engines that power the Ka-52K.

India, a prospective customer?

Interestingly, ever since the Ka-52K project was announced, Russian officials have said the Indian Navy was a prospective customer.

Kamov chief designer Sergei Mikheyev said in August 2014, "Upon request from the Indian Navy, we are ready to supply jointly with Russian Helicopters the necessary number of seaborne helicopters and offer the latest developments to the Indian side, including the Ka-52K helicopters."

<https://www.theweek.in/news/world/2021/09/21/why-would-china-want-russian-attack-helicopters-for-new-amphibious-warships.html>

Indian astronomers study how solar ejections affect space weather as ISRO preps for Aditya L1 mission to Sun

Coronal mass ejection is one of the biggest eruptions from the Sun's surface that can contain a billion tons of matter accelerated to several million miles per hour into space

New Delhi: Space weather is one of the most dynamic events beyond Earth that has effects not only on payload operating in the orbit but also on the ground telecommunication networks. A new study now sheds light on how conditions and events in the solar atmosphere like coronal mass ejections influence the accuracy of space weather prediction.

The study will aid the upcoming Aditya L1 mission to the Sun by the Indian Space Research Organisation (ISRO) set to be launched next year.

A team of astronomers led by Dr Wageesh Mishra of the Indian Institute of Astrophysics (IIA), Bengaluru showed that plasma properties and Earth arrival times of CMEs from the Sun can vary substantially. The research published in Monthly Notices of Royal Astronomical Society is based on the study of observations of Interplanetary Coronal Mass Ejection (ICME) structures during the year 2011. The team studied the Earth-directed CMEs and ICMEs with data from NASA's STEREO spacecraft and the LASCO coronagraph located near the first Lagrangian point (L1) on the Sun-Earth line. Astronomers reconstructed a 3D view of the CMEs & ICMEs that happened on March 11 and arrived on Earth on August 6, 2011.



The team studied the Earth-directed CMEs and ICMEs. (Photo: Getty)

The astronomers studied the differences in the dynamics, arrival time, plasma, and magnetic field parameters of ICME structures at the locations in the heliosphere where the different satellites are located. They explained that the Sun emits a continuous stream of charged particles called the Solar Wind and they "found that plasma characteristics and arrival times of a CME-driven shock, propagating in a pre-conditioned medium, may be different at different longitudinal locations in the heliosphere," said Wageesh Mishra

The study highlights the difficulties in connecting the local observations of an ICME from a single in situ spacecraft to its global structures and explains that accurate prediction of large CME structures at any location in the heliosphere is challenging.

The new study comes weeks after Chandrayaan-2 looked at the inner layers of the Sun and scientists measured the magnetic field of an eruption from the Sun's atmosphere.

Coronal mass ejection is one of the biggest eruptions from the Sun's surface that can contain a billion tons of matter accelerated to several million miles per hour into space. This solar material streams out through the interplanetary medium, impacting any planet or spacecraft in its path. When a really strong CME blows past the Earth, it can damage the electronics in our satellites and disrupt radio communication networks on Earth.

<https://www.indiatoday.in/science/story/sun-coronal-mass-ejection-aditya-l1-mission-isro-solar-wind-1855344-2021-09-21>

Carbon fibers electrical measurements pave way for lightning strike protection technologies

Carbon fiber reinforced polymer composite structures are serving an increasingly important role in aerospace, infrastructure, energy generation, and transportation. Yet, the electrical behavior of a composite is challenging to measure or predict because of the electrical conductivity of constituent carbon fibers and the composite's complex hierarchical microstructure.

In *Journal of Applied Physics*, researchers from the University of Illinois at Urbana-Champaign report the first direct measurement of the transverse electrical resistivity of a single carbon fiber. The researchers combined a precise sample preparation with a technique called the van der Pauw method to accomplish this challenging measurement.

"Our experiments confirm that the electrical properties measured transverse to a carbon fiber are not the same as the properties measured along the length the of the fiber," said co-author Nancy Sottos.

When carbon fibers are made, the strong carbon-carbon covalent bonds are aligned in planes parallel to the fiber axis in the longitudinal direction. Only weak van der Waals bonds exist between the planes in the transverse direction, leading to directionally dependent properties.

The researchers used a technique known as the van der Pauw method to accurately measure the resistivity in the transverse direction of a carbon fiber. The resistance measurements were performed on a slice of carbon fiber cut using a focused ion beam and connected to electrodes for electrical resistance measurements. "Our results reveal that an IM7 carbon fiber is more electrically conductive in the direction parallel to the length," said co-author Satoshi Matsuo.

Previously, the van der Pauw method was mainly used to measure resistivity of thin films or discs. The researchers cut and manipulated a slice of carbon fiber using a focused ion beam and a needle, a tool more commonly used to prepare transmission electron microscopy specimens.

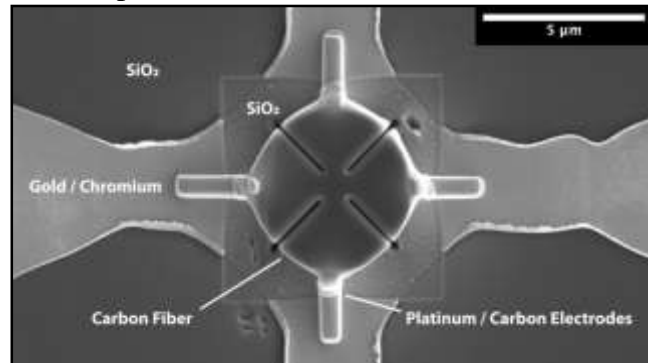
The researchers are now working on electrical contact resistance measurements between two carbon fibers. The electrical contact resistance depends on the electrical resistivity and the contact area, which also varies depending on the angle at which the two fibers cross each other.

Next, they plan to examine the transverse electrical resistivity measurements on different types of carbon fibers with varying measurement conditions such as the environmental temperature.

"This procedure may also be applied to other homogenous conductive fibrous materials with a diameter on the order of microns such as conductive polymer fiber or metallic fiber," said Sottos.

More information: "Single carbon fiber transverse electrical resistivity measurement via the van der Pauw method" *Journal of Applied Physics*, [aip.scitation.org/doi/full/10.1063/5.0060126](https://doi.org/10.1063/5.0060126)

Journal information: *Journal of Applied Physics*
<https://phys.org/news/2021-09-carbon-fibers-electrical-pave-lightning.html>



The slice of carbon fiber in the microelectric circuit is electrically connected to the gold/chromium electrodes with platinum/carbon electrodes. Credit: Satoshi Matsuo and Nancy R. Sottos

Bringing real-time, fine-scale, subsurface quality control to 3D printing

3D printing is revolutionizing manufacturing by wasting much less material and energy than that by conventional machining and production line assembly. Now, researchers from Japan have made a discovery that will help companies reliably make even highly complex 3D-printed products.

In a study recently published in *Ultrasonics*, researchers from Osaka University used laser ultrasonics to detect fine-scale defects below the surface of 3D-printed metal assemblies, and in so doing have introduced a unique quality control technology to the field of 3D printing.

Machining has long been the primary method to make products. The basic idea is that you start with a larger piece of material, cut it into a specific shape, and then assemble separately prepared parts into a larger product. With machining, quality control checks can be performed at each step of the manufacturing process, but it's difficult to rapidly build a prototype or a highly complex product. In these instances, a more useful approach is 3D printing: layer-by-layer assembly starting from (for example) a computerized blueprint.

Overcoming the challenges of 3D printing—such as the difficulty of detecting internal defects without damaging the product—is something the researchers at Osaka University aimed to address.

"It is often challenging to use laser-generated ultrasonic echoes for identifying subsurface defects in 3D-printed devices," explains lead author of the study Takahiro Hayashi. "We generated ultrasonic waves in the megahertz range to uncover small defects that are frequently difficult to image."

To create an artificial defect in a 3D-printed part, the researchers first fabricated an aluminum plate with a millimeter-scale hole drilled into it, and affixed on top of that a thin, defect-free aluminum plate. They then scanned a laser across the surface and detected the resulting ultrasonic vibrations from the aluminum. Mathematical processing of these vibrations enabled a graphical readout that highlighted the location and size of the internal defects.

"We systematically varied the laser pulse duration, frequency range, and repetition frequency to optimize imaging of defects, and developed a theoretical analysis of our findings," says Takahiro Hayashi. "Advanced tests on a 3D-printed alloy commonly used as a benchmark in research indicated that we can even detect defects that are only 500 micrometers in size."

These results have diverse applications. By further optimizing the defect detection system, one could detect damage to a 3D-printed part as fabrication proceeds, and thus repair it in real time with the same ease as is done in machining. In so doing, the Osaka University researchers are enhancing the practicality of 3D printing for building intricate devices on a commercial scale.

More information: Takahiro Hayashi et al, Non-contact imaging of subsurface defects using a scanning laser source, *Ultrasonics* (2021). DOI: [10.1016/j.ultras.2021.106560](https://doi.org/10.1016/j.ultras.2021.106560)

<https://phys.org/news/2021-09-real-time-fine-scale-subsurface-quality-3d.html>

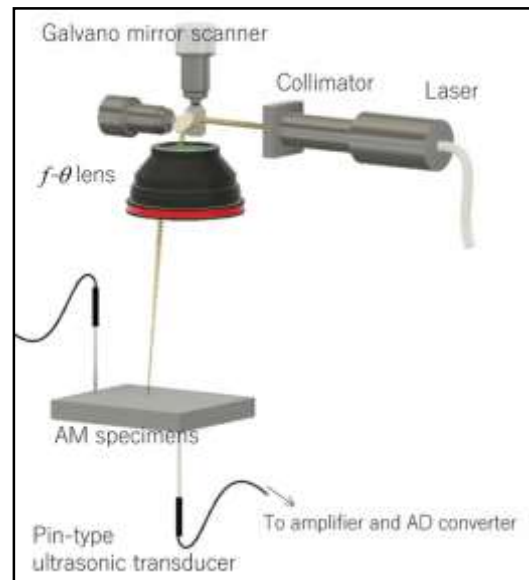


Fig.1 Experimental configuration. Credit: DOI: [10.1016/j.ultras.2021.106560](https://doi.org/10.1016/j.ultras.2021.106560)

Electrons on the edge: The story of an intrinsic magnetic topological insulator

An intrinsic magnetic topological insulator MnBi_2Te_4 has been discovered with a large band gap, making it a promising material platform for fabricating ultra-low-energy electronics and observing exotic topological phenomena.

Hosting both magnetism and topology, ultra-thin (only several nanometers in thickness) MnBi_2Te_4 was found to have a large band-gap in a Quantum Anomalous Hall (QAH) insulating state, where the material is metallic (ie, electrically conducting) along its one-dimensional edges, while electrically insulating in its interior. The almost zero resistance along the 1D edges of a QAH insulator, make it promising for lossless transport applications and ultra-low energy devices.

History of QAH: how to achieve the desired effect

Previously, the path towards realizing the QAH effect was to introduce dilute amounts of magnetic dopants into ultra-thin films of 3D topological insulators.

However, dilute magnetic doping results in a random-distribution of magnetic impurities, causing non-uniform doping and magnetisation. This greatly suppresses the temperature at which the QAH effect can be observed and limits possible future applications.

A simpler option is to use materials that host this electronic state of matter as an intrinsic property.

Recently, classes of atomically -thin crystals have emerged, similar to the famous graphene, that are intrinsic magnetic topological insulators (ie, possess both magnetism and topological protection).

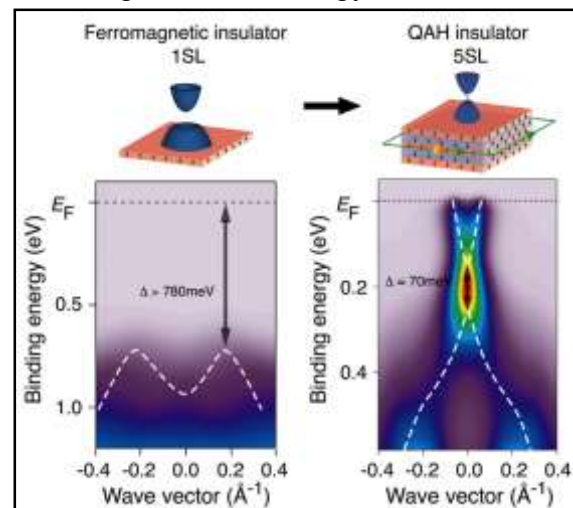
These materials have the advantage of having less disorder and larger magnetic band-gaps, allowing robust magnetic topological phases operating at higher temperature (i.e., closer to the ultimate aim of room-temperature operation).

"At FLEET's labs at Monash University, we grew ultra-thin films of an intrinsic magnetic topological insulator MnBi_2Te_4 and investigated their electronic band structure," explains lead author Dr. Chi Xuan Trang.

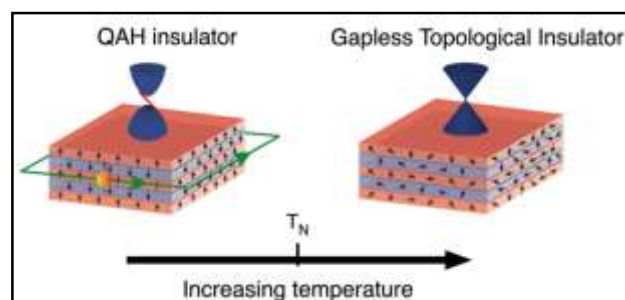
Mind the gap: how to observe the band-gap in a magnetic insulator

Magnetism introduced in topological-insulator materials breaks time-reversal symmetry in the material, resulting in opening a gap in the surface state of the topological insulator.

"Although we cannot directly observe the QAH effect using angle-resolved photoemission spectroscopy (ARPES), we can use this technique to probe the size of a band-gap opening on the



The observed band-gaps and corresponding schematic in 2D ferromagnetic insulator (left) and QAH insulator MnBi_2Te_4 (right). Credit: FLEET



Observing the phase transition from QAH insulator phase (left) to paramagnetic gapless TI phase (right), when above the magnetic ordering temperature. Credit: FLEET

surface of MNBI_2TE_4 and how it evolves with temperature," says Dr. Trang, who is a Research Fellow at FLEET.

In an intrinsic magnetic topological insulator, such as MNBI_2TE_4 , there is a critical magnetic ordering temperature where the material is predicted to undergo a topological phase transition from QAH insulator to a paramagnetic topological insulator.

"By using angle-resolved photoemission at different temperatures, we could measure the band gap in MNBI_2TE_4 opening and closing to confirm the topological phase transition and magnetic nature of the bandgap," says Qile Li a FLEET Ph.D. student and co-lead author on the study.

"The bandgaps of ultrathin film MBT can also change as a function of thickness, and we observed that a single layer MNBI_2TE_4 is a wide bandgap 2D ferromagnetic insulator. A single layer of MBT as a 2D ferromagnet could also be used in proximity magnetisation when combined in a heterostructure with a topological insulator." says Qile Li.

"By combining our experimental observations with first-principles density functional theory (DFT) calculations, we can confirm the electronic structure and the gap size of layer-dependent MNBI_2TE_4 ," says FLEET AI and group leader Dr. Mark Edmonds.

Applications of the intrinsic magnetic topological insulator MNBI_2TE_4

MNBI_2TE_4 has potential in a number of classical computing applications, such as in lossless transport and ultra-low energy devices. Furthermore, it could be coupled with a superconductor to give rise to chiral Majorana edge states, which are important for topological quantum computing device schemes.

The study

FLEET researchers used angle-resolved photoemission spectroscopy (ARPES), and density functional theory (DFT) calculations to study the electronic state and band structure of MNBI_2TE_4 .

Crossover from 2D Ferromagnetic Insulator to Wide Band Gap Quantum Anomalous Hall Insulator in Ultrathin MNBI_2TE_4 was published in August 2021 in *ACS Nano*.

Ultrathin MNBI_2TE_4 film's recipe in this study was initially found in Edmonds Electronic Structure laboratory at Monash University. Afterward, the ultrathin films were grown and characterized using ARPES measurements at the Advanced Light Source (Lawrence Berkeley National Laboratory) in California.

More information: Chi Xuan Trang et al, Crossover from 2D Ferromagnetic Insulator to Wide Band Gap Quantum Anomalous Hall Insulator in Ultrathin MNBI_2TE_4 , *ACS Nano* (2021). [DOI: 10.1021/acsnano.1c03936](https://doi.org/10.1021/acsnano.1c03936)

Journal information: [ACS Nano](https://doi.org/10.1021/acsnano.1c03936)

<https://phys.org/news/2021-09-electrons-edge-story-intrinsic-magnetic.html>

Research finds how saline solution can inhibit replication of Covid

Researchers at the University of São Paulo (USP) in Brazil have shown that a hypertonic saline solution inhibits replication of SARS-CoV-2, the virus that causes COVID-19, and have elucidated the biochemical mechanism involved. An article reporting the research is published in ACS Pharmacology & Translational Science. The study was performed in the laboratory using human epithelial lung cells infected with the virus.

If the strategy proves effective in clinical trials, it could contribute to the development of novel prophylactic interventions to prevent COVID-19 or even treatments for the disease.

“Given the gravity of the pandemic, we believe it would be important to extend this line of research by conducting clinical trials designed to verify the efficacy of using a spray with hypertonic sodium chloride [NaCl] saline as a form of prophylaxis, helping to stop the virus from spreading within the infected organism and reducing the likelihood of more severe inflammation,” said Cristiane Guzzo, last author of the article and a researcher at the university’s Biomedical Sciences Institute (ICB-USP).

The study was supported by FAPESP. Edison Durigon, Professor of Virology at ICB-USP, and Henning Ulrich, at the Institute of Chemistry (IQ-USP), also participated.

Although the evidence suggests the use of saline inhibits viral replication, it does not afford full protection against infection, let alone a cure. “It’s very simple and cheap. It’s already used prophylactically against other respiratory diseases, and it could minimize the severity of COVID-19 by reducing viral load. It could be added to safety protocols without replacing the use of face coverings, social distancing and vaccination,” Guzzo said.

The right concentration

By comparing different concentrations of the product, the researchers found that a 1.5% NaCl solution completely inhibited viral replication in Vero cells. In human epithelial lung cells, a 1.1% solution was sufficient to achieve 88% inhibition. Vero cells are derived from kidney epithelial cells extracted from an African green monkey, and widely used as a model for studying SARS-CoV-2.

Hypertonic saline is already adopted prophylactically to manage cases of influenza, bronchiolitis, rhinitis, sinusitis, and other respiratory disorders. A spray is sufficient for the upper airways, while a nebulizer is needed to reach the lungs. These interventions can minimize the symptoms of such diseases, but the mechanisms underlying their effects are poorly understood.

“Our explanation of this intracellular response to the hypertonic solution was basic science but the findings of the study have evident applications in healthcare and clinical approaches to the management of various respiratory diseases,” Ulrich said. “What we observed with regard to SARS-CoV-2 is likely to apply to other viruses as well, since the mechanism concerned is part of the host cell’s response to infection.”

No energy

To grasp the mechanism involved, it is useful to bear in mind that viruses use elements of the host cell such as proteins and energy sources to replicate their genetic material and invade other cells and organs. “We discovered that NaCl doesn’t interfere with interaction between the SARS-

CoV-2 spike protein and the ACE-2 receptor used by the virus to invade cells, but the saline does affect the post-infection viral cycle,” Guzzo said.

In an earlier article, published in *The Journal of Physical Chemistry Letters*, Guzzo and colleagues showed how interaction between the spike protein and ACE-2 receptor survived different concentrations of NaCl. “The virus probably evolves so as to compensate for fluctuations in ionic strength and maintain an effective medium for cell invasion,” she said.

When NaCl molecules enter a cell, the membrane surrounding the cytoplasm is polarized owing to an increase in sodium ions (Na^+). As a result of this energy imbalance, a large amount of the cell’s potassium (K^+) is ejected to restore a balance of charges in the membrane (this mechanism is known as the sodium-potassium pump).

Saturation due to the sodium-potassium pump makes the cell expend ATP (adenosine triphosphate), one of the main sources of energy for cellular processes. Consumption of ATP for cellular depolarization prevents the virus from using it to replicate.

“Cells have to get rid of sodium via the sodium-potassium pump, and this uses up their energy store, so there’s no ATP left for viral replication,” Ulrich explained.

The study also showed that the salt does not affect mitochondrial activity. Mitochondria are dynamic organelles involved in cellular respiration and ATP creation, as well as other metabolic processes. “At these concentrations, the salt doesn’t damage the cell. We observed that mitochondria remained healthy throughout the process,” Guzzo said.

In the study, the researchers suggest that the use of hypertonic saline could be tested in two ways. One is a nasal spray for prophylaxis of the airways, the main gateway for SARS-CoV-2 to enter the organism. “This type of spray can be found in any pharmacy and could be used prophylactically by front-line health workers or other people who are highly exposed to the virus. If its efficacy is confirmed in clinical trials, it could reduce viral replication in the nose and throat,” Guzzo said.

The other strategy they propose is nebulizing the saline into the lungs. In this case, the right concentration of NaCl is essential, and the efficacy of the method can be assessed only in clinical trials involving COVID-19 patients. It is worth recalling that hypertonic saline nebulization is already used to treat children with bronchiolitis, for example.

In the case of respiratory syncytial virus (RSV), the most common cause of bronchiolitis, hypertonic saline is known to reduce infection and inflammation in cultured human respiratory epithelial cells.

“It’s not a single solution, and it would have to be used in the first few days after infection,” Guzzo said. “Reducing viral replication means reducing the severity of the disease and the inflammatory response. COVID-19 is a complex disease, comprising the viral replication stage, which hypertonic saline could treat, and then systemic inflammation, which is far more extensive. This second stage can be intense and lead to a number of complications in different organs.”

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<https://www.miragenews.com/research-finds-how-saline-solution-can-inhibit-636591/>

