

Aug  
2021

# समाचार पत्रों से चयित अंश Newspapers Clippings

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खंड : 46 अंक : 158 11 अगस्त 2021

Vol.: 46 Issue : 158 11 August 2021



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## THE TIMES OF INDIA

Wed, 11 Aug 2021

### India to conduct first-ever naval combat exercise with Saudi Arabia

New Delhi: As part of the continuing upward trajectory in military ties with the Gulf countries, India is now all set to conduct its first-ever naval exercise with Saudi Arabia called “Al Mohed Al Hind”.

Guided-missile destroyer INS Kochi, with its two integral Sea King-42B helicopters, arrived at Port Al Jubai on Monday during its Persian Gulf deployment. Flag officer commanding India’s western fleet, Rear Admiral Ajay Kochhar, held discussions with Saudi Eastern Fleet commander, Rear Admiral Majid Al Qahtani, on Tuesday ahead of the exercise.



INS Kochi last week had conducted an exercise with the UAE Navy, “Zayed Talwar”, off the coast of Abu Dhabi. UAE had deployed a Baynunah-class guided-missile corvette, along with helicopters, for the exercise on August 7, which included tactical manoeuvres, over-the-horizon targeting and electronic warfare operations.

The exercises come shortly after IAF chief Air Chief Marshal R K S Bhadauria visited UAE and Israel earlier this month to bolster bilateral military ties with the two countries. The UAE, incidentally, has taken the lead among the Gulf countries in “normalizing” ties with Israel, a country with which India also has robust defence cooperation.

The policy to expand military ties with the Gulf countries also saw Army chief General M M Naravane tour UAE and Saudi Arabia, in the first-ever such visit by an Indian Army chief, in December last year.

In March this year, the IAF had taken part with Sukhoi-30MKI fighters and C-17 Globemaster-III aircraft in a major multi-nation air combat exercise called “Desert Flag ” in the UAE. Air forces from the US, France, South Korea, UAE, Saudi Arabia and Bahrain also took part in the exercise.

The UAE Air Force, incidentally, has been providing support through its Airbus MRTT refuelling aircraft to IAF’s new Rafale fighters on their over 7,000-km flight to India from France.

India is also in discussions to export BrahMos supersonic cruise missiles, which have a strike range of 290-km, and the Akash air defence missiles, which have an interception range of 25-km, to the UAE and Saudi Arabia. Both the countries are also keen on joint defence production ventures with India.

<https://timesofindia.indiatimes.com/india/india-to-conduct-first-ever-naval-combat-exercise-with-saudi-arabia/articleshow/85211901.cms>



Wed, 11 Aug 2021

## कोरोना की तीसरी लहर के खतरे से लड़ने को तैयार चंदनकियारी सीएचसी

चंदनकियारी: कोरोना की दूसरी लहर में बड़ी संख्या में लोगों की मौत के बाद संभावित तीसरी लहर को लेकर आमलोग बेहद ही भयभीत हैं। दूसरी लहर में स्वास्थ्य विभाग में संसाधन का अभाव सामने आया। इस कारण झारखंड सरकार ने पूर्व से ही तीसरी लहर के लिए तैयार रहने का निर्देश दिया है। सरकारी अस्पतालों को आक्सीजन सिलेंडर, आक्सीजन कंसट्रेटर व वेंटिलेटर मशीन को क्रियाशील बनाए रखने के लिए उपलब्ध कराया गया है।

इसी तैयारी के क्रम में कोरोना संक्रमण की दूसरी लहर के बाद अब संभावित तीसरी लहर के नियंत्रण को लेकर चंदनकियारी सामुदायिक स्वास्थ्य केंद्र पूरी तरह तैयार है। वहीं, संभावित तीसरी लहर को देखते हुए चंदनकियारी प्रखंड के कोड़िया व बरमसिया प्राथमिक स्वास्थ्य केंद्र के अलावा बाटबिनोर, महाल, भोजुडीह, माढरा, लाघला, आद्राकुड़ी समेत अन्य उपस्वास्थ्य केंद्रों में कोविड जांच व टीकाकरण कार्य तेज कर दिया गया है। कोरोना की तीसरी लहर पर नियंत्रण को लेकर सामुदायिक स्वास्थ्य केंद्र प्रबंधन द्वारा अस्पताल परिसर के अलावा लगातार पंचायतों व गांवों में शिविर लगाकर टीकाकरण व कोविड की जांच की जा रही है। वहीं, प्रखंड स्थित अंतरराज्यीय व अंतरजिला सीमा पर आने-जाने वाले लोगों की कोरोना जांच की जा रही है।

### 30 बेड का कोविड केयर सेंटर

कोरोना संक्रमित मरीजों के इलाज को लेकर सामुदायिक स्वास्थ्य केंद्र परिसर स्थित आयुष चिकित्सालय भवन को कोविड केयर सेंटर बनाया गया है, जहां इलाज के लिए आक्सीजन युक्त 30 बेड की उपलब्धता बहाल कर दी गई है। ताकि, कोरोना संक्रमित मरीज मिलने पर अस्पताल में भर्ती कर इलाज किया जा सके। यहां, पाइपलाइन के माध्यम से हर बेड पर आक्सीजन की सप्लाई की जाएगी।

### आक्सीजन प्लांट निर्माणाधीन

कोरोना की दूसरी लहर में आक्सीजन की कमी को गंभीरता से लेते हुए राज्य सरकार के निर्देश पर डीआरडीओ द्वारा निर्माणाधीन आक्सीजन प्लांट लगाया जा रहा है, जिसका निर्माण कार्य अंतिम चरण में है। सब कुछ ठीक-ठाक रहा तो जल्द आक्सीजन प्लांट काम करना शुरू कर देगा। आक्सीजन प्लांट से मरीजों के बेड तक सीधे पाइपलाइन द्वारा निर्बाध रूप से आक्सीजन की आपूर्ति की जाएगी।

<https://www.jagran.com/jharkhand/bokaro-how-much-preparation-for-the-third-wave-ready-for-the-third-wave-of-corona-government-health-department-21915902.html>

# Defence Strategic: National/International



Press Information Bureau  
Government of India

Ministry of Defence

*Tue, 10 Aug 2021 5:21PM*

## INS Tabar at Bergen, Norway

INS Tabar, as part of the ongoing deployment, entered Bergen harbour on 05 Aug 21. The ship was received by the Liaison Officer of Royal Norwegian Navy and the Indian Defence Attaché. Commodore Trond Gimmingsrud, Chief of Royal Norwegian Naval Fleet and Mr. Christian Hafstad, the Deputy Harbour Master of Bergen Harbour visited the ship and interacted with the Commanding Officer on jetty as per prevailing covid protocols. The Norwegian officials expressed their happiness on receiving an Indian warship and hoped to see more such similar engagements in future to consolidate the relations between the two countries.



On completion of port visit, in a landmark first for the Indian Navy, INS Tabar participated in a Maritime Partnership Exercise with Royal Norwegian Navy ship, HNoMS Storm, a Skjold class FAC (M) on 08 Aug 21. A range of operations like surface manoeuvres, Visit Board Search & Seizure exercise (VBSS) and vertical replenishment by helicopter were exercised. The exercise was mutually beneficial in enhancing interoperability and towards consolidating combined operations against maritime threats.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1744466>



Press Information Bureau  
Government of India

Ministry of Defence

*Tue, 10 Aug 2021 5:12PM*

## INS Talwar exercises with a Kenyan Naval Ship

Post conclusion of exercise Cutlass Express INS Talwar undertook a Maritime Partnership Exercise with a Kenya Navy Ship Shujaa, an Offshore Patrol Vessel, on 07 Aug 21.

Basic manoeuvring exercises were undertaken by the ships to enhance interoperability and strengthen maritime cooperation. On completion of exercise, INS Talwar thanked Kenya Navy for hosting them at Mombasa and KNS Shujaa appreciated Indian Navy for ensuring maritime safety in the southern IOR especially, East Coast of Africa.



<https://pib.gov.in/PressReleasePage.aspx?PRID=1744468>

Wed, 11 Aug 2021

## Viable alternatives required to replace existing procurement procedures

By Amit Cowshish

The Army Chief MM Naravane recently criticised the current process of procurement of defence materiel for the armed forces in no uncertain terms. Speaking at an event organised by the Delhi-based United Service Institution, he said the process had not kept pace with time and the need of the hour was a revolution in bureaucratic affairs.<sup>1</sup>

He added that many procedural lacunae had crept into the acquisition process due to the overbearing nature of rules and regulations, leading to a ‘Zero Error Syndrome’ and that the focus must be on faster decision making. Calling for a systemic metamorphosis, he suggested that perhaps the concept of L1 (lowest bidder) should be done away with altogether.<sup>2</sup>



Most of what the Army Chief said is valid, but it begs the question why the procedural lacunae – none of them new – could not be addressed while revising the Defence Procurement Procedure 2016 (DPP 2016). It was only last October that, after extensive consultations with all the stakeholders, including the industry and think tanks, DPP 2016 was replaced by the Defence Acquisition Procedure 2020 (DAP 2020).

The Services were an integral part of this exercise, which was overseen by an 11-member committee constituted by the Ministry of Defence (MoD) in August 2019 under the stewardship of the Director General (Acquisition) with the following terms of reference,<sup>3</sup> which subsume the concerns expressed by the Army Chief:

- i. Revise the procedures as given in DPP 2016 and DPM 2009<sup>4</sup>, so as to remove procedural bottlenecks and hasten defence acquisition
- ii. Align and standardise the provisions in the DPP 2016 and Defence Procurement Manual DPM 2009 (DPM 2009), wherever applicable, to optimise life cycle support for equipment
- iii. Simplify policy and procedures to facilitate greater participation of Indian industry and develop a robust defence industrial base
- iv. Wherever applicable, examine and incorporate new concepts, such as life cycle costing, life cycle support, performance-based logistics, ICT, lease contracting, codification & standardisation
- v. Include provisions to promote Indian start-ups and research & development
- vi. Any other aspect which will contribute towards refining the acquisition process and support the ‘Make in India’ initiative

In turn, this MoD committee set up many sub-committees to examine various aspects of the procedure laid down in DPP 2016 and DPM 2009 and after more than a year of deliberations – during which a draft manual was also released inviting comments from the interested parties – the final 681-page document was approved by the Defence Acquisition Council (DAC) and released by Defence Minister Rajnath Singh. All Service Chiefs, Chief of Defence Staff, and Secretaries of various MoD departments are members of the DAC.

In the foreword to DAP 2020, the Defence Minister claimed that it “introduces a slew of conceptual, structural and procedural reforms in the acquisition procedure to create a climate in

which the industry can thrive while meeting the security and operational needs of the Services” and that the document’s focus is on “ensuring that contemporary technology based equipment is made available to the Services in a time bound manner, to further expedite the modernisation of the armed forces”.<sup>5</sup>

It is difficult to imagine what constraints the committee might have faced in making procedural improvements to address the problems that the Army Chief mentioned in his address. The fact is that within the broad principles of public procurement laid out in the General Financial Rules, 2017 (GFR 2017), the MoD is free to evolve a procedure that addresses the peculiarities of defence acquisitions.

This would be evident from a comparison of GFR 2017 and the Manual for Procurement of Goods, 2017 issued by the Ministry of Finance (MoF), and their earlier versions, with the several versions of the DPP issued between 2002 and 2016, and the latest DAP 2020. There is a marked difference between the procedure followed by the MoD and other civil ministries though the basic principles underlying the procurement architecture remains the same.

It is possible that the Army Chief was hinting at the need for changing one or more of these fundamental principles of public procurement. One gets this impression from the Army Chief’s suggestion to do away with the L1 concept altogether. Considering that a section of the strategic community has been castigating this concept for a long time, it is surprising that the MoD-appointed committee and its sub-committees either did not take up this issue or were unable to offer an alternative.

Be that as it may, four points need to be made regarding this L1 business. One, though L1 is among the fundamental principle of public buying, there are exceptions to it as in the case of single-source procurements. In fact, most of the MoD’s single-source negotiated acquisitions from the Indian vendors or under the government-to-government or inter-governmental agreements are *not* based on the L1 concept. Procurements made from the United States (US) through the Foreign Military Sales (FMS) route are a case in point.

Two, the L1 system does not require the Services to blindly pick up the cheapest equipment. The L1 bidder is determined through a rigorous process of elimination. This process starts with the Request for Information (RfI) to gather information about the available equipment that meets the Services’ operational requirements and to formulate the Services Qualitative Requirements (SQRs).

The SQRs are formulated by the Services – at times warranting some modifications in the available equipment to meet their requirement – and approved by the Services Equipment Policy Committee (SEPC).

The detailed SQRs are mentioned in the Request for Proposal (RfP) and the bidders’ responses are technically evaluated by the Services to shortlist the vendors whose products meet their needs. The shortlisted vendors are then asked to bring their equipment for extensive field trials, wherever considered necessary. These trials constitute the second filter to shortlist the vendors based on the actual performance of the equipment.

At the last stage, the commercial offers of only those vendors, whose product *fully* meets the requirements of the Services, are opened and L1 determined. Conceptually, L1 is identified from among the bidders whose product is certified by the Services as being suitable for performing the intended operational role. Seen in this perspective, the L1 system seems fair and equitable, but if it is not, it should indeed be modified, if not junked altogether.

Three, it is permissible to specify Enhanced Performance Parameters (EPP) in addition to the SQRs, enabling the vendors to offer a product that is more advanced than the one based on the SQRs. The vendors meeting those EPPs get a weightage up to 10 per cent while determining L1.

In simpler words, if the price quoted by a vendor for the product meeting the EPPs mentioned in the RfP is Rs 100 and full weightage of 10 per cent is applicable as per the terms of the RfP, the quoted price is reduced to Rs 90 for the purpose of comparison with the price quoted by other vendors. And if, with reference to the depressed price, such a vendor emerges as L1, the contract is

awarded to him/her at the quoted price of Rs 100. This is a departure from the conventional L1 concept.

When introduced in 2016, this feature was lauded as a progressive step that would address the real or perceived rigours of the L1 system to a considerable extent. Going by the Army Chief's statement, however, the excitement was misplaced.

Lastly, if none of the systems mentioned above is working well and has become a hindrance in acquiring state-of-the-art defence materiel expeditiously, a case needs to be made out based on demonstrable drawbacks of the existing system and, more importantly, a detailed blueprint of what system should replace it. Prejudicial condemnation of the L1 system, or other aspects of the existing procedure, is of little help.

*Views expressed are of the author and do not necessarily reflect the views of the Manohar Parrikar IDSA or of the Government of India.*

- [1.](#) "Procurement Process Hasn't Kept Pace with Time; Revolution in Bureaucratic Affairs Needed: Army Chief", *The Economic Times*, August 03, 2021.
- [2.](#) Ibid.
- [3.](#) "Raksha Mantri Shri Rajnath Singh Approves a Committee to Review Defence Procurement Procedure to Strengthen 'Make in India'", *Press Information Bureau*, Government of India, August 17, 2019.
- [4.](#) With the formation of the Department of Military Affairs (DMA) in December 2019, the revision of the Defence Procurement Manual 2009 (DPM 2009) was reassigned to this department. The revised version is yet to be finalised.
- [5.](#) "Defence Acquisition Procedure 2020", Foreword by Defence Minister Rajnath Singh, *Ministry of Defence*, Government of India, 30 September 2020.

<https://www.idsa.in/idsacomment/viable-alternatives-procurement-procedures-acowshish-100821>



Wed, 11 Aug 2021

## IAF focused on boosting capabilities after Balakot strikes, Galwan Valley clashes: IAF Chief

*The IAF Chief said the induction of the Rafale aircraft has helped in lifting the overall offensive capability of the Air Force*

New Delhi: India's air power capabilities in terms of hitting targets with precision, defending assets and use of new technologies have gone up significantly after the Balakot air strikes and rapid developments in eastern Ladakh following the Galwan Valley clashes, Chief of Air Staff Air Chief Marshal R.K.S. Bhadauria said on Tuesday.

In an address at a leading think-tank, the IAF Chief said India now has an "edge" in its ability on both the Western and Northern fronts to "react fast, respond fast and hit fast", noting that induction of Rafale jets has helped in bringing the "next level" of operational transformation.

About the drone strike on the Jammu airbase, he said the IAF is taking a series of initiatives including procuring next-generation jammers to deal with such challenges and added that the attack would not have been possible if it was attempted two-three months later.

Referring to the 11-day conflict between Israel and Hamas in May, Air Chief Marshal Bhadauria said that Israel's use of air power in



R.K.S. Bhadauria. File. | Photo Credit: MOORTHY RV



carrying out operations with surgical precision to achieve its objectives in Gaza against the militant group while ensuring minimum collateral damage was a reflection of the ability of the air assets.

Explaining the role of air power, the IAF Chief also talked about the general perception to look at only its offensive role and the general tendency to say "no-no" for its use in certain situations, saying the paradigms and scenarios have shifted and there is a need to keep this in mind.

"The ability of air power which was largely seen as an offensive, as a no-no in some situations particularly in the subcontinent...the paradigms have shifted, the scenarios have shifted and we need to keep this in mind as we go ahead," he said at the United Service Institution of India (USI).

At a seminar last month, Chief of Defence Staff Gen Bipin Rawat, while referring to the proposed integrated theatre commands, described the Air Force as a "support arm" but Air Chief Marshal Mr. Bhadauria disagreed with him, saying airpower has a huge role to play.

About the IAF's operational readiness, he said the focus was to bring in the next level of operational transformation including in the cyber-security domain after the Galwan Valley clashes and his force has been largely successful in its endeavour.

Air Chief Marshal Mr. Bhadauria said the "edge" that the IAF has today came from a combination of its weapons, training status, platforms network environment and its ability to "react fast, respond fast and hit fast."

"That is the edge we have today in both scenarios, be it on the western front or be it on the northern front," he said.

He said the "transformation" was triggered by the developments like Balakot strikes and situation in eastern Ladakh and it now has now taken the IAF to the "next level."

The IAF Chief said the induction of the Rafale aircraft has helped in lifting the overall offensive capability of the Air Force. "It is a level or a level-and-a-half above where we were." He said the focus after the Galwan Valley clashes was to bolster the cyber security system as it was identified as an area of concern mainly because of some of the "actions", he said in an apparent reference to the ability of the adversary to the IAF's networks.

He said the IAF's operational offensive capability has gone up in terms of having long-distance air-to-ground weapons, in carrying out precision strikes and possessing network-centric environment.

Twenty Indian Army personnel laid down their lives in clashes with Chinese troops on June 15 last year that marked the most serious military conflicts between the two sides in decades.

In February, China officially acknowledged that five Chinese military officers and soldiers were killed in the clashes though it is widely believed that the death toll was higher.

The Chief of Air Staff also mentioned Balakot air strikes as an important event while talking about the transformation of the IAF in the last few years, and said it sent out a clear message about India's approach in dealing with security challenges.

Indian fighter jets bombed Jaish-e-Mohammed's biggest training camp near Balakot deep inside Pakistan on February 26, 2019, 12 days after the terror outfit claimed responsibility for a suicide attack on a CRPF convoy in Kashmir, killing 40 soldiers.

Pakistan retaliated by attempting to target Indian military installations the next day. However, the IAF thwarted their plans.

Air Chief Marshal Mr. Bhadauria also spoke about the low cost activities of commercial drones and its use for supply of arms, drugs, money as well as use of the armed version of the unmanned aerial vehicles to launch an attack on the Jammu airbase.

He referred to China's emergence at the world stage, its diplomacy, economic clout and military belligerence in Indo-Pacific.

<https://www.thehindu.com/news/national/iaf-focused-on-boosting-capabilities-after-balakot-strikes-galwan-valley-clashes-iaf-chief/article35837643.ece>

## एयर चीफ मार्शल आरकेएस भदौरिया बोले, वायुसेना हाल की घटनाओं को देखते हुए अपनी क्षमताओं को रही है बढ़ा

वायुसेना अध्यक्ष एयर चीफ मार्शल आरकेएस भदौरिया ने कहा कि बालाकोट एयर स्ट्राइक और गलवन घाटी में संघर्ष के बाद क्षमता बढ़ाने पर वायुसेना ज्यादा ध्यान दे रही है। सटीकता से लक्ष्य पर हमला करना अपनी संपत्तियों की सुरक्षा और नई प्रौद्योगिकी के इस्तेमाल पर जोर दे रहे हैं।

By AvinashRai

नई दिल्ली: भारतीय वायुसेना हाल की घटनाओं को देखते हुए अपनी क्षमताओं को बढ़ा रही है। वायुसेना अध्यक्ष एयर चीफ मार्शल आरकेएस भदौरिया ने मंगलवार को कहा कि बालाकोट एयर स्ट्राइक और गलवन घाटी में संघर्ष के बाद क्षमता बढ़ाने पर वायुसेना ज्यादा ध्यान दे रही है। इसके तहत ज्यादा सटीकता से लक्ष्य पर हमला करना, अपनी संपत्तियों की सुरक्षा करना और नई प्रौद्योगिकी के इस्तेमाल पर जोर दिया जा रहा है।



एक प्रमुख थिंक टैंक को संबोधित करते हुए वायुसेना प्रमुख ने कहा कि पश्चिमी और उत्तरी दोनों मोर्चों पर वायुसेना को बढ़त हासिल है। यह तेजी से जवाब दे सकती है और लक्ष्य को निशाना बना सकती है। वायुसेना में राफेल जेट के शामिल होने से अगले स्तर का परिचालन संबंधी बदलाव आया है। जम्मू एयरबेस पर ड्रोन हमले के बारे में भदौरिया ने कहा कि वायुसेना इसको लेकर कई कदम उठा रही है। ऐसी चुनौतियों से निपटने के लिए अगली पीढ़ी के जैमर खरीदे जा रहे हैं। उन्होंने कहा, यह हमला मुमकिन ही नहीं होता, यदि दो-तीन महीने बाद ऐसा प्रयास किया जाता।

वायुसेना की भूमिका के बारे में चर्चा करते हुए भदौरिया ने कहा कि परिदृश्य बदल चुका है और हमें इस बात को ध्यान में रखना चाहिए। पिछले महीने एक सेमिनार के दौरान चीफ आफ डिफेंस स्टाफ जनरल बिपिन रावत ने कहा था कि वायुसेना की भूमिका सिर्फ सहायक बल की है। इससे असहमति जताते हुए भदौरिया ने कहा था कि वायुसेना को बड़ी भूमिका निभानी होती है। उन्होंने आगे कहा कि किसी भी अभियान को सफल बनाने के लिए आपको हवा में अपना दबदबा बनाना जरूरी है, अभियान तब तक सफल नहीं चला सकता।

<https://www.jagran.com/news/national-indian-air-force-is-enhancing-its-capabilities-in-view-of-recent-events-says-air-chief-marshal-rks-bhadauria-21915814.html>

Wed, 11 Aug 2021

# IAF builds one of world's highest mobile ATC towers in Ladakh, at advanced landing ground

*The Indian Air Force has been routinely deploying fighter aircraft such as the Rafale and MiG-29 to perform out missions in eastern Ladakh in two places*

*By Anwasha Majumdar*

For the first time ever, at the Advanced Landing Ground, the Indian Air Force (IAF) has constructed one of the world's tallest transportable air traffic control (ATC) towers. Under the authority of the ATC, fixed-wing aircraft and helicopters will be operated in eastern Ladakh are under the authority of the ATC. Further information is still to be given by the authorities.

Similarly, India is looking into building airfields in eastern Ladakh, which includes Daulat Beg Oldi (DBO), Fukche, and Nyoma, which are all only a few minutes away from China's Line of Actual Control (LAC).

The Air Force has also launched Iгла man-portable air defense missiles to counter any aerial invasion by hostile aircraft.

IAF has been routinely deploying fighter aircraft including the Rafale and MiG-29s to perform missions in eastern Ladakh, where soldiers have been disengaged at two places, Pangong Tso and Gogra heights, but neither side has de-escalated.

The Indian Air Force is also maintaining and strengthening its capabilities in the region, including assets in Leh.

Over the last year, the Chinese have been accumulating troops and carrying out aggression under the guise of an exercise, after which the Indian security forces reacted in kind and put a stop to the Chinese aggression.

## **Earlier weapon installations**

A few days earlier, to counter the Chinese invasion, Indian Army personnel stationed at advanced outposts have been equipped with the newest American Sig Sauer 716 assault rifles and Swiss MP-9 pistol weapons. Army officers stationed in these high-altitude regions claimed the troops are already receiving American Sig Sauer 716 assault rifles for operations, citing the weapon's 500-meter range as an advantage in mountain combat.

With India making emergency orders for about 1.5 lakh, the rifles were procured in significant quantities. This was done shortly after the situation along the border deteriorated owing to Chinese assault in Eastern Ladakh, particularly the Galwan valley. The guns are versatile, allowing troops to wield them readily if they are needed in combat, according to officials.

Previously, in an effort to defuse tensions along the Line of Actual Control, India and China have withdrawn soldiers from the Gogra heights area and returned them to their regular posts (LAC). The disengagement took place over two days on August 4 and 5, and both sides' forces have returned to their regular positions.

<https://www.republicworld.com/india-news/general-news/iaf-builds-one-of-worlds-highest-mobile-atc-towers-in-ladakh-at-advanced-landing-ground.html>



Credit: ANI

## How many aircraft carriers does India need?

*By Bhartendu Kumar Singh*

After two decades of protracted wait, India's first indigenous aircraft carrier IAC-1, or Vikrant, has just completed its first field trials. When it is eventually commissioned into the Indian Navy, India would once again have the luxurious comfort of two carriers. Concurrently, the Indian Navy is also gunning for go-ahead sanction to initiate the IAC-2 project towards a larger aircraft carrier in due course. All these issues necessitate discussion about a fundamental doubt – how many aircraft carriers does India need? Assuming we want more, do we have that kind of money to build and operate another carrier?

The political economy of big war machines has always engendered debate about their usage and cost-effective alternates. Aircraft carriers do not curry favour with finance ministries in great powers as they entail huge capital expenditure (Capex) along with operating expenditure (Opex). Today, the average cost of building an armed mid-size carrier is touching \$10 billion (Rs 75,000 cr). The American Navy that uses aircraft carriers as the centerpiece of its power projection approach is seriously debating several issues such as big versus small carriers, conventional vs nuclear fuel, and the very number of active carriers in future. Such debates are being fuelled due to cost considerations. The aircraft carrier's military usage is also bereft of consensus since the actual war histories do not have much to boast as 'solid successes'. Interestingly, the USS Gerald R Ford, the costliest and largest carrier so far, is facing problems related to launching and landing of jets, even after three years of commissioning.

Given such complexities, it is baffling that India procured a carrier in 1957 (HMS Hercules, commissioned as INS Vikrant in 1961) when its financial condition was wretched; it didn't face any maritime threat; and no other country in Asia actually owned a carrier! The procurement decision was perhaps influenced by Patrick Blackett, the British physicist and Nobel Laureate, who had served in the Royal British Navy during World War I and was the scientific advisor to Indian government in the early decades of the Republic. The UK had extra carriers built during World War II and wanted to dispose them off. When India bought INS Virat from the UK and commissioned it in 1987, it was only logical since the Indian Navy now had a tradition and experience of more than 25 years in operating an aircraft carrier. Admiral Gorshkov's procurement from Russia (INS Vikramaditya) in 2004 was, nevertheless, painful due to humongous cost escalations, negotiation complexities, delayed delivery and commissioning, and now, recurring refits.

The IAC-1, therefore, is a significant milestone in indigenisation and puts a curtain on imported carriers and Gorshkov-type bitterness. On the face of it, another IAC would provide further boost to domestic shipbuilding industry and proliferate dual-use technologies. Any decision making gap at this stage may mean losing out on technological gains and know-how in the specialised field of aircraft carrier engineering. Moreover, while IAC-1 is of 45,000 tonnage and based on STOVAR (short take-off but arrested recovery) launching and landing system, the IAC-2 would be a bigger carrier (up to 65,000 tonnes), based on CATOBAR (catapult assisted take-off but arrested recovery) technology. Officially, therefore, the Indian Navy has been pushing for a three-carrier based maritime strategy.

Is the Indian Navy's desire for three carriers just? Should we go for the IAC-2 at least? There are many financial considerations that militate against a go-ahead for IAC-2. First, aircraft carriers have not provided commensurate returns in India's war history. The first generation Vikrant was hardly used in operations and was mostly docked during crisis times. It was again in dockyards for repairs prior to 1971 war and was pulled out just to avoid controversy over its role. It retreated after smashing the weak challenge on East Pakistan maritime front. Even INS Virat and Vikramaditya have not undertaken any major operational role. Thus, from a purely cost-benefit perspective, it is

worth asking if India got bang for its buck. Second, while the US maintains 12 carriers and China and the UK have two each, other military powers have only one carrier each. This despite that most of these countries are cash-rich. That brings an important consideration: when military powers like Russia and France, having global spread, are doing with one, why India's wish list stretches to two or three? Third, a futuristic carrier would mean \$9-10 billion defrayed over six-to-seven years. Navy's own capital acquisition fund is pegged at Rs 32,253 cr (\$0.43 billion) for 2021-22. It is also committed to spend \$6 billion over next few years for the indigenous submarine project as well as \$3 to 4 billion for furnishing the IAC-1 with jets. Where will the money come from? Even if the newly created non-lapsable Modernisation Fund for Defence and Internal Security (MFDIS) are to be pooled in, either that would not be sufficient or other defence capital acquisitions would suffer.

India's strategic threats in foreseeable future would perpetuate from the land borders with China and Pakistan, including a dreadful scenario of two-front war. Contemporary maritime threats, on the other hand, are manageable with partial increase in current fleet resources without aiming at pax Indica. Policy suggestion for converting the Andaman group of islands into an affordable, non-floating and unsinkable carrier deserves consideration. A dispassionate study of reasons for time and cost escalation in IAC-1, net gains in technology development, industry proliferation, along with identification of savings in other acquisition schemes, may help shift the balance of arguments towards the IAC-2.

We lost the opportunity to debate 'does India need an aircraft carrier' in fifties and got swayed away by irrational foreign advisory. Today, we are at the cusp of another debate. We need to discuss our past mistakes, emerging global perspective on carriers, availability of cost-effective alternates, and above all, the financial resources. Probably, that would facilitate public policy clarity about India's requirement for more aircraft carriers.

*Note: The author is in the Indian Defence Accounts Service. Views are personal.*

<https://timesofindia.indiatimes.com/blogs/voices/how-many-aircraft-carriers-does-india-need/>

 **The Indian EXPRESS**

Wed, 11 Aug 2021

## Why India's military leaders must have a free and frank discussion on demarcation of air power roles and missions

*Arun Prakash writes: The conundrum that needs to be resolved is the IAF's certainty about the indivisibility of air power, versus the army and navy's belief that aviation must be available at their disposal*

*By Arun Prakash*

The conundrum that needs to be resolved is the IAF's certainty about the indivisibility of air power, versus the army and navy's belief that aviation must be available at their disposal overlap and confusion, and this led the US Congress to enact the National Security Act of 1947, which, apart from unifying the armed forces, created an independent US Air Force.

However, many issues related to resources as well as institutional boundaries remained unresolved and bitter infighting broke out between the US Navy and the USAF over aviation "roles and missions". Given the urgency of addressing these contentious issues, in March 1948, the US Secretary of Defence cloistered himself with the service chiefs, and, together, they hammered out a consensus. This was enshrined in the



An indigenous LCA Tejas at the Aero India show in Bengaluru. (Express Photo)

“US Code of Federal Laws”, and remains the legal basis for roles and missions of the US military. In India, no such discussion has ever taken place and there is no mutually agreed upon or government-mandated demarcation of aviation roles and missions. Periodic “sniping” and even “poaching” has, therefore, taken place, leaving the IAF beset with a deep sense of insecurity, for reasons that I outline.

The 1970s saw an acrimonious debate between the IAF and the Indian Navy (IN) about the discharge of the maritime reconnaissance (MR) role, which the air force had inherited at independence. The penetration in 1971 of our waters by Pakistani submarines, having brought matters to a head, the government decided to hand over the MR role and aircraft to the IN in 1976.

The Indian Army, too, had been demanding the creation of an integral air arm, citing unsatisfactory aviation support by the IAF in forward areas. The issue became another inter-service squabble till the government intervened in 1986 and sanctioned the transfer of assets from the IAF to the newly formed Army Aviation Corps. The controversy did not end here as control of attack helicopters remained an issue of inter-service contention.

The IAF, having seen sister services appropriate its roles and assets, remained wary about jointness. Concepts of CDS and integrated commands which would require air assets being placed under non-IAF control, ring alarm bells in Air HQs. There are misperceptions on both sides of the “air-power divide”, and the crying need of the day is for the tri-service leadership to sit around a table and provide mutual reassurance regarding service “roles and missions”.

Air power, in the post-Cold War era, acquired a new aura. Based on the lethality and speed of modern air power, it is claimed that once “air dominance” has been achieved, the war is virtually won. In this paradigm, close support of surface forces receives low priority because quick military victories can be won from the air at minimal cost. However, such euphoric assumptions were based on recent conflicts where modern air forces wielding advanced technology had encountered irregular forces.

India, on the other hand, is faced with well-equipped, motivated and competent adversaries. The PAF, although numerically inferior, is a professional peer and has the assurance of Chinese support. The PLA Air Force not only outnumbers the IAF, but has the advantage of an advanced technological base. In our calculus, therefore, we cannot afford to bank on any specific advantage, nor speak nonchalantly about establishing “air dominance” over Pakistan or Tibet.

For too long have we treated the demarcation of air power roles and missions as a “holy cow” and shirked from free and frank discussion. The facade of inter-service bonhomie has concealed a germ of discord which needs to be exorcised. The conundrum that needs to be resolved is posed by the IAF’s certainty about the “indivisibility of air power”, versus the belief of the army and navy that aviation must be an integral resource, available at their disposal.

Questions that military leaders will need to address, jointly, are: One, should attainment of air dominance be an end in itself, superseding military and maritime strategies? Two, should air power be seen as merely an instrumentality to gain operational objectives on land, sea and air? Three, is there a via-media which will maximise the synergy and combat effectiveness of all three services, perhaps by modifying the IAF’s 2012 doctrine?

Three final points need to be made in the closely related context of the joint commands being currently contemplated/constituted. First, it must be ensured that allocation of air power is not made piece-meal, but flows from an integrated, tri-service plan. Second, operational deployment of the command’s aviation resources must be managed on behalf of the C-in-C, by his 2/3-star IAF component commander. Finally, the government must clarify that most high-level posts will, eventually, be tenable by officers of all three services. The rationale for integrated commands must, therefore, not be dictated by provision, to each service, of its “quota” of ranks/posts.

*(The writer is a retired chief of naval staff, who flew with the IAF fighter squadron in the 1971 Indo-Pakistan war)*

<https://indianexpress.com/article/opinion/columns/why-indias-military-leaders-must-have-a-free-and-frank-discussion-on-demarcation-of-air-power-roles-and-missions-7447880/>

## India, Saudi Arabia begin first naval exercise

*Planning by India and Saudi Arabia for their first naval exercise had begun in 2019 but the move was impacted by the Covid-19 pandemic*

*By Rezaul H Laskar*

A frontline Indian warship is currently participating in the first naval exercise with Saudi Arabia, reflecting the growing defence ties between the two sides in the wake of the Indian Army chief's first visit to the West Asian country last year.

INS Kochi, the flagship destroyer of the Indian Western Naval Fleet, arrived at Port Al-Jubail on Monday for the "Al-Mohed Al-Hindi 2021" exercise. The warship sailed to Saudi Arabia after conducting the "Zayed Talwar" drill with the United Arab Emirates (UAE) off the coast of Abu Dhabi on Saturday.

India's defence and military ties with Saudi Arabia received a major boost with Indian Army chief Gen MM Naravane's visit to Riyadh – the first such trip by an Indian service chief – last December. Naravane had also visited the UAE on the same tour. The Al-Mohed Al-Hindi exercise began with the harbour phase on Monday, and the Indian embassy said the drill "heralds a new chapter in the bilateral defence ties". INS Kochi was welcomed at the port by officials of the Royal Saudi Naval Forces, Border Guards and the Indian embassy. Al-Mohed Al-Hindi comprises a number of shore and sea-based drills between the two navies. During its stay at Jubail port, the Indian warship will follow all Covid-19 protocols laid down by Saudi authorities.

Planning by India and Saudi Arabia for their first naval exercise had begun in 2019 but the move was impacted by the Covid-19 pandemic. The Indian Navy held a few minor exercises amid the pandemic but plans for larger drills were recently revived. Warships from India, Australia, Japan and the US – the four members of the Quadrilateral Security Dialogue or Quad – will participate in the Malabar exercise in the Western Pacific later this month.

The Indian Navy's exercises with the UAE and Saudi Arabia are being held against the backdrop of growing tensions in the Persian Gulf following a drone attack on the tanker MV Mercer Street off Oman that killed a Briton and a Romanian citizen.

The UAE fielded a guided missile corvette and a Panther helicopter for the exercise with INS Kochi. The two sides carried out tactical manoeuvres, search and rescue operations, and an electronic warfare drill to enhance interoperability. The exercise came a week after the Indian Air Force chief, Air Chief Marshal RKS Bhadauria, visited the UAE.

The visit of INS Kochi, an indigenously designed and built Kolkata-class stealth guided missile destroyer, also gives India an opportunity to display its ship-building capabilities in West Asia. The warship incorporates new design concepts for stealth and has a large component of indigenous combat suites.

It is equipped with sophisticated digital networks, and a unique feature of the warship is the high level of indigenisation, with most systems sourced from within India. Some of the major indigenised systems on INS Kochi include the electronic warfare suite and the ship's stabilisers.

<https://www.hindustantimes.com/india-news/india-saudi-arabia-begin-first-naval-exercise-101628579181223.html>



The UAE fielded a guided missile corvette and a Panther helicopter for the exercise with INS Kochi. The two sides carried out tactical manoeuvres, search and rescue operations, and an electronic warfare drill to enhance interoperability. (Courtesy: India)

### ISRO-SAC instrument finds presence of hydroxyl and water molecules on Moon

*The research also strongly suggests that the presence of these could correlate with mineralogy and latitudinal location, according to a paper published in the latest issue of fortnightly journal 'Current Science'*

*By Sohini Ghosh*

Ahmedabad: In a pathbreaking discovery, ISRO's homegrown instrument aboard Chandrayan-2 has detected the unambiguous presence of hydroxyl and water molecules on the Moon with the precision of differentiating between the two.

The research also strongly suggests that the presence of these could correlate with mineralogy and latitudinal location, according to a paper published in the latest issue of fortnightly journal 'Current Science'.

The Imaging infrared spectrometer (IIRS), an imaging instrument that collects information from the electromagnetic spectrum for understanding the mineral composition of the lunar surface with each element possessing a 'spectral signature' unique to itself, was developed by Ahmedabad-based unit of Space Applications Centre (SAC) of ISRO.



**The discovery is being hailed as critical for future planetary exploration and resource utilisation.**

The discovery is being hailed as critical for future planetary exploration and resource utilisation.

While the first Moon mission of Chandrayan-1 in 2008 carried a similar instrument called Moon Mineralogy Mapper (commonly known as M3) capable of detecting water, the range of detection was lower — between 0.4 to 3 micrometre — and was also developed by NASA's Jet Propulsion Laboratory and was not indigenous to ISRO. The higher wavelength range of IIRS permits for better accuracy in results. In September 2009, results published of the M3 instrument data had shown detection of absorption features on the polar regions of the surface of the moon "usually linked to hydroxyl- and/ or water-bearing molecules," as NASA states. A 2017 research article by researchers from the Brown University had noted, "...the wavelength range of M3 is too limited to accurately determine the full shape and maximum absorption point within the 3- $\mu$ m (micrometre) region, making it difficult to differentiate OH (hydroxyl) from H<sub>2</sub>O (water), particularly if both species are present." Notably, the human eye is capable of detecting wavelengths in the range of 0.3 and 0.7 micrometre.

Prakash Chauhan, director at IIRS Dehradun, in response to queries by The Indian Express said in a written statement that since the spectral coverage of M3 instrument was limited upto 3 micrometre, distinction between hydroxyl, water and water ice/frost was not possible.

As more data from the mission is made available in the future, researchers are hoping that they will be able to learn more about hydroxyl and water production and hydration processes on the moon

As per a research article in the August issue of Current Science, three strips on the Moon's surface were analysed by IIRS sensor for hydration presence and as reported, the initial analysis "demonstrates the presence of widespread lunar hydration and unambiguous detection of OH



(hydroxyl) and H<sub>2</sub>O (water) signatures on the Moon.” It was also observed from the data that the rockier regions of the Moon were found to have higher hydroxyl or possibly water molecules, compared to the large basaltic plain regions where hydroxyl appeared to be dominant, especially at higher surface temperature.

As the paper, authored by scientists from IIRS-Dehradun, SAC in Ahmedabad, UR Rao Satellite Centre and ISRO headquarters in Bengaluru, notes, the most common and widespread process for the formation of hydroxyl and water on the Moon is considered to be due to interaction of solar winds with the lunar surface.

<https://indianexpress.com/article/technology/science/isro-sac-instrument-finds-presence-of-hydroxyl-and-water-molecules-on-moon-7448012/>

**TIMESNOWNEWS.COM**

Wed, 11 Aug 2021

## India to get new 'eye in the sky' ahead of I-Day: All you need to know about ISRO's GISAT-1 launch

*Scheduled to blast off from the Satish Dhawan Space Centre (SDSC) in Sriharikota, Andhra Pradesh, GISAT-1 will become India's most advanced geo-imaging satellite*

### **Key Highlights**

- *Dubbed India's 'eye in the sky,' India's GISAT-1 is a state-of-the-art geo-imaging satellite that, according to a reply by Union Minister Jitendra Singh to Rajya Sabha, will be able to conduct daily imaging of the country at a rate of three to four times*
- *Weighing more than 2 tonnes, the satellite has a lift-off mass of 2,268 kg and a power generation capacity of 2280 W*
- *Shortly after its launch, ISRO plans to launch RISAT-1A, a radar imaging satellite with synthetic aperture radar (SAR) capable of taking pictures during both, the day and night, and able to see through cloud cover as well*

Just three days ahead of India's 75th Independence Day, the Indian Space Research Organisation (ISRO) will reach a major milestone in space history when it launches the country's first Earth Observation Satellite (EOS).

Scheduled to blast off from the Satish Dhawan Space Centre (SDSC) in Sriharikota, Andhra Pradesh, GISAT-1 will become India's most advanced geo-imaging satellite, allowing for improved monitoring of the Indian subcontinent, including its borders with Pakistan and China.

### **What is GISAT-1?**

Dubbed India's 'eye in the sky,' India's GISAT-1 is a state-of-the-art geo-imaging satellite that, according to a reply by Union Minister Jitendra Singh to Rajya Sabha, will be able to conduct daily imaging of the country at a rate of three to four times. The satellite will perch itself some 36,000 km above the Earth's surface, and its geosynchronous orbit will mean that it can provide constant, real-time satellite imagery of areas of interest.

Weighing more than 2 tonnes, the satellite has a lift-off mass of 2,268 kg and a power generation capacity of 2280 W. According to the ISRO website, “The satellite is configured around modified I-2k bus carrying multispectral and hyperspectral payloads in different bands with improved spatial and temporal resolution. This is also, reportedly, the first ISRO has utilised a four-metre diameter Ogive shaped payload faring (heat shield).



**ISRO's GISAT-1 satellite will launch on August 12 from the Satish Dhawan Space Centre (SDSC) in Sriharikota, Andhra Pradesh. | Photo Credit: Twitter**

Described as a 'gamechanger,' GISAT-1 will primarily have three uses. As per ISRO, it will provide close to real-time imaging of large area regions of interest at frequent intervals. It can also be used to monitor natural disasters, episodic events and any short-term events. The satellite can also obtain spectral signatures for agriculture, forestry, mineralogy, disaster warning, cloud properties, snow & glaciers and oceanography.

### ISRO's satellite launches this year

The satellite was originally scheduled to launch in March last year. However, that launch date was pushed back with ISRO noting that it had encountered some minor technical issues. The onset of the COVID-19 pandemic and the subsequent restrictions proved to be another spanner in the works, and the launch had to be pushed back for over a year.

The launch of GISAT-1 will only be ISRO's second this year, following its February launch of 18 small satellites. ISRO has stated that India now "has one of the largest constellations of remote sensing satellites" to observe the Earth.

But ISRO does not plan to rest on its laurels following the launch of GISAT-1. Shortly after its launch, it plans to launch RISAT-1A, a radar imaging satellite with synthetic aperture radar (SAR) capable of taking pictures during both, the day and night, and able to see through cloud cover as well.

The RISAT-1A satellite will, reportedly, weigh over 1,800 kg and is set to launch in September. Its ability to operate across 24 hours and in all-weather conditions will see it play a strategic role in the country defence.

<https://www.timesnownews.com/technology-science/article/india-to-get-new-eye-in-the-sky-ahead-of-i-day-all-you-need-to-know-about-isros-gisat-1-launch/797289>

## हिन्दुस्तान

Wed, 11 Aug 2021

### इसरो कल आसमान में तैनात करेगा भारत का 'निगहबान', EOS-3

### सैटेलाइट की लॉन्चिंग का काउंटडाउन शुरू, जानें इसकी खासियत

भारत के 75वें स्वतंत्रता दिवस से तीन दिन पहले भारतीय अंतरिक्ष अनुसंधान संगठन भारत को एक तोहफा देने जा रहा है। भारत अंतरिक्ष में एक बड़ी छलांग लगाने जा रहा है जिसके बाद से आसमान में भारत का एक निगहबान अपनी जगह बना लेगा। बता दें कि इसरो पृथ्वी की निगरानी करने वाले अपने देश के पहले उपग्रह ईओएस-03 का प्रक्षेपण करने वाला है। जियोसिंक्रोनस सैटेलाइट लॉन्च व्हीकल-एफ 10 (जीएसएलवी ) ईओएस-03 मिशन के प्रक्षेपण के लिए काउंटडाउन शुरू हो चुका है। इसके सफल होने के बाद से भारत की ताकत में बढ़ोतरी होगी। यह उपग्रह भारत में आने वाली बाढ़ और चक्रवात जैसी आपदाओं की निगरानी रखने में सक्षम होगा। इसका प्रक्षेपण कल सुबह पांच बजकर 43 मिनट पर होगा।

इसरो ने ट्वीट कर काउंटडाउन शुरू होने की जानकारी दी है, इसने लिखा, "जियोसिंक्रोनस सैटेलाइट लॉन्च व्हीकल-एफ 10 ईओएस-03 के प्रक्षेपण के लिए काउंटडाउन आज सतीश धवन अंतरिक्ष केंद्र (SDSC) शार, श्रीहरिकोटा पर शुरू हो चुका है।"

#### कल होगा प्रक्षेपण

बता दें कि भारतीय अंतरिक्ष अनुसंधान संगठन (इसरो) के श्रीहरिकोटा स्थित सतीश धवन अंतरिक्ष केंद्र से 12 अगस्त को सुबह पांच बजकर 43 मिनट पर उपग्रह ईओएस-03 का प्रक्षेपण किया जाएगा। इससे मौसम संबंधी गतिविधियों को समझने में और आसानी होगी।

इससे भारत को बहुत फायदा होगा। बताया जा रहा है कि जीएसएलवी उड़ान उपग्रह को 4 मीटर व्यास-ओगिव आकार के पेलोड फेयरिंग में ले जाएगी, जिसे रॉकेट पर पहली बार उड़ाया जा रहा है, जिसने अब तक अंतरिक्ष में उपग्रह और साझेदार मिशनों को तैनात करने वाली 13 अन्य उड़ानें संचालित की हैं।

क्या है खासियत?

इसके बारे में कहा जा रहा है कि जीएसएलवी उड़ान उपग्रह एक दिन में पूरे देश की चार-पांच बार तस्वीर लेगा, जो मौसम और पर्यावरण परिवर्तन से संबंधित प्रमुख डेटा भेजेगा। इतना ही नहीं, यह EOS-03 उपग्रह भारतीय उपमहाद्वीप में बाढ़ और चक्रवात जैसी प्राकृतिक आपदाओं की लगभग रीयल टाइम निगरानी में सक्षम होगा क्योंकि यह प्रमुख पर्यावरणीय और मौसम परिवर्तनों से गुजरता है।

<https://www.livehindustan.com/national/story-isro-to-launch-gslv-f10-eos-3-to-understand-meteorological-activities-isro-countdown-for-the-launch-of-eos-3-begins-4333300.html>



Wed, 11 Aug 2021

## Metamaterials research challenges fundamental limits in photonics

Cornell researchers are proposing a new way to modulate both the absorptive and the refractive qualities of metamaterials in real time, and their findings open intriguing new opportunities to control, in time and space, the propagation and scattering of waves for applications in various areas of wave physics and engineering.

The research published in the journal *Optica*, "Spectral causality and the scattering of waves," is authored by doctoral students Zeki Hayran and Aobo Chen, M.S. '19, along with their adviser, Francesco Monticone, assistant professor in the School of Electrical and Computer Engineering in the College of Engineering.



Credit: CC0 Public Domain

The theoretical work aims to expand the capabilities of metamaterials to absorb or refract electromagnetic waves. Previous research was limited to modifying either absorption or refraction, but the Monticone Research Group has now shown that if both qualities are modulated in real time, the effectiveness of the metamaterial can be greatly increased.

These temporally modulated metamaterials, sometimes referred to as "chrono-metamaterials" may open unexplored opportunities and enable technological advances in electromagnetics and photonics.

"What we demonstrate," Monticone said, "is that if you modulate both properties in time, you manage to absorb electromagnetic waves much more efficiently than in a static structure, or in a structure in which you modulate either one of these two degrees of freedom individually. We combined these two aspects together to create a much more effective system."

The findings may lead to the development of new metamaterials with wave absorption and scattering properties that far outperform what is currently available. For example, a broadband absorber has to be thicker than a certain value to be effective, but the material thickness will limit the applications of the design.

"To decrease the thickness and increase the bandwidth of such an absorber, you have to overcome the limitations of conventional materials," Hayran said. "One of the ways to bypass these limitations is through temporally modulating the structure."

The aim of Monticone's group is to open new areas of research to produce increasingly efficient practical applications.

"What we are trying to do is not incremental changes to the technology," Monticone said. "We want disruptive changes. That's really what motivates us. So how can we make a dramatic improvement to the technology, not just an incremental improvement? To do that, very often, you have to go back to the fundamentals."

The new research pushes the limits of electromagnetic wave absorption by using another degree of freedom, which is modulation in time, something not typically done in this area, but now receiving increasing research attention.

With a new theoretical underpinning in place, experimentally implementing temporal modulations of this kind is the challenge for further research. A physical experiment would first need to design a mechanism to control the modulation of absorptive and refractive qualities of a material over time, which might include laser beams or microwave components.

The ideas have direct implications for several applications, such as broadband radar absorption and temporal invisibility and cloaking. Applications could also extend to other domains of wave physics such as acoustics and elastodynamics.

"Our findings, and the exciting results by other researchers working in this area, highlight the many opportunities offered by time-varying metamaterials for both classical and quantum electromagnetics and photonics," Monticone said.

**More information:** Zeki Hayran et al, Spectral causality and the scattering of waves, *Optica* (2021). [DOI: 10.1364/OPTICA.423089](https://doi.org/10.1364/OPTICA.423089)

**Journal information:** [\*Optica\*](#)

<https://phys.org/news/2021-08-metamaterials-fundamental-limits-photonics.html>

## New method for fabricating flexible electronics

A new method for manufacturing electronics which prints high-performance silicon directly onto flexible materials could lead to breakthroughs in technologies including prosthetics, high-end electronics and fully bendable digital displays.

In a new paper published in the journal *npj Flexible Electronics*, engineers from the University of Glasgow's Bendable Electronics and Sensing Technologies (BEST) group outline how they have streamlined and improved the conventional process for creating flexible large area electronics.

Until now, the most advanced flexible electronics have been mainly manufactured by a process called transfer printing, a three-stage stamping process a bit like receiving an ink stamp in a passport when visiting another country.

First, a silicon-based semiconductor nanostructure is designed and grown on a surface known as a substrate. In the second stage, the nanostructure is picked up from the substrate by a soft polymeric stamp. In the final stage, the nanostructure is transferred from the stamp to another flexible substrate, ready for use in bendable devices like health monitors, soft robotics, and bendable displays.

However, the transfer printing process has a number of limitations which have made it challenging to create more large-scale, complex flexible devices. Precisely controlling critical variables like the speed of transfer, and the adhesion and orientation of the nanostructure, makes it difficult to ensure each stamp is identical to the last.

Similar to how a badly stamped passport can make it difficult for travelers to read, an incomplete or misaligned polymeric stamp onto the final substrate can lead to substandard electronic performance or even prevent devices from working.

While processes have been developed to make the stamping transfer more effective, they often require additional equipment like lasers and magnets, adding additional manufacturing cost.

The Glasgow team have taken a different approach, removing altogether the second stage of the conventional transfer printing process. Instead of transferring nanostructures to a soft polymeric stamp before it is transferred to the final substrate, their new process what they call 'direct roll transfer' to print silicon straight onto a flexible surface.

The process begins with the fabrication of a thin silicon nanostructure of less than 100 nanometres. Then the receiving substrate—a flexible, high-performance plastic foil material called polyimide—is covered in an ultrathin layer of chemicals to improve adhesion.

The prepared substrate is wrapped around a metal tube, and a computer-controlled machine developed by the team then rolls the tube over the silicon wafer, transferring it to the flexible material. By carefully optimizing the process, the team have managed to create highly-uniform prints over an area of about 10 square centimeters, with around 95% transfer yield—significantly higher than most conventional transfer printing processes at the nanometre scale.

Professor Ravinder Dahiya is the leader of the BEST group at the University of Glasgow's James Watt School of Engineering.

Professor Dahiya said: "Although we used a square silicon wafer sample of 3cm on each side in the process we discuss in this paper, the size of the flexible donor substrate is the only limit on the size of silicon wafers we can print. It's very likely that we can scale up the process and create very complex high-performance flexible electronics, which opens the door to many potential applications.

"The performance we've seen from the transistors we've printed onto flexible surfaces in the lab has been similar to the performance of comparable CMOS devices—the workhorse chips which control many everyday electronics.

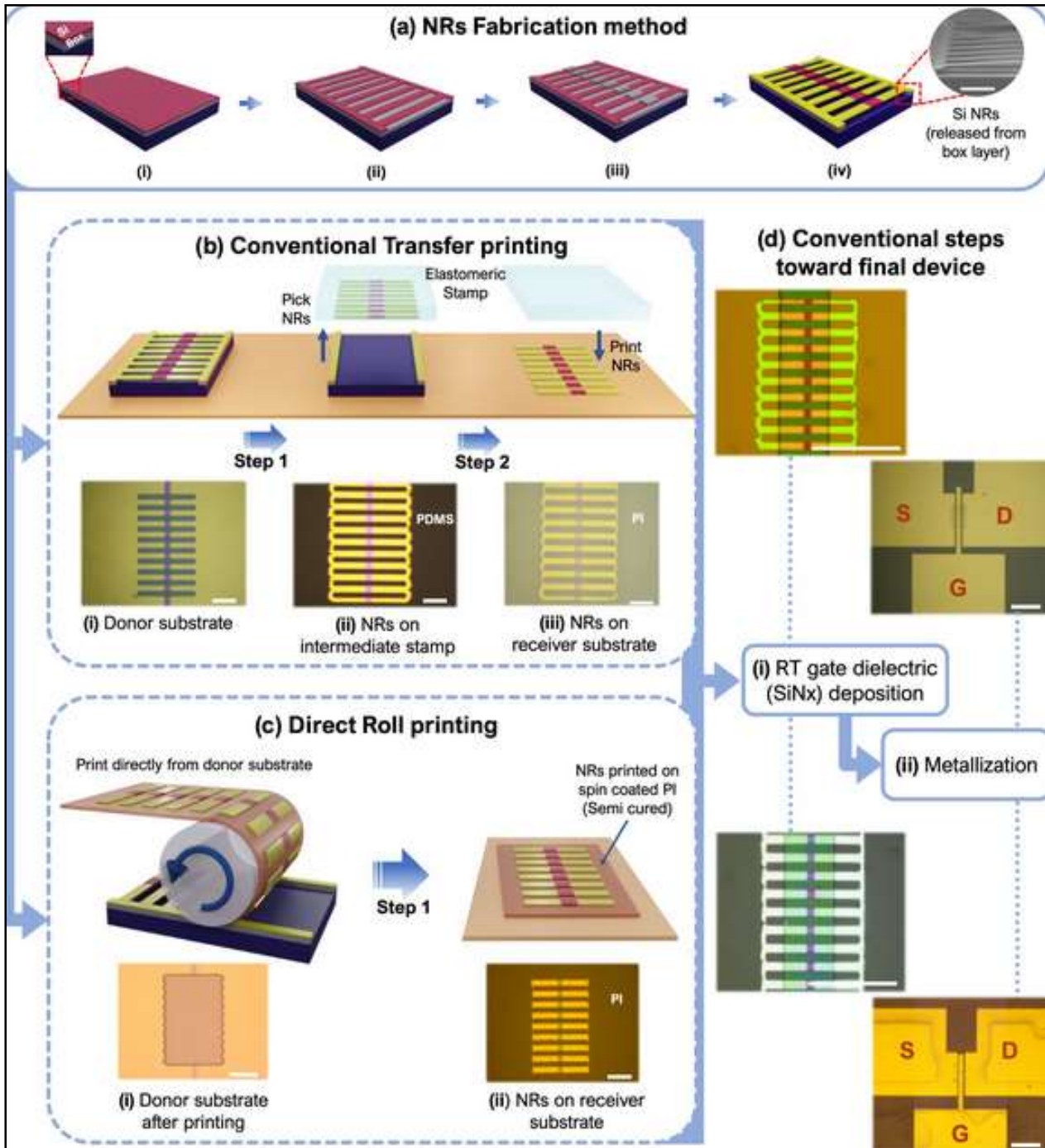


Fig. 1: Schematic illustration of the steps involved in the direct roll printing process with corresponding optical and SEM images. a Fabrication step of Si NRs carried out on the donor substrate with n+ selective doping followed by releasing the NRs from buried oxide (Box) layer as shown in SEM cross-sectional image (scale bar, 10  $\mu\text{m}$ ). b Conventional transfer printing steps using an elastomeric stamp (PDMS) with an optical image of each step (scale bar, 25  $\mu\text{m}$ ). c Direct roll printing of NRs from donor to the semi-cured PI substrate (scale bar, 25  $\mu\text{m}$ ). d Conventional microfabrication processing steps toward a final NRFET device (i.e., room temperature dielectric deposition, metallization, etc (scale bar, 100  $\mu\text{m}$ )). Credit: DOI: 10.1038/s41528-021-00116-w

"That means that this type of flexible electronics could be sophisticated enough to integrate flexible controllers into LED arrays, for example, potentially allowing the creation of self-contained digital displays which could be rolled up when not in use. Layers of flexible material stretched over prosthetic limbs could provide amputees with better control over their prosthetics, or even integrate sensors to give users a sense of 'touch.'"

"It's a simpler process capable of producing high-performance flexible electronics with results as good as, if not better, than conventional silicon based electronics. It's also potentially cheaper and more resource-efficient, because it uses less material, and better for the environment, because it produces less waste in the form of unusable transfers."

**More information:** Ayoub Zumeit et al, Direct roll transfer printed silicon nanoribbon arrays based high-performance flexible electronics, *npj Flexible Electronics* (2021). DOI: [10.1038/s41528-021-00116-w](https://doi.org/10.1038/s41528-021-00116-w)  
<https://phys.org/news/2021-08-method-fabricating-flexible-electronics.html>



Wed, 11 Aug 2021

## Invisible barrier breakthrough a boon for electronics, artwork and more

Curtin University researchers have found applying a thin invisible layer of graphene oxide to silicon forms an impermeable barrier, which could be used to protect artwork, prevent corrosion of metals, and produce higher efficiency solar cells.

Lead author Dr. Nadim Darwish from Curtin's School of Molecular Life Sciences said while protective layers on silicon were already used as an efficiency enhancer in devices such as solar cells and microchips, the procedure for forming these protective coatings was complicated and required highly specialised fabrication laboratories.

"Silicon solar cells often require the application of a layer of alumina, silica or other material to increase their efficiency in transforming sunlight to electricity.

Our breakthrough was finding that graphene oxide reacts quickly with silicon without the need for external catalysts, additives or complicated procedures," Dr. Darwish said.

"We found the graphene oxide protects silicon from ambient oxygen for at least 30 days, which is a significant step forward in applying the properties of 2D materials such as graphene and graphene oxide to make silicon even more efficient and useful."

Research co-author Ph.D. student Soraya Rahpeima, also from Curtin's School of Molecular Life Sciences said the new method could potentially enable development of new types of solar cells for more efficient generation and supply of power along with many applications in electronics.

"This breakthrough opens a whole new realm of possibilities even beyond silicon research," Ms Rahpeima said.

"For example, graphene and graphene oxide can be used to protect sensitive materials from gases and ambient environments including ultraviolet light.

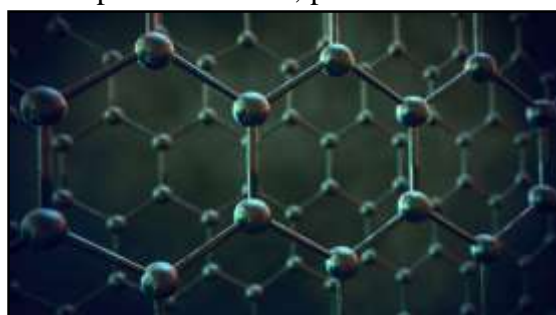
"A thin, invisible, and flexible layer when applied to artwork such as valuable paintings and stamps could potentially protect them from harmful light and moisture and other damaging elements contained in air without the need to cover the artwork with thick glass or protective layers that diminish the beauty of the artwork."

The paper, "Impermeable Graphene Oxide Protects Silicon from Oxidation," was published in journal *ACS Applied Materials & Interfaces*.

**More information:** Soraya Rahpeima et al, Impermeable Graphene Oxide Protects Silicon from Oxidation, *ACS Applied Materials & Interfaces* (2021). DOI: [10.1021/acsami.1c06495](https://doi.org/10.1021/acsami.1c06495)

**Journal information:** [ACS Applied Materials and Interfaces](https://doi.org/10.1021/acsami.1c06495)

<https://phys.org/news/2021-08-invisible-barrier-breakthrough-boon-electronics.html>



This visualisation shows layers of graphene used for membranes. Credit: University of Manchester

### **Covid-19 may diminish cognitive abilities: Study**

*The research, published in The Lancet's E clinical Medicine journal late last month, builds on what is slowly emerging in multiple scientific and clinical studies: the Sars-CoV-2 virus impacts the brain and its effects can be felt long after people recover*

New Delhi: People who have recovered from Covid-19 possibly suffer from significant cognitive deficit, a study of more than 81,000 people in the UK who took an intelligence test online has suggested, offering more scientific basis to the anecdotal evidence from a growing number of people who report “Long Covid“ brain fog.

The research, published in The Lancet's E clinical Medicine journal late last month, builds on what is slowly emerging in multiple scientific and clinical studies: the Sars-CoV-2 virus impacts the brain and its effects can be felt long after people recover.

“Our analyses provide converging evidence to support the hypothesis that Covid-19 infection is associated with cognitive deficits that persist into the recovery phase,” said the team of researchers led by Adam Hampshire of London's Imperial College, in their report.

The study found that the deficit in cognition was worse among people who had more severe respiratory symptoms and among those who received a confirmed positive test. The researchers adjusted their analysis to account for differences based on age, gender, education or other demographic and socioeconomic variables.

The report is the third in two months to flag the impact Covid-19 has on the brain.

On June 15, a team led by neuroscientists and researchers in Oxford university published the result of their analysis of brain scans of people before and after they had Covid-19. In close to 400 people whose brain scans from before and after the illness were available, they found significant loss of grey matter – which indicates some brain damage – and the areas that were affected involved functions relating to smell and taste, cognition and memory formation.

On July 29, scientists and clinicians attending the 2021 Alzheimer's Association International Conference reported findings from Greece and Argentina that suggested Covid-19 left older adults with cognitive impairment, including lasting lack of smell and early Alzheimer-like symptoms.

“We're starting to see clear connections between Covid-19 and problems with cognition months after infection,” said one of the scientists, Gabriel de Erausquin of the University of Texas Health Science Center at San Antonio Long School of Medicine, at the time. “It's imperative we continue to study this population, and others around the world, for a longer period of time to further understand the long-term neurological impacts of Covid-19,” Erausquin added.

The report from the study led by Hampshire found that the loss in cognitive function may be substantial – more than the average 10-year overall decline people between the age of 20-70 report. “It was larger than the mean deficit of 480 people who indicated they had previously suffered a stroke (0.24SDs) and the 998 who reported learning disabilities (0.38SDs). For comparison, in a classic intelligence test, 0.47 SDs equates to a 7-point difference in IQ,” the authors wrote.

The test was offered to people who visited popular websites such as those of the BBC as a general intelligence test, and participants were later subsequently asked to answer if they had Covid-19, before more details about their backgrounds were logged by the test.

The assessment was designed to measure distinct aspects of human cognition, spanning planning/reasoning, working memory, attention and emotion processing abilities, the researchers



said. They also explained that they divided up respondents to keep uniformity on the basis of age, gender, education level, income, racial-ethnic group, pre-existing medical disorders, tiredness, depression and anxiety.

As on Tuesday, close to 185 million people are known to have recovered from Covid-19 across the world. The report by the team led by Hampshire said their findings “accord with reports of Long Covid cognitive symptoms that persist into the early-chronic phase” and that the results “should act as a clarion call for further research with longitudinal and neuroimaging cohorts to plot recovery trajectories and identify the biological basis of cognitive deficits in Sars-CoV-2 survivors”.

<https://www.hindustantimes.com/health/covid19-may-diminish-cognitive-abilities-study-101628639533504.html>

