

Dec  
2021

# 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

खंड : 46      अंक : 239      01 दिसंबर 2021  
Vol.: 46      Issue : 239      01 December 2021



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## CONTENTS

S. No.	TITLE	Page No.
<b>DRDO News</b>		<b>1-5</b>
<b>DRDO Technology News</b>		<b>1-4</b>
1.	LETTER   RMAF purchase of Light Combat Aircraft to bolster defence industry	1
2.	Dubai Airshow 2021: India pushes its Light Combat Aircraft 'Tejas'	2
3.	BU's law school holds fort at world congress on tackling disaster	3
<b>COVID 19: DRDO's Contribution</b>		<b>4-5</b>
4.	Covid spreading in the Valley may get worse as winter arrives	4
<b>Defence News</b>		<b>6-15</b>
<b>Defence Strategic: National/International</b>		<b>6-15</b>
5.	Admiral R Hari Kumar, PVSM, AVSM, VSM, ADC assumes Command of the Indian Navy as 25th Chief of the Naval Staff	6
6.	एडमिरल आर. हरि कुमार, पीवीएसएम, एवीएसएम, वीएसएम, एडीसी ने नौसेना स्टाफ के 25वें प्रमुख के रूप में भारतीय नौसेना की कमान संभाली	7
7.	Vice Admiral Ajendra Bahadur Singh takes over as Flag Officer Commanding-In-Chief, Western Naval Command	8
8.	वाइस एडमिरल अजेंद्र बहादुर सिंह ने पश्चिमी नौसेना कमान के फ्लैग ऑफिसर कमांडिंग-इन-चीफ के रूप में पदभार ग्रहण किया	9
9.	Lt Gen Manoj Kumar Mago takes over as NDC Commandant	10
10.	India closes in on chopper export to the Philippines	11
11.	Army receives new Israeli Heron drones for deployment in Ladakh sector	13
12.	India's new threat: 4th Gen Warfare	14
<b>Science &amp; Technology News</b>		<b>16-23</b>
13.	The mystery behind the high abundance of Lithium in some evolved stars traced	16
14.	Quantum computers getting connected for multiple task-optimized smaller systems	18
15.	All-optical computing based on convolutional neural networks	19
16.	Physicists create time crystals with quantum computers	20
<b>COVID-19 Research News</b>		<b>23-23</b>
17.	Blood groups A, B and Rh+ more disposed to Covid-19, shows Ganga Ram Hospital study	23

## **LETTER | RMAF purchase of Light Combat Aircraft to bolster defence industry**

*By Sherman Socka*

LETTER | The Malaysian government has mandated a requirement for prospective suppliers of the 18 Light Combat Aircraft (LCA) for the Royal Malaysian Air Force (RMAF), currently being evaluated, to source or procure at least 30 percent of products/services from domestic companies.

The six international manufacturers of the LCA, who have submitted their bids when the tender for the supply of 18 units of fighter jets closed on October 6, 2021, will have to factor in this important national industrial policy requirement.

This could pose a major challenge for foreign manufacturers who may view such collaboration in defence-related projects with concerns over sensitivity on sharing knowledge on military technology.

While it is not known to what extent the current bidders for the supply of LCA for the RMAF will freely comply with the local content requirement or prevented from doing so, from information gathered in the public domain, one of the strong contenders at least has disclosed its willingness and ability to comply with such requirement.



Last week also saw the opening of Turkish Aerospace's first engineering and design office in Malaysia. Reports stated that Turkish and Malaysian engineers will carry out joint studies in a variety of areas, which include unmanned aerial vehicles, jet trainers, helicopter projects and modernisation programmes for the global aviation ecosystem. Turkey is one of the international bidders for the RMAF LCA tender, offering its yet-to-be-built Hurjet.

Well before the tender for the LCAs was announced mid-year by the RMAF, Hindustan Aeronautical Limited (HAL), which is aggressively looking at the export market in the region, disclosed its intention to collaborate with suitable local players to set up an MRO joint venture in Malaysia.

HAL, which is offering its advanced signature asset, the fourth generation fly-by-wire Tejas, announced in March 2020 of its interest in setting up logistics bases in Malaysia, Vietnam, Indonesia and Sri Lanka as part of its initiative to provide close support for international customers for its Tejas as well as MRO facility for the country that purchases its planes.

Its chairperson and managing director, R Madhavan, was quoted as saying the development of such bases would serve as a facility for MRO services and provide after-sales services more efficiently and be more cost-effective.

In a more recent follow-up move to reiterate its serious commitment to Malaysia, it is understood that HAL has inked a conditional understanding to collaborate with Boustead Heavy Industries Corporation (BHIC), a leading defence contractor with diverse interests in the defence, security and marine sectors. BHIC, whose largest shareholder (59.4 percent) is the Armed Forces

Fund Board, a public-listed organisation with investments in several public-listed companies as well.

The proposal to collaborate with BHIC, the largest conglomerate of its kind in the country, is seen as a strategic move to not just meet the “localisation” content requirement but also as a platform to produce components parts for Tejas as exports from Malaysia.

Subject to HAL winning the contract for the LCAs, with the proposed JV with BHIC, HAL will offer the full range of Depot Level Maintenance, covering reliability, availability, maintainability and supportability (RAMS). This D-Level maintenance is the highest level of support ever to be seen by a foreign defence manufacturer in Malaysia and looks certain to result in high technology and expertise transfer to RMAF and build the nation’s aerospace technical and local vendor ecosystem. It also will reduce the cost of maintenance and aircraft downtime to RMAF, ensuring Malaysia’s air defence readiness is at the optimum level.

Together with HAL’s end-to-end logistics support system covering a broad range of areas including preventive and corrective maintenance, data management, obsolescence maintenance, response planning and facilities management the linkage impact is expected to be very strong and extensive.

Such an initiative proposed by HAL is expected to further strengthen and expand the role of BHIC in the development of local industries in the defence sector as outlined in the National Defence and Security Industry Policy and strongly advocated by the Malaysian government.

*(SHERMAN SOCKA is an industry and investment analyst.)*

*(The views expressed here are those of the author/contributor and do not necessarily represent the views of Malaysiakini.)*

<https://www.malaysiakini.com/letters/601324>



Wed, 01 Dec 2021

## Dubai Airshow 2021: India pushes its Light Combat Aircraft 'Tejas'

AKIPRESS.COM - The India made Tejas Light Combat Aircraft was prominent in the flying display at the recently held Dubai Airshow in November this year, as manufacturer Hindustan Aeronautics Limited (HAL) eyes first deliveries of the Mk1A variant by early 2023, and work continues on the more advanced Mk2, Shephard reported.

India is keen to promote its indigenously developed and produced Tejas single-engine Light Combat Aircraft at overseas exhibitions, and the Dubai Airshow is no exception.

An Indian Air Force (IAF)-piloted Tejas Mk1 has been a daily feature in the flying display, and three aircraft were on static display. A spokesman for manufacturer HAL told Shephard that the first of 83 Tejas Mk1A aircraft on order for the IAF should be delivered by the end of 2022, or beginning 2023 at the latest.

Meanwhile, a representative of the state-run Defence Research and Development Organisation (DRDO), one of the driving forces behind the Tejas design, mentioned the development process of a more advanced Mk2 version of the Indian fighter.



A first Tejas Mk2 flight prototype is being built, the DRDO spokesperson told Shephard, expressing confidence that the prototype will be completed in 2022, and the maiden flight of the aircraft will follow in 2023.

Indian designers plan to complete the Tejas Mk2 by 2026. The Tejas Mk2 will feature a new Uttam AESA radar (which could also be installed on the latest and upcoming production batches of the Tejas Mk1A) and a General Electric F414 INS6 engine to deliver better performance than the F404 IN20 used on the Tejas Mk1A.

Other planned improvements in the Tejas Mk2 include stealth measures to reduce the radar cross-section of the aircraft, a radiation-absorbent coating, as well as a new integrated EW system.

The Indian Air Force (IAF) contingent has managed to grab eyeballs at the Dubai Air Show. The indigenous HAL Tejas light combat aircraft and two IAF aerobatics teams — Suryakiran comprising nine Hawk advanced jet trainers (AJTs), and Sarang, with four Dhruv helicopters — presented a spectacular aerial display at the event.

This is the first time that Tejas, developed by the HAL, has showcased its aerial manoeuvres in the Gulf nation, according to news agency

So far, three countries have shown interest in the HAL Tejas — Malaysia, Argentina, and Egypt. The Royal Malaysian Air Force (RMAF), which has plans to buy 18 planes, with an option to add another 18 later, could emerge as the first foreign buyer of Tejas.

The Dubai air show is a leading aerospace event in the Middle East and the growing airshow in the world.

[https://akipress.com/news:665409:Dubai Airshow 2021 India pushes its Light Combat Aircraft Tejas /](https://akipress.com/news:665409:Dubai Airshow 2021 India pushes its Light Combat Aircraft Tejas/)

## THE TIMES OF INDIA

Wed, 01 Dec 2021

### **BU's law school holds fort at world congress on tackling disaster**

New Delhi: Bennett University's School of Law participated in the World Congress on Disaster Management held from November 24 to 27 at Indian Institute of Technology, Delhi (IIT-D). A special technical panel hosted by the knowledge partner was aimed at studying and discussing various legal rights and duties emerging due to the disaster scenario and the need to incorporate disaster management studies in legal education.

The event was jointly organised by Delhi government, IIT-Delhi and Disaster Management Initiatives and Convergence Society, Hyderabad, in collaboration with National Disaster Management Authority, National Institute of Disaster Management, Defence Research and Development Organisation and Indian Council of Medical Research.

Giving the welcome address, Bennett University vice-chancellor Prabhu Kumar Aggarwal noted how all had witnessed the need for regulation and coordination among several agencies and individuals during the Covid-19 pandemic. He shared the example of Odisha and how a course on disaster management would be taught as a compulsory subject in the state's colleges.

Nuzhat Parveen Khan, who was the chair, shared her personal experience in drafting the curriculum for Disaster Management Studies. She observed that the theme of the session was specifically developed to bring disaster management as an important component in the curriculum of legal education and its practice. She added that such education could be structured by incorporating various courses and modules in the curriculum.

Professors, law students and PhD scholars presented papers during the event. One of the papers was titled "Underlining the role of legal systems, legal education and legal awareness in managing

substance abuse during Covid-19 pandemic with special reference to alcohol consumption in India”.

Another paper was titled “Climate hazards and the role of local authorities: Exploring the Indian legal framework”. A third paper was titled “Role of higher education in disaster preparedness and management”.

<https://timesofindia.indiatimes.com/city/delhi/bus-law-school-holds-fort-at-world-congress-on-tackling-disaster/articleshow/88017730.cms>

## COVID 19: DRDO's Contribution



Wed, 01 Dec 2021

### Covid spreading in the Valley may get worse as winter arrives

*Covid fatalities have increased five times and infections by 58 percent in the last month only*

*By Mufti Islah*

Srinagar: In Kashmir, not a single case of Omicron strain has been detected yet, but Covid 19 is still spreading, raising fears of the possibility of a third wave hitting the region as winter nears.

The latest figures shared by the health directorate show covid fatalities have increased five times and infections by 58 percent in the last month only. Against seven deaths in October, there have been 35 in November in the Valley alone. The positive cases have jumped to 3,623 from 2,290 during the same period.

Two of the four hospitals, DRDO Khunmoh and Chest Disease hospitals that deal with the pandemic, say the daily admissions have gone up from one to two admissions between April and September to six in October and eight to nine in November. The DRDO's current admission is 50 and there are 60 more that have been put up in CD.

The data may not be huge when compared to metros or bigger cities of the country but given that Kashmir has only eight million population, the viral spread needs not to be taken lightly.

Doctors and administrators are surprised that even fully vaccinated people have contracted the virus though the fatality rate is less in their cases.

Since July, 3,423 and 2,032 persons fully or partially vaccinated, have contracted infection but only 21 per cent meaning 11 each have died. As against this 30 persons of the 3306 (30) have succumbed to the virus.

"It is evident that breakthrough infections have been there even if people have received double jabs but the fatalities are less," Dr Rashid Para, medical superintendent at the biggest DRDO hospital told News 18.

The 500 bedded DRDO facility with a huge infrastructure and staff that includes 80 doctors and 600 paramedics and the allied staff was set up in July on the outskirts of Srinagar in Khunmoh



Against seven deaths in October, there have been 35 in November in the Valley alone (Reuters File)

Against seven deaths in October, there have been 35 in November in the Valley alone (Reuters File)



locality within just 17 days. The state-of-the-art facility was created on the war-footing scale to meet any exigency and to put brakes on the virus.

"It is important people don't compromise on basic Covid behaviour. Vaccines don't mean you should be complacent and do away with Covid protocol," warned Dr Mir Mushtaq, who is studying the fresh surge at the health directorate. "We have been telling people vaccines don't shield you from Covid if you throw away the mask, don't maintain hygiene. People should respect Covid and Covid will respect them in turn," Dr Mushtaq said, delivering a curt message to people to stick to Covid discipline. Between March and September this year, the virus was contained to around 30 to 50 cases daily but October saw a three-fold surge.

First, it was the huge marriage gatherings in September and October that triggered a spike in Covid cases in Kashmir and now the progression of those cases coupled with cold weather conditions are likely to worsen the situation.

Experts warn the virus may multiply given that winters tend to confine people in small spaces and sans any aeration. "This may get worse in the next few months due to poor ventilation in closed rooms. We witnessed the same in the first and second waves. The caseload increases in smaller spaces and more people may pick up an infection in winters," said Dr Para.

As of Monday, 4,476 persons have died in J&K, Kashmir and Jammu account for 2,291 and 2,185, respectively. Dr Naveed Nazir, Head, Chest Diseases Hospital, said his hospital has seen more patient admissions in the last four weeks.

"There are 60 admissions as of today as compared to 20 to 30 in last 10 weeks," he said, adding it seems the virus has reached clusters and is progressing steadily if not rapidly. "It will take some time to get out of these clusters," he warned.

Meanwhile, the administration in Srinagar and Baramulla have earmarked some special zones for strict monitoring. "We have created micro containment zones to curb corona spread," an officer said.

The health officials have scaled up scrutiny at the Srinagar airport and on the national highway so that travellers carrying the infection are stopped and tested, tracked and isolated before they mix up with the locals.

"We have laid down SOPs for the tourists. RTPCR test prior to 48 hours before flying into Srinagar and a RAT on arrival at Srinagar airport ensures no vector gets into Kashmir undetected," Mohammad Asad Ajaz, Srinagar district magistrate told News 18 last week.

In view of Omicron transmission world over, the authorities have reset guidelines. "Negative travellers will be sent for home quarantine of 7 days and retested on 8th day whereas positive patient would be sent for a 15-day institutional quarantine and their samples would be sent for genome sequencing for detection of Omicron variant at ICMR designated testing laboratories," officials said.

Jammu and Kashmir Chief Secretary Arun Kumar Mehta has asked the health department to ensure the readiness of manpower and machinery to cater to the peak caseload of 7,500 patients per day.

<https://www.news18.com/news/india/covid-spreading-in-the-valley-may-get-worse-as-winter-arrives-4504715.html>

# Defence Strategic: National/International



Press Information Bureau  
Government of India

Ministry of Defence

*Tue, 30 Nov 2021 1:24PM*

## **Admiral R Hari Kumar, PVSM, AVSM, VSM, ADC assumes Command of the Indian Navy as 25th Chief of the Naval Staff**

Admiral R Hari Kumar, PVSM, AVSM, VSM, ADC assumed command of the Indian Navy on 30 November 2021 as the 25th Chief of the Naval Staff. He succeeds Admiral Karambir Singh, PVSM, AVSM, ADC who retires upon superannuation, after an illustrious career, spanning over forty one years, in the Indian Navy.

Admiral R Hari Kumar is an alumnus of the prestigious National Defence Academy, Khadakwasla. He was commissioned into the Indian Navy on 01 January 1983. In his career spanning over 38 years, he has commanded Coast Guard Ship C-01, *IN* Ships Nishank, Kora, Ranvir and the Aircraft Carrier *INS Viraat*. A Gunnery specialist, he has held several key appointments, including Fleet Operations Officer and Fleet Gunnery Officer of Western Fleet, Executive Officer (EXO) of *INS Vipul*, Gunnery Officer (GO) of *INS Ranjit*, commissioning GO of *INS Kuthar* and commissioning crew of *INS Ranvir*. His shore appointments include Command Gunnery Officer at HQWNC, Naval Advisor to Government of Seychelles, UN Mission in Somalia (UNOSOM II) at Mogadishu and Training Commander, *INS Dronacharya*. As a Flag Officer, he has served as Commandant of the Naval War College at Goa, Flag Officer Sea Training (FOST), Flag Officer Commanding Western Fleet (FOCWF), Chief of Staff, Western Naval Command, Controller Personnel Services and Chief of Personnel (COP) at Naval Headquarters. He has also served as the Chief of Integrated Defence Staff to The Chairman Chiefs of Staff Committee (CISC) at the critical junction during the creation of the institution of Chief of Defence Staff (CDS) and Department of Military Affairs (DMA).

He was the Flag Officer Commanding-in-Chief, Western Naval Command at Mumbai, prior taking over helm as Chief of the Naval Staff on 30 November 2021.



<https://pib.gov.in/PressReleasePage.aspx?PRID=1776395>





पत्र सूचना कार्यालय  
भारत सरकार

रक्षा मंत्रालय

Tue, 30 Nov 2021 1:24PM

## एडमिरल आर. हरि कुमार, पीवीएसएम, एवीएसएम, वीएसएम, एडीसी ने नौसेना स्टाफ के 25वें प्रमुख के रूप में भारतीय नौसेना की कमान संभाली

एडमिरल आर. हरि कुमार, पीवीएसएम, एवीएसएम, वीएसएम, एडीसी ने आज (30 नवंबर 2021) नौसेना स्टाफ के 25वें प्रमुख के रूप में भारतीय नौसेना की कमान संभाली। उन्होंने एडमिरल करमबीर सिंह, पीवीएसएम, एवीएसएम, एडीसी का स्थान ग्रहण किया है, जो भारतीय नौसेना में 41 साल से अधिक के अपने शानदार करियर के बाद सेवानिवृत्त हुए हैं।

एडमिरल आर. हरि कुमार प्रतिष्ठित राष्ट्रीय रक्षा अकादमी, खडकवासला के पूर्व छात्र रहे हैं। उन्हें 01 जनवरी, 1983 को भारतीय नौसेना में कमीशन मिला था। अपने 38 वर्ष से अधिक के शानदार करियर के दौरान उन्होंने तटरक्षक जहाज सी-01, भारतीय नौसेना जहाज के निशंक, कोरा, रणवीर तथा विमान वाहक आईएनएस विराट की कमान संभाली है। एडमिरल आर. हरि कुमार तोपखाना विशेषज्ञ रहे हैं। उन्होंने पश्चिमी बेड़े के फ्लीट ऑपरेशंस ऑफिसर और फ्लीट गनरी ऑफिसर, आईएनएस विपुल के कार्यकारी अधिकारी (ईएक्सओ), आईएनएस रंजीत के गनरी ऑफिसर (जीओ), आईएनएस कुठार के कमीशनिंग जीओ और आईएनएस रणवीर के कमीशनिंग कू सहित अनेक महत्वपूर्ण पदों को सुशोभित किया है। उनकी तटवर्ती नियुक्तियों में मुख्यालय डब्ल्यूएनसी में कमांड गनरी ऑफिसर, सेशेल्स में सरकार के नौसेना सलाहकार, मोगादिशु सोमालिया में संयुक्त राष्ट्र मिशन (यूएनओएसओएम- II), आईएनएस द्रोणाचार्य के प्रशिक्षण कमांडर शामिल हैं। फ्लैग ऑफिसर के रूप में, उन्होंने नेवल वॉर कॉलेज, गोवा में कमांडेंट, फ्लैग ऑफिसर सी-ट्रैनिंग (एफओएसटी), फ्लैग ऑफिसर कमांडिंग वेस्टर्न फ्लीट (एफसोसीडब्ल्यूएफ), चीफ ऑफ स्टाफ, पश्चिमी नौसेना कमान, कंट्रोलर्स पर्सनेल सर्विसेज और नौसेना मुख्यालय में कार्मिक प्रमुख (सीओपी) के रूप में काम किया है। उन्होंने चीफ ऑफ डिफेंस स्टाफ (सीडीएस) संस्थान के निर्माण के दौरान महत्वपूर्ण संयोजन में चेयरमैन चीफ ऑफ स्टाफ कमेटी (सीआईएससी) के चीफ ऑफ इंटीग्रेटेड डिफेंस स्टाफ प्रमुख के रूप में तथा सैन्य मामलों के विभाग में भी काम किया है।

एडमिरल आर. हरि कुमार 30 नवंबर, 2021 को नौसेना स्टाफ के प्रमुख के रूप में पदभार ग्रहण करने से पहले मुंबई में पश्चिमी नौसेना कमान के फ्लैग ऑफिसर कमांडिंग-इन-चीफ थे।



<https://pib.gov.in/PressReleasePage.aspx?PRID=1776416>



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

**Ministry of Defence**

*Tue, 30 Nov 2021 4:00PM*

## **Vice Admiral Ajendra Bahadur Singh takes over as Flag Officer Commanding-In-Chief, Western Naval Command**

Vice Admiral Ajendra Bahadur Singh, AVSM, VSM took over as the Flag Officer Commanding-in-Chief (FOC-in-C), Western Naval Command (WNC) from Vice Admiral R Hari Kumar, PVSM, AVSM, VSM, ADC at an impressive Ceremonial Parade held at INS Shikra.

Prior to taking over as the Flag Officer Commanding-in-Chief of the WNC, Vice Admiral AB Singh served as the Flag Officer Commanding-in-Chief of the Eastern Naval Command. He is among the very few Commanders-in-Chief who have been bestowed with the unparalleled honour and unique distinction of heading both operational commands of the Indian Navy.

Vice Adm AB Singh also paid homage to all personnel who have made the supreme sacrifice in service to the Nation by placing a floral wreath at the Gaurav Stambh - Victory at Sea Memorial, at Naval Dockyard, Mumbai.



Commissioned into the Navy on 01 July 1983, Vice Admiral AB Singh is a specialist in Navigation and Direction. An alumnus of UP Sainik School, Lucknow and the National Defence Academy, Khadakvasla, he received his first Master's degree from Madras University during the Staff Course at Defence Services Staff College, Wellington wherein he was also awarded the Scudder Medal. He also earned a Master's Degree in Global Security from Cranfield University, United Kingdom in 2005.

A recipient of the Ati Vishist Seva Medal and Vishist Seva Medal, he has held several key operational, staff and training appointments in his naval career. He was the Navigating Officer of INS Kamorta (during Op Pawan) and destroyer INS Ranjit, besides being the Fleet Navigating Officer of the Western Fleet during Op Parakram. He has immense experience of serving at WNC in several appointments. All four of his operational commands have been of ships based at Mumbai - Indian Naval Ships Veer (missile vessel), Vindhyagiri (frigate), Trishul (guided missile frigate) and Viraat (aircraft carrier). He has also been an instructor at the National Defence Academy at Pune and the Navigation and Direction School at Kochi, and Directing Staff at Defence Services Staff College Wellington.

He was promoted to the rank of Rear Admiral in 2012 and served in the important staff appointment of Assistant Chief of Naval Staff (Policy & Plans) at Naval Headquarters. Thereafter, he has commanded the prestigious Eastern Fleet. On promotion to Vice Admiral in 2015, he served as Deputy Commander-in-Chief, Strategic Forces Command, the Chief of Staff of WNC at Mumbai and later as Deputy Chief of Integrated Defence

Staff (Operations & Training) at the Integrated Defence Staff, New Delhi.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1776447>



पत्र सूचना कार्यालय  
भारत सरकार

रक्षा मंत्रालय

Tue, 30 Nov 2021 4:00PM

## वाइस एडमिरल अजेंद्र बहादुर सिंह ने पश्चिमी नौसेना कमान के फ्लैग ऑफिसर कमांडिंग-इन-चीफ के रूप में पदभार ग्रहण किया

वाइस एडमिरल अजेंद्र बहादुर सिंह, एवीएसएम, वीएसएम ने वाइस एडमिरल आर. हरि कुमार, पीवीएसएम, एवीएसएम, वीएसएम, एडीसी से आईएनएस शिकरा में आयोजित शानदार औपचारिक परेड में पश्चिमी नौसेना कमान (डब्ल्यूएनसी) के फ्लैग ऑफिसर कमांडिंग-इन-चीफ (एफओसी-इन-सी), के रूप में पदभार ग्रहण किया।

पश्चिमी नौसेना कमान के फ्लैग ऑफिसर कमांडिंग-इन-चीफ के रूप में कार्यभार संभालने से पूर्व, वाइस एडमिरल ए.बी. सिंह ने पूर्वी नौसेना कमान के फ्लैग ऑफिसर कमांडिंग-इन-चीफ के रूप में कार्य किया है। वह उन कुछ कमांडर-इन-चीफ में से एक हैं, जिन्हें भारतीय



नौसेना के दोनों परिचालन कमान का नेतृत्व करने के लिए विशिष्ट सम्मान और अद्वितीय गौरव से सम्मानित किया गया है।

वाइस एडमिरल ए.बी. सिंह ने मुंबई के नौसेना डॉकयार्ड में गौरव स्तंभ - विकट्री एट सी मेमोरियल पर पुष्पांजलि अर्पित कर उन सभी कर्मियों को भी श्रद्धांजलि अर्पित की जिन्होंने राष्ट्र की सेवा में सर्वोच्च बलिदान दिया है।

वाइस एडमिरल ए.बी. सिंह को 01 जुलाई, 1983 में नौसेना में कमीशन प्रदान किया गया था। श्री सिंह नेविगेशन और डायरेक्शन के विशेषज्ञ हैं। वे उत्तर प्रदेश सैनिक स्कूल, लखनऊ और राष्ट्रीय रक्षा अकादमी, खडकवासला के पूर्व छात्र हैं। इन्होंने रक्षा सेवा स्टाफ कॉलेज, वेलिंगटन में स्टाफ कोर्स के दौरान मद्रास विश्वविद्यालय से अपनी पहली मास्टर डिग्री प्राप्त की थी। जिसमें उन्हें स्कडर मेडल से भी सम्मानित किया गया था। इन्होंने क्रैनफील्ड यूनिवर्सिटी, इंग्लैंड से वर्ष 2005 में ग्लोबल सिक्योरिटी में मास्टर डिग्री भी हासिल की है।

अति विशिष्ट सेवा पदक और विशिष्ट सेवा पदक से सम्मानित वाइस एडमिरल ए.बी. सिंह ने अपने नौसैनिक करियर के दौरान अनेक प्रमुख परिचालन, स्टाफ एवं प्रशिक्षण नियुक्तियां भी की हैं। वे ऑपरेशन पराक्रम के दौरान पश्चिमी बेड़े के फ्लीट नेविगेटिंग ऑफिसर के अलावा आईएनएस कमोर्ता (ऑपरेशन पवन के दौरान) और विध्वंसक आईएनएस रंजीत के नेविगेटिंग ऑफिसर भी रहे थे। उन्हें पश्चिमी नौसेना कमान में अनेक नियुक्तियां करने का भी व्यापक अनुभव है। उनकी सभी चार ऑपरेशनल कमांड मुंबई में स्थित जहाजों - भारतीय नौसेना के जहाज वीर (मिसाइल पोत), विंध्यगिरी (फ्रिगेट), त्रिशूल (गाइडेड मिसाइल फ्रिगेट) और विराट (विमान वाहक) की हैं। वह पुणे में राष्ट्रीय रक्षा अकादमी और कोच्चि में नेविगेशन और डायरेक्शन स्कूल में प्रशिक्षक और डिफेंस सर्विसेज स्टाफ कॉलेज वेलिंगटन में डायरेक्टिंग स्टाफ भी रह चुके हैं।

इन्हें वर्ष 2012 में रियर एडमिरल के पद पर पदोन्नत किया गया था। इन्होंने नौसेना मुख्यालय में असिस्टेंट चीफ ऑफ नेवल स्टाफ (नीति और योजना) की महत्वपूर्ण स्टाफ नियुक्ति में सेवा प्रदान की है। इसके बाद इन्होंने प्रतिष्ठित पूर्वी बेड़े की कमान संभाली। वर्ष 2015 में वाइस एडमिरल के रूप में पदोन्नत होने पर, इन्होंने डिप्टी कमांडर-इन-चीफ, स्ट्रैटेजिक फोर्सज कमांड, पश्चिमी नौसेना कमान, मुंबई में चीफ ऑफ स्टाफ और बाद में इंटीग्रेटेड डिफेंस स्टाफ, नई दिल्ली में डिप्टी चीफ ऑफ इंटीग्रेटेड डिफेंस स्टाफ (संचालन और प्रशिक्षण) के रूप में कार्य किया।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1776503>



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

**Ministry of Defence**

*Tue, 30 Nov 2021 3:35PM*

## **Lt Gen Manoj Kumar Mago takes over as NDC Commandant**

Lieutenant General Manoj Kumar Mago took over as the 34th Commandant of National Defence College (NDC), New Delhi from Air Marshal D Choudhury who superannuates on November 30, 2021.

Lt Gen Manoj Kumar Mago is an alumnus of Indian Military Academy, Dehradun. He was commissioned into the elite 7th Battalion Brigade of the GUARDS on December 15, 1984 and later commanded 16 GUARDS.

In his distinguished military career spanning over 36 years, the General Officer has tenanted all his command assignments in challenging operational environment. He commanded one of the largest and challenging Infantry Brigade and a versatile Infantry Division, all on the active line of control in Jammu and Kashmir.

Lt Gen Manoj Kumar Mago is also an alumnus of Defence Services Staff College, Wellington and attended the prestigious Higher Command and National Defence College Courses. He has held various important staff and instructional appointments like Brigade Major of a Mountain Brigade in (Counter Insurgency Operations) Jammu and Kashmir, Director in Military Operations Directorate, Deputy Military Secretary of Headquarter Southern Command. Principal Director in Headquarter Strategic Forces Command and steered the operational Logistics as Directorate General of Operational Logistics and Strategic Movement at Integrated HQ of MoD (Army). His instructional experience includes tenures as Directing Staff, Senior Command Wing, Army War College, Mhow and Commandant of one of the most prestigious institute, the famous Counter Insurgency and Jungle Warfare School.

He has been awarded Yudh Seva Medal and Sena Medal (Twice) for his distinguished services. The General Officer has distinguished himself on two United Nations peace keeping assignments in Somalia (UNOSOM-II) and as Force Chief of Staff in Congo (MONUSCO) where he was awarded the Force Commander (MONUSCO) Commendation.

Prior to taking over as the Commandant NDC, Lt Gen Manoj Kumar Mago was commanding the prestigious 10 Corps.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1776429>



## India closes in on chopper export to the Philippines

*Manila is evaluating a maritime variant of the Dhruv ALH, which HAL has developed in Bengaluru on request from the Indian Navy and Coast Guard*

*By Ajai Shukla*

Bengaluru: Illustrating the benefits of developing indigenous weapons platforms, Hindustan Aeronautics Ltd (HAL) is poised to sell the Philippines at least seven Dhruv Advanced Light Helicopters (ALH) and eight Dornier 228 aircraft, possibly through a Government of India line of credit.

Manila is evaluating a maritime variant of the Dhruv ALH, which HAL has developed in Bengaluru on request from the Indian Navy and Coast Guard. It involved integrating the Dhruv Mark III with maritime policing capabilities, converting the plain vanilla ALH into a variant called the Dhruv Maritime Role (MR).

As the “original equipment manufacturer” (OEM) of the Dhruv, HAL developed the Dhruv MR without being blocked by end user restrictions.

The Philippines contracts will be worth a record Rs 3,000 crore, India’s largest-ever export of defence equipment. If both aircraft perform well and deliver high serviceability rates, further export orders could follow.

According to industry and market assessments, Manila’s maritime helicopter purchase has boiled down to a straight contest between two helicopters – the Dhruv MR and Airbus Helicopters Panther AS565.

HAL had first revealed Manila’s interest in buying these two “Made in India” platforms in its Annual Report for 2020-21. Now, HAL’s chairman, R Madhavan, has confirmed to *Business Standard*: “Our prospects in the Philippines look good.”

“Both helicopters cost roughly the same, but we will offer a better support package, including spares and support from HAL. We will also offer Manila the option to do its own MRO. We also will price the Dhruv MR aggressively,” says Madhavan.

Contacted for comments, an Airbus spokesperson stated: “We do not comment on discussions we might or might not be having with our customers.”

The Dhruv ALH has been growing in sophistication, as well as in cost. The initial ALH version – the plain vanilla Dhruv Mark I – was sold to the military for Rs 45-50 crore. The cost rose to Rs 70 crore for each Dhruv Mark III, with its glass cockpit and anti-vibration dampers. With the maritime role fitments on the Dhruv MR adding another Rs 40 crore, the cost of each Dhruv MR will be about Rs 110 crore.

The specialist maritime equipment in the Dhruv MR includes: an on-board weather radar (6-7 crore); an electro-optical pod (5-6 crore); a searchlight (one crore); a tracker beam, emergency flotation gear; a VHF homing device; a traffic collision avoidance device; a rescue hoist that is anchored just below the main rotors, and a slithering device for marine commandoes.

HAL’s confidence in designing and developing helicopters is growing as it develops newer and more sophisticated variants. The HAL chief says more than 320 Dhruv ALHS have been delivered to the military. The eponymous Light Combat Helicopter (LCH), which has been regaling air show audiences with aerobatics performances, is awaiting its first orders.





On November 19, Prime Minister Narendra Modi handed over a HAL-produced LCH to the Indian Air Force (IAF). Perhaps the most promising is the single-engine Light Utility Helicopter (LUH), which HAL hopes to build 400 of.

IAF boss Air Chief Marshal VR Chaudhary asked, during a recent visit to HAL, if the Dhruv could be fitted with additional capabilities. HAL's helicopter engineers say they replied: "Just select the systems you want. We can integrate them all into the ALH, within the limits of its flying capability."

India's South Asian neighbours and nearby island countries – including the Maldives, Mauritius, Nepal and now Philippines – are already operating the Dhruv ALH in small numbers and expressing interest in more. Myanmar wants the LCH.

Notwithstanding India's growing potential as a helicopter exporter, "end user" issues still constrain its freedom of action. With the indigenous content of HAL's choppers still in the region of 50-55 per cent, and critical systems still imported from the UK, Israel and France; exporting these helicopters requires export clearances from these supplier countries. That often requires a political consensus over which countries it is permissible to sell these choppers to. Sometimes supplier countries are reluctant to sell weaponry to countries such as Myanmar.

Despite the rhetoric over "Atmanirbhar Bharat" (self-reliant India), simple economics makes it impossible to raise indigenous content above 50-55 per cent. The composite material that the helicopter fuselage is fabricated from is imported. Nor do any Indian firms manufacture the aluminium alloys that go into the chopper, because it is not needed in quantities large enough to create economies of scale.

HAL's engineers cite the example of ejection seats – a sophisticated product that is almost entirely monopolised by British firm, Martin Baker. Similarly, a British manufacturer, Cobham, makes mid-air refuelling gear for almost the entire western aerospace market. And, until Indian firms begin manufacturing aircraft and helicopter engines, exports of those will continue to take up 25-30 per cent of the cost of aircraft.

[https://www.business-standard.com/article/current-affairs/india-closes-in-on-chopper-export-to-the-philippines-121113001510\\_1.html](https://www.business-standard.com/article/current-affairs/india-closes-in-on-chopper-export-to-the-philippines-121113001510_1.html)

## Army receives new Israeli Heron drones for deployment in Ladakh sector

*These drones are operational now and are far more advanced than the Herons in the existing inventory and their anti-jamming capability is much better than their previous versions.*

New Delhi: After a delay of a few months due to COVID-19, the Indian Army's surveillance capabilities have received a major boost as Israel has delivered advanced Heron drones under the emergency procurement clause to keep an eye on the Chinese activities in the Ladakh sector.

"The advanced Heron drones have arrived in the country and are being deployed for surveillance operations in the eastern Ladakh sector," top government sources told ANI.

These drones are operational now and are far more advanced than the Herons in the existing inventory and their anti-jamming capability is much better than their previous versions, the sources said.

The acquisition of these drones has been done under the emergency financial powers granted by Prime Minister Narendra Modi-led government to the defence forces under which they can buy equipment and systems worth ₹500 crores to upgrade their warfighting capabilities, amid ongoing border conflict with China, they added.

According to sources, the other small or mini drones are being acquired from Indian firms.

The Indian defence forces have been taking these initiatives to acquire weapon systems that can help them in the ongoing conflict with China. The last time such a facility was given to the defence forces was in 2019 right after the Balakot airstrikes against terrorist camps in Pakistan.

Using the same facility, the Indian Navy has leased two Predator drones which have been taken from American firm General Atomics.

The Indian Air Force had exercised the same powers to acquire a large number of anti-tank guided missiles, long-range precision-guided artillery shells along with the Hammer air to ground standoff missiles with a strike range of around 70 kilometres.

The emergency procurement powers under capital acquisition route ended on August 31 this year.

The armed forces have a few more projects in the final stages and if they get an extension, they may go ahead for purchasing that equipment too for improving their combat capabilities.

<https://www.hindustantimes.com/india-news/army-receives-new-israeli-heron-drones-for-deployment-in-ladakh-sector-101638265519344.html>



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## India's new threat: 4th Gen Warfare

By DC Pathak

### Highlights

*Whenever there is mention of a threat to national security, people think of our defence forces in their glorious battle dress – protecting the country on our borders against external attacks and winning the war for us*

Whenever there is mention of a threat to national security, people think of our defence forces in their glorious battle dress – protecting the country on our borders against external attacks and winning the war for us. In the days of Cold War, the two superpowers tried to outdo each other militarily and their race for superiority in the use of missiles produced the ultimate deterrence - the system termed as Mutually Assured Destruction (MAD) built by the US.

Even as the open warfare was kept in check, there were attempts to cause ideological subversion and foment armed insurgency to weaken the adversary. It



India's new threat: 4th Gen Warfare

is, however, the rise of the phenomenon of 'covert' offensives witnessed in the post-Cold War period – after the success of the anti-Soviet armed campaign in Afghanistan had resulted in the dismemberment of USSR ending the Cold War – that brought in the era of 'asymmetric' warfare.

Use of terrorism for covert offensives across geographical boundaries helped replace open attacks with 'proxy wars' – with India becoming the biggest victim of cross-border terror instigated by Pakistan in Kashmir and elsewhere. 26/11 became India's 9/11 as Pakistan's ISI used terrorists to carry out an unprecedented covertly planned attack on Mumbai from the sea front.

This war by stealth has set apart the distinct dimensions of 'defence' and 'security,' calling for new measures to cope with the advancement of weaponry in one case, and the technology used by terrorists in the other. The Sino-Pak axis has aggravated the threat of Pak-sponsored proxy war against India as cross-border terrorism was now sustained by the use of drones – a product of Chinese technology – for surreptitious dropping of arms and ammunition in the Kashmir Valley and drugs in the bordering areas of Punjab. Emergence of social media as an instrument of combat and use of internet for spreading 'radicalisation' and facilitating recruitment of potential terrorists have made the work of the adversary easier and the task of countering it so much more difficult.

An entirely new extension of 'proxy war' aimed at 'winning the war by other means' is the use of civil rights fora to run down a democratically elected government by building narratives for influencing the unsuspecting people against the ruling dispensation. Majoritarianism, authoritarianism and treatment of minorities are 'issues' that could be easily built on vague grounds for creating the impression that Constitutional mandate is not being followed by the ruling regime.

Influencing the political outcome through non-governmental bodies linked to lobbies at home and abroad is a new age phenomenon – it uses 'human' channels that supplemented what was being attempted through 'technology' on the internet.

The significance of the recent address of National Security Advisor Ajit Doval at the 'passing out' function for new IPS officers at the National Police Academy in Hyderabad can be grasped in this context. He pointed out that civil society was the new frontier of war as it can be manipulated to hurt a nation's interests. He aptly described it as 'fourth generation' warfare – it certainly represented the finer realms of 'proxy war.' Those who are to safeguard internal security – and police is often the first responder there – need to be made fully aware of this challenge that goes beyond the conventional law and order. The success of the adversary in creating an underground

network of agents and operators that needs to be thwarted. In vulnerable border states such as J&K, Punjab, Arunachal, Mizoram, Nagaland and Manipur, a greater proportion of state police personnel should be seconded to intelligence function. Even policemen in uniform should be sensitised to take note of activities of fora that are playing 'politics by proxy' in collaboration with external lobbies. This should be done without prejudice to legitimate media activity and philanthropic missions, and action should be initiated only where there is a clear violation of the country's laws.

In essence, the three contemporary features of India's internal security scenario are the adversary's attempts to use radicalisation for trapping vulnerable elements into becoming a part of the underground terror network, accentuate the majority-minority divide to feed communal militancy, and float civil society platforms to run down India on issues of governance.

Intellectualised debates have been sponsored on matters ranging from putting a question mark on Indian identity to advocating a place for China in Indo-Pak talks on Kashmir, because of the Chinese claim on the territory of that state. The challenge on internal security front is to draw in the police as a responder without permitting any scope for politicisation of the same.

*(The writer is a former Director of Intelligence Bureau)*

<https://www.thehansindia.com/hans/opinion/news-analysis/indias-new-threat-4th-gen-warfare-717639>



## The mystery behind the high abundance of Lithium in some evolved stars traced

Scientists have found a clue to the mystery behind the high abundance of Lithium— a trace element on Earth, and a key component of rechargeable batteries, in some evolved stars.

For more than four decades, Astronomers have known that a class of stars have an anomalous amount of Lithium on their surface. The reason and processes behind the high abundance of Lithium in about one percent red giants has remained a puzzle since the models of how stars evolve predict the Lithium must have been destroyed in the hot plasma of the star.

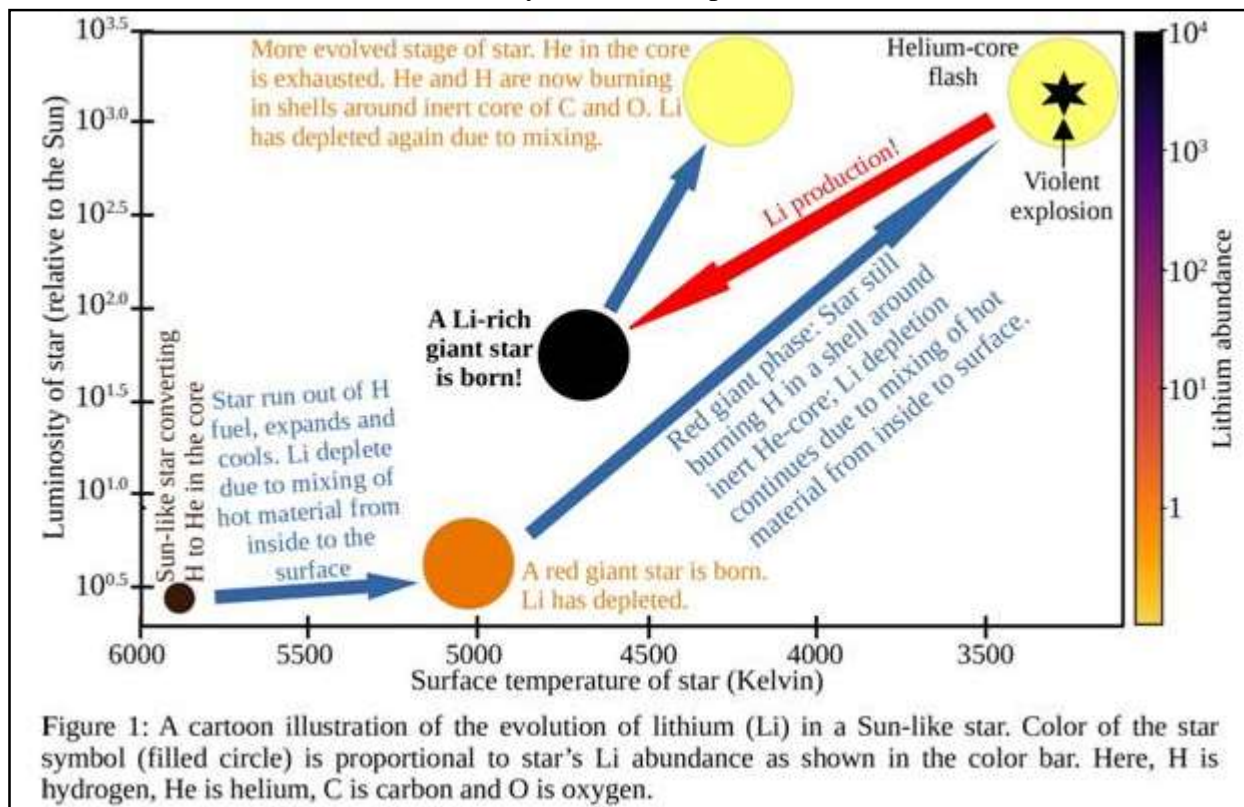


Figure 1: A cartoon illustration of the evolution of lithium (Li) in a Sun-like star. Color of the star symbol (filled circle) is proportional to star's Li abundance as shown in the color bar. Here, H is hydrogen, He is helium, C is carbon and O is oxygen.

Mr. Deepak from the Indian Institute of Astrophysics (IIA) Bangalore, an autonomous institute of the Department of Science & Technology (DST), Government of India and Professor Emeritus David L. Lambert from the University of Texas at Austin and an Honorary Fellow of IIA Bangalore have for the first time confirmed that all the lithium-rich stars are burning helium in their core. They speculated in their paper published in the journal *MNRAS* that lithium production is linked to the violent helium-core flash.

“About four decades ago, a red giant with extraordinarily high lithium abundance at its surface was discovered. In all other respects, this red giant was of normal composition. Early follow-up investigation of lithium among red giants showed that just about one percent of sun-like red giants had a lithium-enriched surface. The questions on processes that led to a 100-fold or so increase in



the lithium abundance in this exceptional red giant and reason behind this selective enrichment of lithium in the one percent of red giants intrigued us,” Deepak explains.

The authors drew on a large survey of the compositions of red giants undertaken in Australia at the Australian National University with observations gathered by on the 3.9 m Anglo-Australian Telescope at the Australian Astrophysical Observatory. The survey GALAH - named after a common Australian bird -- provided a collection of about 500,000 stars with well-determined physical and chemical properties, including lithium abundances.

To find if the enrichment of lithium in red giants favours any particular mass and metallicity, they separated GALAH's stars into different mass and metallicity ranges and then searched for lithium-rich giants among these groups. This exercise, done for the first time on such a large scale and across a wide range of mass and metallicity, reveals the rare presence of lithium-rich giants in all the Sun-like low-mass stars.

They created virtual stars of various masses and metallicity and compared the properties of these virtual stars with that of real stars from the GALAH survey. These comparisons confirmed that all the lithium-rich stars are burning helium in their core.

In a separate study, the researchers combined information about oscillations in stars' interiors with their lithium abundances to find the origin of lithium-rich giant stars. For this study, they collected astero-seismic data (i.e., information about oscillations in stars' interiors) for giant stars with measured lithium abundances. They found that all the lithium-rich giant stars are burning helium in their core.

Years ago, nuclear astrophysicists proposed a simple and short sequence of nuclear reactions involving a collision between the two stable helium isotopes which led to a stable lithium isotope. This reaction is supposed to occur during the initial violent ignition of helium-burning in the hydrogen-depleted core just prior to the onset of stable helium burning in the red giant. The authors adopt this idea and call for theoretical astrophysicists interested in the interior structure of red giants to provide quantitative estimates of lithium production during the ignition of helium burning in red giants.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1776403>

## Quantum computers getting connected for multiple task-optimized smaller systems

A promising route towards larger quantum computers is to orchestrate multiple task-optimized smaller systems. To dynamically connect and entangle any two systems, photonic interference emerges as a powerful method, due to its compatibility with on-chip devices and long-distance propagation in quantum networks.

One of the main obstacles towards the commercialization of quantum photonics remains the nanoscale fabrication and integration of scalable quantum systems due to their notorious sensitivity to the smallest disturbances in the close environment. This has made it an extraordinary challenge to develop systems that can be used for quantum computing while simultaneously offering an efficient optical interface.

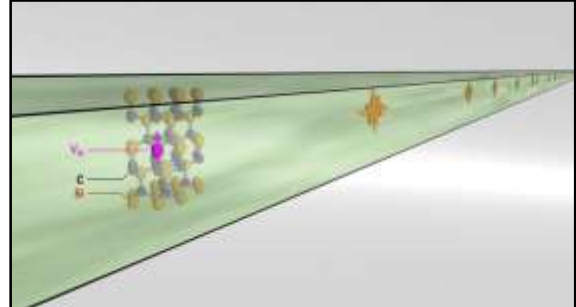
A recent result published in *Nature Materials* shows how the integration obstacle can be overcome. The work is based on a multi-national collaboration with researchers from Universities of Stuttgart, California—Davis, Linköping and Kyoto, as well as the Fraunhofer Institute at Erlangen, the Helmholtz Centre at Dresden and the Leibniz-Institute at Leipzig.

The researchers followed a two-step approach. First, their quantum system of choice is the so-called silicon vacancy center in silicon carbide, which is known to possess particularly robust spin-optical properties. Second, they fabricated nanophotonic waveguides around these color centers using gentle processing methods that keep the host material essentially free of damage.

"With our approach, we could demonstrate that the excellent spin-optical properties of our color centers are maintained after nanophotonic integration," says Florian Kaiser, Assistant Professor at the University of Stuttgart, the supervisor of this project. "Thanks to the robustness of our quantum devices, we gained enough headroom to perform quantum gates on multiple nuclear spin qubits. As these spins show very long coherence times, they are excellent for implementing small quantum computers."

"In this project, we explored the peculiar triangular shape of photonic devices. While this geometry is of commercial appeal because it provides versatility needed for scalable production, little has been known about its utility for high performing quantum hardware. Our studies reveal that light emitted by the color center, which carries quantum information across the chip, can be efficiently propagated through a single optical mode. This is a key conclusion for viability of integration of color centers with other photonic devices, such as nanocavities, optical fiber and single-photon detectors, needed to realize full functionalities of quantum networking and computing."—says Marina Radulaski, Assistant Professor at the University of California—Davis.

What makes the silicon carbide platform particularly interesting are its CMOS compatibility and its heavy usage as high-power semiconductor in electric mobility. The researchers now want to benefit from these aspects to leverage the scalable production of spin-photonics chips. Additionally, they want to implement semiconductor circuitry to electrically initialize and readout the quantum states of their spin qubits. "Maximizing electrical control—instead of traditional optical control via lasers—is an important step towards system simplification. The combination of efficient nanophotonics with electrical control will allow us to reliably integrate more quantum systems on one chip, which will result in significant performance gains.", adds Florian Kaiser, "In



Visualization of a VSi center integrated into a nanophotonic SiC waveguide. Credit: University of Stuttgart / Physics 3

this sense, we are only at the dawn of quantum technologies with color centers in silicon carbide. Our successful nanophotonic integration is not only an exciting enabler for distributed quantum computing, but it can also boost the performance of compact quantum sensors."

**More information:** Charles Babin et al, Fabrication and nanophotonic waveguide integration of silicon carbide colour centres with preserved spin-optical coherence, *Nature Materials* (2021). DOI: [10.1038/s41563-021-01148-3](https://doi.org/10.1038/s41563-021-01148-3)

**Journal information:** *Nature Materials*  
<https://phys.org/news/2021-11-quantum-multiple-task-optimized-smaller.html>



Wed, 01 Dec 2021

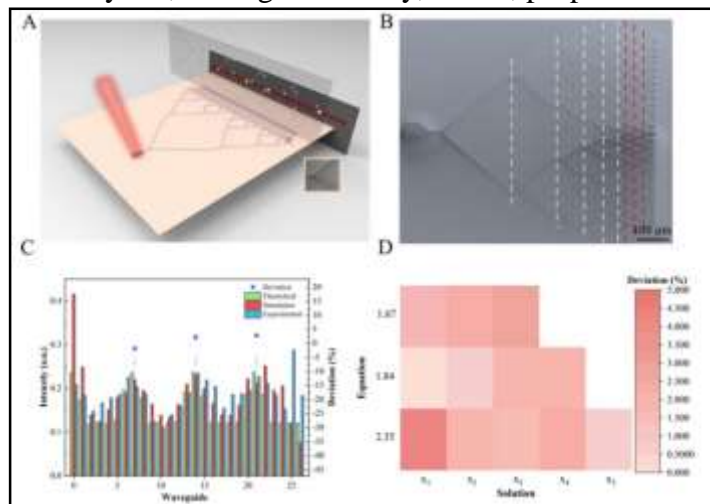
## All-optical computing based on convolutional neural networks

In a new publication from *Opto-Electronic Advances* the research group of Professor Xiaoyong Hu and Professor Qihuang Gong from School of Physics, Peking University, China, propose a new strategy to realize ultrafast and ultralow-energy-consumption all-optical computing chip scheme based on convolutional neural network (CNN), which supports the execution of multiple computing tasks.

With the rapid development of advanced engineering computing, economic data analysis and cloud computing, the demand for ultra-high speed and energy-efficiency computing is growing exponentially. Due to the limited data communication bandwidth between memory and processor, the inherent RC delay of the integrated circuit, and the heat dissipation caused by resistance loss in the electronic circuit, the dominant computing platform, namely the traditional electronic signal processor under von Neumann architecture is difficult to achieve high speed and low energy consumption at the same time.

All optical computing using photons as information carrier provides a potential alternative to the traditional electronic signal processor. However, there is an inherent trade-off that the larger nonlinear coefficient can only be at the expense of the slower response time. This trade-off poses a major challenge to the construction of integrated photonic processors based on von Neumann architecture, which usually requires complex heterogeneous integration of various photonic devices in a single chip. Therefore, it is urgent to explore new architecture and unconventional all-optical computing scheme.

The research group of Prof. Xiaoyong Hu and Prof. Qihuang Gong from School of physics, Peking University, proposes a new strategy to realize ultrafast and ultralow-energy-consumption



All-optical transcendental equation solver. (A) schematic diagram of the all-optical transcendental equation solver. (B) Top-view SEM image of the all-optical transcendental equation solver, where the scale bar is 100  $\mu\text{m}$ . Here, the white dotted lines mark the five layers for waveform discretization, and the red dotted lines separate the three layers of the optical CNN structure. (C) Output light intensity distribution in the output waveguides ( $k = 1.67$ ). The arrows in the figure correspond to the locations of the solutions. The horizontal axis is the number of discrete waveguides, the vertical axis on the right represents the output signal intensity, and the vertical axis on the left gives the deviation between the experimental output signal and the theoretical value. (D) A graphic representation of solution deviation. The horizontal axis labels the individual solutions, and the vertical axis represents three values of the parameter  $k$ . The shade of the color indicates the magnitude of the deviation. Credit: OEA

all-optical computing chip scheme based on convolutional neural network (CNN), which supports the execution of multiple computing tasks. The optical CNN consists of cascaded silicon Y-shaped waveguides with side-coupled silicon waveguide segments designed to control the amplitude and phase of light in the waveguide branches. As a proof-of-concept, they experimentally implemented the network design through several computation tasks including transcendental equations solvers, multifunctional logic gate operators, and half-adders. The time-of-flight of light through the network structure corresponds to an ultrafast computing time of the order of several picoseconds with an ultralow energy consumption of dozens of femtojoules per bit. Their approach can be further expanded to offer the possibility of parallel computing using wavelength multiplexing based on non-von Neumann architectures and thus paves a new way for on-chip all-optical computing.

$$\cos 2kx + 4 = \tan^{-1}(kx)$$

For example, a transcendental equation solver has been achieved to solve the above equation with high accuracy with a maximum deviation less than 5%, and in most cases the deviations are less than 3%. The accuracy of the solution can be improved by increasing the number of output waveguides in theory. Besides excellent solution accuracy, the all-optical equation solver also features ultrafast (The time-of-flight of light passing through the characteristic structure is  $\sim 1.3$  ps) and energy-efficiency computation ( $\sim 92$  fJ/bit ). Stability analysis of their network further demonstrates its high fault tolerance to defects such as weight deviation and waveguide damage. This work therefore points to a promising direction for next-generation all-optical computing systems.

**More information:** Kun Liao et al, All-optical computing based on convolutional neural networks, *Opto-Electronic Advances* (2021). DOI: [10.29026/oea.2021.200060](https://doi.org/10.29026/oea.2021.200060)  
<https://phys.org/news/2021-11-all-optical-based-convolutional-neural-networks.html>



Wed, 01 Dec 2021

## Physicists create time crystals with quantum computers

By Taylor Kubota

There is a huge global effort to engineer a computer capable of harnessing the power of quantum physics to carry out computations of unprecedented complexity. While formidable technological obstacles still stand in the way of creating such a quantum computer, today's early prototypes are still capable of remarkable feats.

For example, the creation of a new phase of matter called a "time crystal." Just as a crystal's structure repeats in space, a time crystal repeats in time and, importantly, does so infinitely and without any further input of energy—like a clock that runs forever without any batteries. The quest to realize this phase of matter has been a longstanding challenge in theory and experiment—one that has now finally come to fruition.



In research published Nov. 30 in *Nature*, a team of scientists from Stanford University, Google Quantum AI, the Max Planck Institute for Physics of Complex Systems and Oxford University detail their creation of a time crystal using Google's Sycamore quantum computing hardware.

The Google Sycamore chip used in the creation of a time crystal. Credit: Google Quantum AI

"The big picture is that we are taking the devices that are meant to be the quantum computers of the future and thinking of them as complex quantum systems in their own right," said Matteo Ippoliti, a postdoctoral scholar at Stanford and co-lead author of the work. "Instead of computation, we're putting the computer to work as a new experimental platform to realize and detect new phases of matter."

For the team, the excitement of their achievement lies not only in creating a new phase of matter but in opening up opportunities to explore new regimes in their field of condensed matter physics, which studies the novel phenomena and properties brought about by the collective interactions of many objects in a system. (Such interactions can be far richer than the properties of the individual objects.)

"Time-crystals are a striking example of a new type of non-equilibrium quantum phase of matter," said Vedika Khemani, assistant professor of physics at Stanford and a senior author of the paper. "While much of our understanding of condensed matter physics is based on equilibrium systems, these new quantum devices are providing us a fascinating window into new non-equilibrium regimes in many-body physics."

### **What a time crystal is and isn't**

The basic ingredients to make this time crystal are as follows: The physics equivalent of a fruit fly and something to give it a kick. The fruit fly of physics is the Ising model, a longstanding tool for understanding various physical phenomena—including phase transitions and magnetism—which consists of a lattice where each site is occupied by a particle that can be in two states, represented as a spin up or down.

During her graduate school years, Khemani, her doctoral advisor Shivaji Sondhi, then at Princeton University, and Achilleas Lazarides and Roderich Moessner at the Max Planck Institute for Physics of Complex Systems stumbled upon this recipe for making time crystals unintentionally. They were studying non-equilibrium many-body localized systems—systems where the particles get "stuck" in the state in which they started and can never relax to an equilibrium state. They were interested in exploring phases that might develop in such systems when they are periodically "kicked" by a laser. Not only did they manage to find stable non-equilibrium phases, they found one where the spins of the particles flipped between patterns that repeat in time forever, at a period twice that of the driving period of the laser, thus making a time crystal.

The periodic kick of the laser establishes a specific rhythm to the dynamics. Normally the "dance" of the spins should sync up with this rhythm, but in a time crystal it doesn't. Instead, the spins flip between two states, completing a cycle only after being kicked by the laser twice. This means that the system's "time translation symmetry" is broken. Symmetries play a fundamental role in physics, and they are often broken—explaining the origins of regular crystals, magnets and many other phenomena; however, time translation symmetry stands out because unlike other symmetries, it can't be broken in equilibrium. The periodic kick is a loophole that makes time crystals possible.

The doubling of the oscillation period is unusual, but not unprecedented. And long-lived oscillations are also very common in the quantum dynamics of few-particle systems. What makes a time crystal unique is that it's a system of millions of things that are showing this kind of concerted behavior without any energy coming in or leaking out.

"It's a completely robust phase of matter, where you're not fine-tuning parameters or states but your system is still quantum," said Sondhi, professor of physics at Oxford and co-author of the paper. "There's no feed of energy, there's no drain of energy, and it keeps going forever and it involves many strongly interacting particles."

While this may sound suspiciously close to a "perpetual motion machine," a closer look reveals that time crystals don't break any laws of physics. Entropy—a measure of disorder in the system—remains stationary over time, marginally satisfying the second law of thermodynamics by not decreasing.



Between the development of this plan for a time crystal and the quantum computer experiment that brought it to reality, many experiments by many different teams of researchers achieved various almost-time-crystal milestones. However, providing all the ingredients in the recipe for "many-body localization" (the phenomenon that enables an infinitely stable time crystal) had remained an outstanding challenge.

For Khemani and her collaborators, the final step to time crystal success was working with a team at Google Quantum AI. Together, this group used Google's Sycamore quantum computing hardware to program 20 "spins" using the quantum version of a classical computer's bits of information, known as qubits.

Revealing just how intense the interest in time crystals currently is, another time crystal was published in *Science* this month. That crystal was created using qubits within a diamond by researchers at Delft University of Technology in the Netherlands.

### **Quantum opportunities**

The researchers were able to confirm their claim of a true time crystal thanks to special capabilities of the quantum computer. Although the finite size and coherence time of the (imperfect) quantum device meant that their experiment was limited in size and duration—so that the time crystal oscillations could only be observed for a few hundred cycles rather than indefinitely—the researchers devised various protocols for assessing the stability of their creation. These included running the simulation forward and backward in time and scaling its size.

"We managed to use the versatility of the quantum computer to help us analyze its own limitations," said Moessner, co-author of the paper and director at the Max Planck Institute for Physics of Complex Systems. "It essentially told us how to correct for its own errors, so that the fingerprint of ideal time-crystalline behavior could be ascertained from finite time observations."

A key signature of an ideal time crystal is that it shows indefinite oscillations from all states. Verifying this robustness to choice of states was a key experimental challenge, and the researchers devised a protocol to probe over a million states of their time crystal in just a single run of the machine, requiring mere milliseconds of runtime. This is like viewing a physical crystal from many angles to verify its repetitive structure.

"A unique feature of our quantum processor is its ability to create highly complex quantum states," said Xiao Mi, a researcher at Google and co-lead author of the paper. "These states allow the phase structures of matter to be effectively verified without needing to investigate the entire computational space—an otherwise intractable task."

Creating a new phase of matter is unquestionably exciting on a fundamental level. In addition, the fact that these researchers were able to do so points to the increasing usefulness of quantum computers for applications other than computing. "I am optimistic that with more and better qubits, our approach can become a main method in studying non-equilibrium dynamics," said Pedram Roushan, researcher at Google and senior author of the paper.

"We think that the most exciting use for quantum computers right now is as platforms for fundamental quantum physics," said Ippoliti. "With the unique capabilities of these systems, there's hope that you might discover some new phenomenon that you hadn't predicted."

**More information:** Mi, X et al, Time-Crystalline Eigenstate Order on a Quantum Processor, *Nature* (2021). [doi.org/10.1038/s41586-021-04257-w](https://doi.org/10.1038/s41586-021-04257-w)

**Journal information:** *Nature*, *Science*

<https://phys.org/news/2021-11-physicists-crystals-quantum.html>

### Blood groups A, B and Rh+ more disposed to Covid-19, shows Ganga Ram Hospital study

*Meanwhile, blood groups O, AB and Rh- are at a significantly lower risk of the infection, the study says*

New Delhi: A study at Delhi's Sir Ganga Ram Hospital has found that blood groups A, B and Rh+ are more disposed to Covid-19 infection, while blood groups O, AB and Rh- are at a significantly lower risk of the infection.

The study was conducted in 2,586 Covid-19 positive patients who were admitted to the hospital from April 8 2020 to October 4 2020. The findings were published in the November 21 issue of *Frontiers in Cellular and Infection Microbiology*.

“Severe acute respiratory syndrome coronavirus 2 is a new virus, and it is unclear whether blood groups have any impact on Covid-19 risk or progression. Therefore, we investigated the association of ABO and Rh blood group with Covid-19 susceptibility, prognosis, recovery time, and mortality in this study,” said Dr. Rashmi Rana, Consultant, Department of Research.



According to the research paper, the frequencies of A, B, O and AB blood groups were 29.93%, 41.8%, 21.19% and 7.89% respectively, while in a control group of 79,325, their frequencies were 21.86%, 38.49%, 29.37% and 10.28% respectively. Of the patients, 98.07% were Rh positive.

“We also found that male patients with blood group B are more prone to Covid-19 than female patients with the same blood group and blood group AB was observed to be more susceptible to infection in patients with age group  $\leq 60$  years,” said Dr. Vivek Ranjan, Co-author and Chairperson, Department of Blood Transfusion.

However, the paper says that they found no association between blood groups and susceptibility to severity of disease and mortality. It did find that blood groups A and Rh+ types are associated with a decrease in recovery period while blood groups O and Rh- are associated with increase in recovery.

However, the study concludes by stating that “...the ABO and/or Rh blood groups may not be responsible for this association, as these may indicate an unexplored underlying factor like comorbidity. Therefore, larger, multicenter, and prospective studies are needed to ascertain the relationship between blood groups and SARS-CoV-2.”

<https://indianexpress.com/article/cities/delhi/bloods-groups-a-b-rh-more-disposed-to-covid-19-ganga-ram-hospital-study-7648878/>

