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Military R&D is a continuous and time-consuming process

Interview/ Ajay Kumar Singh, director-general, life sciences, DRDO

By Pradip R Sagar

A few months ago, Ajay Kumar Singh, director-general of the life sciences wing of the Defence Research and Development Organisation, was heading a team of defence scientists to innovate affordable medical equipment for Covid-19 management. But with India and China still locked in a standoff at the border, his team has been tasked to step up efforts to equip soldiers for high-altitude warfare. In an interview with THE WEEK, Singh shared his views. Excerpts:

Q/ After the Ladakh standoff, has the DRDO been asked to carry out innovations and studies for the benefit of soldiers?

A/ The DRDO's life sciences labs proactively provided habitability solutions like improvised space-heating device, oxygenated shelters, anti-frostbite formulation, and fresh and nutritious food in collaboration with several stakeholders. Our high-altitude region labs have contributed in developing technologies that ensure availability of fresh produce to armed forces throughout the year.



Q/ Can you share some special efforts made by defence life sciences scientists for the Indian Army for high-altitude operations?

A/ A team of scientists recently visited forward posts in a high-altitude region. Several products have been delivered to the troops for their trial and use and it is also planned to oxygenate existing shelters. DRDO has provided ergonomically designed backpacks and sleeping bags suitable for temperatures up to -50°C. Research and development (R&D) is also underway to develop extreme winter clothing using indigenous textile technologies.

DRDO life sciences labs have been working in close collaboration with the Army for enhancing troop acclimatisation by physical, physiological and psychological interventions. Different modalities like pre-acclimatisation of soldiers at moderate altitude, use of Intermittent Hypoxia Training (IHT) in the plains and use of pharmacological agents as strategies have been suggested for rapid induction of troops after extensive R&D. In addition, the recommendation of tenure of posting at different altitudes and of nutritionally balanced ration scales has been made and are being followed by the Indian Army.

Q/ DRDO scientists are often criticised for disappointing armed forces when it comes to meeting their requirements.

A/ Military R&D is a continuous and time-consuming process, which involves synergy between various stakeholders. The R&D contributions made by DRDO are palpable and are acknowledged by the armed forces. However, to meet futuristic requirements, there is a need for more synergistic

efforts between the DRDO, armed forces and industrial partners, wherein the services and industry view DRDO not only as developers, but also as their joint collaborative partners.

<https://www.theweek.in/theweek/current/2020/12/03/military-r-and-d-is-a-continuous-and-time-consuming-process.html>

THEWEEK

Fri, 04 Dec 2020

Battle of bunker hill

How an army of defence scientists is helping soldiers in Ladakh

By Pradip R Sagar

Temperatures in eastern Ladakh have dipped to -20 degrees Celsius, but the spirit of the Indian Army is soaring. Apart from keeping a check on enemy troops, Indian soldiers are guarding themselves from the fierce Himalayan winter.

Extreme winter clothing, sleeping bags, highly nutritious food, drinking water, kerosene—these are some of the basic items that soldiers in 8x8ft bunkers on the Rezang La heights need to survive. To fight, he needs compact battle kits containing weapons, ammunition and communication equipment.

With more than 50,000 troops deployed on the India-China border—the biggest such deployment since 1962—the Army is looking for ways to ride out the harsh winter. Defence scientists are offering multiple solutions to keep soldiers fighting fit for high-altitude warfare. Laboratories of the Defence Research and Development Organisation (DRDO) are looking at ways to reduce the acclimatisation period of troops and help soldiers keep themselves mentally and physically fit.

In early October, a team of DRDO scientists visited the Army's 14 Corps headquarters in Leh. They proposed more than two dozen winter-gear accessories and other inventory that would help soldiers survive extreme weather conditions. The proposals include a high-altitude water purification system, oxygen-enriched shelters, space heating devices, sleeping bags that can be used at -50 degrees Celsius, high-nutrition quercetin bars and solar-powered shelters.

Ladakh has low oxygen levels and extreme weather. According to defence scientists, the atmosphere in eastern Ladakh, which is 15,000ft above sea level on an average, can have adverse physiological, psychological and hormonal affects that can lead to acute mountain sickness, high-altitude pulmonary oedema and high-altitude cerebral oedema. At present, the Army follows an 11-day acclimatisation regimen for its troops, done in three stages at different altitudes (9,000ft, 12,000ft and 15,000ft).

Though the Indian Army has four decades of experience in deployment in Siachen, the number of troops deployed there is much less than the deployment in Ladakh this time. Three new approaches have been proposed to the Army to reduce the acclimatisation period and speed up deployment. Prior deployment of soldiers at a moderate altitude, putting them through intermittent hypoxia (as training to survive in low-oxygen atmosphere) and providing oxygen shelters are the new methods.



Winter woes: An Indian soldier near a mountain pass that connects Srinagar to Ladakh | AFP

Dr A.K. Singh, director-general of life sciences at DRDO, said maintaining optimal combat efficiency in extreme weather has for long been an objective for the Army. A similar rapid deployment, he said, was last attempted in 1999, during the Kargil war. “Our scientists are working with military doctors for enhancing troop acclimatisation by physical, physiological and psychological interventions,” said Dr Singh.

Indian and Chinese troops have been engaged in a standoff in Ladakh since May. The deployment of troops in eastern Ladakh is being done on the lines of the Siachen pattern—a 90-day deployment cycle before a soldier is replaced by another one. Military strategists believe that, with the trust deficit between the two sides, large-scale deployment of troops will be the new normal on the Line of Actual Control.

The Indian Army has just completed setting up habitats for troops in eastern Ladakh. But these habitats are only at the base camps, not at forward posts. Also, 11,000 sets of special winter clothing have been brought from the US. “Due to the unforeseen situation on the border, the Army had no option but to go for emergency purchase from foreign players. But we have the capability to produce such winter clothing,” said a DRDO scientist. “We are already in touch with the local industry to make it available. And we would be able to provide such clothing in the next six to eight months.”

The extreme winter clothing produced by the Defence Institute of Physiology and Allied Sciences (DIPAS) in Delhi is a three-layered modular system. Each kit weighs around 5kg. The clothing is waterproof, breathable, abrasion resistant and effective even in -50 degrees Celsius.

“It is almost one-fourth the cost of winter clothing that we import,” said the scientist. “All [extreme winter] clothing requires down feathers (fine bird feathers found under the tougher exterior feathers) to minimise heat transfer and keep it lightweight.” To tackle the issue of availability of feathers, scientists are exploring whether duck feathers can be used, since they are water repellent.

Another helpful tool is a space heating device that runs on kerosene. The devices are efficient and they do not release hazardous carbon monoxide. The Army has placed a Rs267-crore order for them.

To provide drinking water on icy heights, DIPAS has come out with a solar snow melter. Trials at Khardungla in Ladakh and Tawang

New from DRDO

TENTS

Can withstand up to minus 40 degrees Celsius. Capacity: 12 men. Weight: 290kg. Cost: ₹1lakh

HIGH-ALTITUDE WATER PURIFICATION SYSTEM
Will fit into a backpack and purify surface water (stream, river, pond). Cost: ₹50,000

SOLAR SHELTER
Modular structures for 2, 6 or 10 persons. Solar-heated, greenhouse effect. Cost: ₹30 lakh for a two-man shelter

ALL-WEATHER WATER TANK
Solar-powered, lithium ion battery-based heater to keep water in liquid form. Cost: ₹10 lakh for two units

EXTREME COLD WEATHER CLOTHING SYSTEM
Effective up to minus 50 degrees Celsius. Three-layered and modular, waterproof, breathable, and abrasion and tear resistant. Weight: 4-5kg. Cost: ₹17,000

ERGONOMICALLY DESIGNED WATER BOTTLE
Can retain water in liquid state for four hours even at minus 20 degrees Celsius. Capacity: 1.3 litre. Cost: ₹1,700.

SLEEPING BAGS
High thermal insulation, breathable, waterproof and can withstand up to minus 20 degrees Celsius. Lightweight (1.7kg). Cost: ₹20,000

QUERCETIN BAR
Ready-to-eat, performance-enhancing food for oxygen-deficient conditions

HEAT PACKS AND CHEST BELT
Provides instant heat, reusable and portable. Cost: ₹1,600

ERGONOMICALLY DESIGNED BACKPACK
Capacity: 70 litre. Has a rifle holder and facility to carry climbing shoes and equipment. Cost: ₹7,000



RESEARCH PRADIP R. SAGAR

found that these portable, manually operated snow melters are very helpful. “The issues faced by soldiers may not be new, but the scale is different this time,” said Singh. “All efforts have been made to cater to the requirements of the Indian Army, as the logistics burden has increased manifold.”

Defence scientists have set goals for themselves to develop new systems in the next few months. In the pipeline are modular garages for tanks, diesel generators that work at -50 degrees Celsius, solar-power shelters, rugged battery chargers, portable mobile cuboids and crevasse cross-bridges.

“Every solution cannot be a panacea for all problems,” said a defence scientist. “To meet future requirements, there is a need for more synergetic efforts between the DRDO, the armed forces and industrial partners, wherein the services and the industry view DRDO not only as developers, but also as their collaborative partners.”

An Army also marches on its stomach. A soldier needs to have around 4,500 calories a day to survive in high altitude. So the ration includes energy bars, chocolates, fruits and vegetables. O.P. Chaurasia, director of the Leh-based Defence Institute of High Altitude Research (DIHAR), says his laboratories are providing at least 28 types of vegetables to the Army. Set up after the 1962 war, DIHAR conducts research on agro-animal activities in extreme cold and high altitude. “In Ladakh, hydroponics (growing crops without soil) and micro-farming seem the only viable options,” said Chaurasia. “With this, limited quantity of fresh vegetables can be grown and it is developed to suit the Ladakh condition.”

Researchers at DIHAR have used their technology to grow vegetables like radish, broccoli and cabbage using low-intensity lights and limited amount of water. DIHAR scientists have also been researching on whether Bactrian camels in the Nubra valley, whose double humps can carry a load of 170kg, can be trained to transport ration and weapons. During the Kargil war, said Chaurasia, DIHAR researchers had successfully trained Zanskar ponies with the same objective.

Surviving in a bunker at -40 degrees Celsius is like living the life of a caveman, said Major General Amrit Pal Singh, former chief of operational logistics of 14 Corps. “We (the Army) are holding hilltops, peaks and cliffhills. And you cannot carry stores to those points. You are actually living like a caveman by crawling into the hole and making a little warm space for yourself. Good clothing, nutritious food and frequent rotation to avoid physiological and psychological ailments are the only ways to protect the soldiers.”

<https://www.theweek.in/theweek/current/2020/12/03/battle-of-bunker-hill.html>

DRDO ने फ्लोरिडा की कंपनी को दी 'सुमेरु-पैक्स' की तकनीक

नई दिल्ली: रक्षा अनुसंधान और विकास संगठन (डीआरडीओ) ने गुरुवार को पर्सनल पोटेक्टिव इक्यूपमेंट (पीपीई) सूट के नीचे पहने जाने वाले 'सुमेरु-पैक्स' की तकनीकी फ्लोरिडा की कंपनी रिओट लैब्स को सौंप दी। डीआरडीओ ने पीपीई किट पहनने वालों को सहज रखने के लिए यह उपकरण विकसित किया है। इसका इस्तेमाल पीपीई सूट के अंदर पहनकर किया जाना है।

डीआरडीओ के अधिकारियों को डॉक्टरों और चिकित्सा कर्मचारियों से मिले फीडबैक के आधार पर पता चला कि पीपीई किट पहनने वाले लोग 30 से 45 मिनट के बाद असहज महसूस करते हैं और पसीना आने लगता है। इसके बाद डीआरडीओ ने एक व्यक्तिगत वायु संचालन प्रणाली विकसित की, जिसका उपयोग पीपीई किट के अंदर पहनने में किया जा सकता है। 'सुमेरु-पैक्स' नाम का यह उपकरण पीपीई किट पहनने वालों को बिना पसीना बहाए आराम करने में मदद करता है। लगभग 500 ग्राम वजन के छोटे बैकपैक के रूप में यह उपकरण 39 डिग्री सेल्सियस के तापमान तक भी अच्छी तरह से काम करता है और पहनने वाले को बिना पसीने के आरामदायक और ठंडा रखता है। यह प्रणाली विशेष रूप से डॉक्टरों और अन्य चिकित्सा कर्मचारियों के लिए उपयुक्त है जो अस्पतालों में छह-छह घंटे तक पीपीई किट पहनकर कार्य करते हैं। यह डिवाइस एक फिल्टर की मदद से बाहरी हवा खींचता है और सामने की ओर खुलने से नम हवा बाहर निकलती है, जिससे गर्दन और सिर का क्षेत्र ठंडा होता है।

फ्लोरिडा की कंपनी रिओट लैब्स का मानना है कि तेजी से विकसित हो रही प्रौद्योगिकी भौगोलिक सीमाओं को तोड़ रही है और वैश्विक आर्थिक संकट और पर्यावरणीय आपदा जैसे मुद्दे बहुराष्ट्रीय और बहुसांस्कृतिक सहयोग को एक आवश्यक वास्तविकता बना रहे हैं। आज के वैश्विक संगठनों में अधिक से अधिक काम व्यक्तियों द्वारा किया जा रहा है, व्यक्तियों द्वारा नहीं। विविधता अक्सर नए दृष्टिकोण और अभिनव समाधानों को प्रोत्साहित करती है, सांस्कृतिक मतभेद भी गलतफहमी और संघर्ष का कारण बन सकते हैं।



डीआरडीओ ने पीपीई किट पहनने वालों को सहज रखने के लिए यह उपकरण विकसित किया है। इसका इस्तेमाल पीपीई सूट के अंदर पहनकर किया जाना है।

<https://www.sanjeevnitoday.com/national/drdo-gives-sumerupax-technology-to-florida-company/20201203/419283>

Aircraft carriers are absolutely necessary: Navy Chief

New Delhi (India), December 3 (ANI): Amid the ongoing debate on whether the country should have a third aircraft carrier or not, Navy chief Admiral Karambir Singh, on Thursday, said that for an economically aspirational nation like India, aircraft carriers are "absolutely necessary".

In his Navy Day press conference, the Navy chief stated that the two Predator drones leased by the force were filling in the gaps in surveillance in the Indian Ocean Region.

"As the Navy, we are absolutely clear of the utility of the carrier. Because air operations are integral to naval operations. Airpower at sea is required here and now. The Navy is all about reach and sustenance, If you are a nation that is aspiration and you want to become a 5 trillion economy shortly and you want to do well you will have to go outwards and seek the world. The navy does not want to be navy tethered to shore. For that aircraft carriers are absolutely necessary," he said.

The debate over the need of an aircraft carrier has been raging as there is a view in the defense ministry that the cost of such a project would be very high and it should not be pursued. Meanwhile, the Navy chief said the Indian Navy has issued a requirement of multirole deck-based fighter aircraft which it wants to pursue with the Air Force requirement for replacing the existing fleet of MiG-29K aircraft.

The Navy Chief said The Defence Research and Development Organisation (DRDO) has also come up with its Twin engine deck-based fighter aircraft and if that is successful, it can be the choice of the maritime force.

"We are working with DRDO on the twin-engine deck-based fighter offered to us. A lot of lessons have been learned from the Light Combat Aircraft (LCA) program and my hope is that the twin-engine jet can enter service by the early 2030s," he said. (ANI)

(Disclaimer: The views expressed in the article above are those of the authors' and do not necessarily represent or reflect the views of this publishing house. Unless otherwise noted, the author is writing in his/her personal capacity. They are not intended and should not be thought to represent official ideas, attitudes, or policies of any agency or institution.)

<http://www.businessworld.in/article/Aircraft-carriers-are-absolutely-necessary-Navy-chief/03-12-2020-349615/>

Indian Navy: An ‘Atmanirbhar’ journey from 1960s to 2020s

The Indian Navy has become increasingly self-reliant and strong

By Captain Deepak Nair

Everyone wants to be strong and self-sufficient, but few are willing to put in the work necessary to achieve worthy goals. – Mahatma Gandhi

While India gained its independence on August 15, 1947, the seeds of an Indianised Navy were sown way before in January 1947 by a British citizen, Patrick Blackett. A renowned British physicist who had pioneered naval operational research in the British Navy during the Second World War, Blackett prepared a report outlining measures necessary for India to become near self-sufficient in defence production. While Blackett correctly assessed self-reliance as key to maintaining strategic autonomy in terms of foreign policy, ably supported by a strong industrial base, his analysis of requiring 18 months to achieve it did not prove true.



Representative image | PTI

The journey towards self-reliance has been long and arduous, impacted by financial limitations, international sanctions and global politics. Yet, the Indian Navy has remained steadfast in this mission. Taking a cue from what Dr A.P.J. Kalam had once said, the dream to achieve self-reliance in all aspects of maritime operations was one which did not let the Navy’s leadership to ever sleep. The commitment was espoused even at the individual level as much as it was ingrained into the very ethos of the organisation. Notwithstanding the considerable challenges, such an attitude ensured continuous investment of two key elements—first being the financial capital and second the human capital, which enabled steady improvement and positive outcomes. The unique involvement of the Navy, both, as the vendor as well as the buyer, enabled a progressive model of indigenisation to be successfully implemented.

Anyone who has spent time at sea will vouch that, in addition to ‘the proverbial enemy’, there is another threat which permeates across peace and war, and that is the sea itself. A deadly mix of salt, water, multi-dimensional motion, oil, ammunition and electricity, all packed into a box of steel, makes routine tasks difficult and the difficult, nearly impossible. While hulls can be strengthened with better steel and engines made more powerful, making electronic systems operate reliably in such hostile environment is exponentially more complicated. It is, therefore, no surprise that unlike the float and move components, which saw early success, the journey to achieve self-reliance in terms of fight component has been relatively arduous. The Navy persevered, and like the confrontation between the stream and the rock, which the stream always wins—determination, professionalism and self-confidence has now resulted in success.

The first major step on this path was when the Navy took a decision to move away from analog systems, already fitted on the first Leander class ship, to digital systems manufactured by the Dutch company, Signaal for subsequent ships. Despite objections from the ship-builder from some quarters within the Navy, the higher leadership was able to discern the long terms advantages, and pushed ahead. This culminated in an agreement between Signaal of Holland and Bharat Electronics (BEL), Bengaluru, which has enabled the latter to subsequently manufacture radar systems like APARNA, LW-08 and DA-08. These systems remained the mainstay of Naval radar systems for years, and BEL (Bangalore) has now achieved adequate capability to supply one of the world’s most advanced radar systems—MF-STAR, for the next generation of naval frigates.

The Indian Navy has also achieved self-reliance in terms of technology as well as manufacturing in the niche field of sonar systems. This was made possible by a synergetic relationship between the Navy, Naval Physical and Oceanographic Laboratory (NPOL), a premier DRDO laboratory dealing with underwater acoustics and M/s BEL (production agency). The difficulties in making western-origin sonars work in tropical waters and rapid advancement in technologies convinced the Navy to indigenise underwater sensors. The journey, which started in 1976, was excruciating, but bold decisions at the highest level helped the Navy navigate this project through difficult waters. Facilitating the participation of highly specialised individuals, alongside teams from DRDO and the academia, all driven by a shared single-minded focus resulted in the development of APSOH, an indigenously designed, developed and manufactured world class sonar. Since then, every Indian Naval ship has been fitted with indigenous sonars, comparable with sonars operated by leading navies of the world, which have been built on the efforts of this initial team.

Amongst all the components on a warship, Electronic Warfare (EW) systems and Computer Aided Action Information Organisation Systems (CAAIO) function at the very cutting edge of technology. Thus, while leading firms are ever ready to sell these systems, they remain unwilling to share the technologies within. Considering the complex technologies involved, a staged development model was adopted by the Navy for both these systems. While the first set of systems, such as Ajanta and EMCCA, were satisfactory, subsequent generations of these systems have surpassed expectations. Today, all newly inducted assets employ indigenously built Combat Management Systems (CMS) and large ship EW Systems which are comparable, if not better, than what is available worldwide.

Amongst this, the indigenous CMS program is of particular pride to the Navy due to the significant participation of the private sector, the crowning glory being successful development of CMS for the indigenous aircraft carrier by M/s Tata Power (SED). A focussed approach towards enhancing private sector participation has yielded rich dividends with M/s Larsen & Toubro supplying the Indigenous Torpedo Tube Launchers, Indigenous Rocket Launcher and Universal Vertical Launch Systems. The development of niche technologies is today no longer the forte of the so-called big boys. MSMEs, based on experience gained by working alongside the Navy, have also made a mark by winning international contracts, beating global giants in the process.

The Navy has also been at the forefront in initiating ground breaking projects through the inter-governmental joint-development model. The BrahMos Aerospace venture between India and Russia, set up in 1998, was able to deliver a supersonic anti-ship missile within just five years. Repeated success has proven this missile's game-changing credentials and BrahMos is today the standard fit onboard IN ships. The induction of Barak-8 systems into the Navy, commencing with the indigenously built Kolkata class ships in 2014, has been a game changer in terms of air-defence capabilities.

When the Honourable Raksha Mantri, Shri Rajnath Singh, announced an embargo on import of over 100 weapons and platforms, there was worry in certain quarters regarding its impact on the Armed Forces' capability enhancement plans. Yet, a quick perusal of the list actually reveals the triumph of the Indian Navy's indigenisation program. The sustained efforts to attain self-reliance over the past six decades has ensured that, the Navy's plans, as enunciated in its Maritime Capability Perspective Plan, remain on track. Though there remains a need to enhance participation of the private sector, there is no denying the lead that the Navy has towards Be Indian, Buy Indian. One of the foremost examples of the Indian Navy's indigenisation is undoubtedly the Indigenous Aircraft Carrier-1 (IAC-1) being built at Cochin Shipyard Ltd. The IAC-1 has provided direct employment to the shipyard, MSMEs and has ploughed back most of its budget back into the country's economy. The Navy is also keen to similarly construct IAC-2, which will not only give a boost to the economy, but also ensure that two Carrier Battle Groups are continuously available.

The geo-political churn in the Indian Ocean Region and growing presence of external maritime forces has significantly enhanced the challenges faced by India in the maritime domain, which could also consequently impact economic growth. The desire to be Atmanirbhar, ingrained into its very DNA, has enabled the Indian Navy to become increasingly self-reliant yet strong—strong

enough to be rated as the fifth most powerful Navy in the World by the Lowy Institute Asia Power Index 2020. However, less than adequate capital investment in the Navy may see a steady erosion of this carefully nurtured indigenous manufacturing capability. With Ministry of Defence taking a lead in the Atmanirbhar initiative, it is imperative that the Government continues to support the Navy and in turn, the indigenous industry, to ensure greater success in our national mission to achieve comprehensive self-reliance.

(Captain Deepak Nair is a serving Indian Naval Officer presently posted at Defence Services Staff College, Wellington, and has keen interest in niche military technologies.)

The contents of this article are the personal views of the author and do not represent official position of the Indian Navy or the Government of India

<https://www.theweek.in/news/india/2020/12/03/indian-navy-an-atmanirbhar-journey-from-1960s-to-2020s.html>

Defence News

Defence Strategic: National/International

Business Standard

Fri, 04 Dec 2020

Govt approves Army Headquarters reorganisation, force gets 3rd deputy Chief

The government has also cleared the creation of the post of Director General Information Warfare in the headquarters who would be dealing with media affairs too

As part of the reorganisation of Army Headquarters, the government has approved the creation of a new deputy chief of strategy in the headquarters as per a plan first envisaged during the Doklam crisis with China in 2017.

The government has also cleared the creation of the post of Director General Information Warfare in the headquarters who would be dealing with media affairs too.

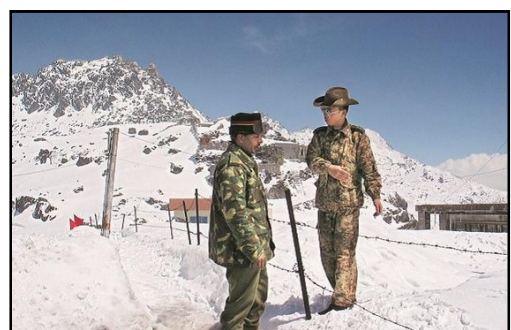
The government sanction letter for the creation of a new post of Deputy Chief of Army Staff (Strategy) as part of Army headquarters' reorganisation has been issued, Army sources said on Thursday.

The first officer to assume the new appointment would be the present Director General of Military Operations Lt General Paramajit Singh, they said.

The new office of the third deputy chief in the Army would reduce the burden on the vice chief of the Army as he would have important officers including the in-charges of military intelligence and military operations under him.

The new post was envisaged during the Doklam crisis when a need for closer and direct coordination was felt in the headquarters.

The sources further informed that the government has also given sanction for creating a new post of Director General Information Warfare.



The new post was envisaged during the Doklam crisis when a need for closer and direct coordination was felt in the headquarters.

The office would have the Additional Director General (Strategic Communications) under him.

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

https://www.business-standard.com/article/current-affairs/govt-approves-army-headquarters-reorganisation-force-gets-3rd-deputy-chief-120120301453_1.html

THEWEEK

Fri, 04 Dec 2020

Third aircraft carrier absolutely necessary, says Navy Chief

"We are very clear that air power at sea is required"

By Pradip R Sagar

Amid debates about the Indian Navy's requirement of an another aircraft carrier, Navy Chief Admiral Karambir Singh said that the Navy is absolutely clear of the utility of the third aircraft carrier.

Speaking to media ahead of Navy Day (December 4), Admiral Karambir maintained that they will move a formal case to the government for a third aircraft carrier after collecting technical information. "We have sent out certain RFIs (Request for Information) to gather information. Once we have collated them we will go in for the AON (Acceptance of Necessity). We all know that air operations are integral to naval operations and air power at sea is required here and now," Admiral Karabir said in response to a question by THE WEEK.



Admiral Karambir Singh | Sanjay Ahlawat

Known as floating air bases, these giant aircraft carriers are equipped with a full-length flight deck capable of carrying, arming, deploying, and recovering aircraft.

Barely a month after taking over as the country's first Chief of Defence Staff (CDS), General Bipin Rawat torpedoed the Indian Navy's future plan to have its third aircraft carrier (the second indigenous aircraft carrier IAC-2). Citing its high cost, General Rawat argued for submarines and developing shore based capabilities over aircraft carrier.

India currently has only one aircraft carrier—the 45,000-ton INS Vikramaditya, acquired from Russia in 2013. This is the third carrier to be operated by the Indian Navy since independence. And country's first Indigenous Aircraft Carrier (IAC-1) is being built in Cochin Shipyard and is expected to be join the Indian navy by next year. Indian Navy argues that, at present, most of the world powers are operating or building technologically advanced aircraft carriers to safeguard their maritime rights and interests. There are a total of 41 active aircraft carriers in operation by 13 navies across the world.

"We are very clear that air power at sea is required. If you are a nation that has aspirations and wants to be a \$5 trillion economy and do not want to be tethered to the shores...aircraft carriers are absolutely essential," Admiral Karambir said.

He added that the navy's fleet capability is aiming to achieve 175 warships goal, as he claimed that "the navy has inducted 24 Indian-built submarines and ships in last six years and 41 other ships are under-construction in India only."

While talking about the Navy's role in the ongoing military standoff with China on eastern Ladakh, navy chief said on several occasions, Indian navy's surveillance assets like P8I long range reconnaissance aircraft and drones were deployed to LAC for help Indian army's operations. He

also said that the navy's activities are in close coordination and synergy with the Army and Indian Air Force during the eight-month-long military face off with China.

"We have deployed the P-8I aircraft and Heron drones at various locations on the requirement of Army and Indian Air Force. P8I is a potent platform with certain equipment to be used on the border areas," navy chief said, while adding that attempts to change status quo on the northern border has increased the complexities in our security situation.

Recently, the Navy has acquired two MQ9B Predator drones on lease from General Atomics of the United States, as MQ 9 has an surveillance endurance of over 33 hours .

And to strengthen India's anti-drone capabilities, Admiral Karambir disclosed that the Indian Navy is procuring Smash-2000 rifles as anti-drone equipment to protect against attacking drones.

<https://www.theweek.in/news/india/2020/12/03/third-aircraft-carrier-absolutely-necessary-says-navy-chief.html>

Outlook

Fri, 04 Dec 2020

Indian Navy to procure more submarines and other assets to boost combat prowess: Naval Chief

New Delhi: Navy Chief Admiral Karambir Singh on Thursday said the Indian Navy is moving towards procuring a number of key assets including six more submarines and a batch of potent drones, and pitched for a third aircraft carrier even as he asserted the force is fully ready to deal with any challenge including from China.

Admiral Singh also said the COVID-19 pandemic and attempts to change the status quo at India's northern borders have thrown up challenging situations, adding the Indian Navy aimed to stand steadfast as a "combat ready, credible and cohesive force", furthering the country's national and maritime interests.

Addressing a press conference on the eve of Navy Day, he said the Navy has put in place a standard operating procedure in the event of any infringement of its maritime domain in the Indian Ocean region (IOR) by China.

He said Chinese research ships and fishing vessels had been deployed in the IOR but there had been no infringement on Indian maritime zones.

Asked about the rapid expansion of the Chinese People's Liberation Army(PLA) and possible challenges from it for India, the Chief of Naval Staff said the Indian Navy was cognisant of it, and was focusing on boosting its overall combat prowess including by procuring niche capabilities and unmanned solutions with available resources.

"As a primary manifestation of India's maritime power, the Indian Navy stands ready to fulfil its mandate to protect our national interests in the maritime domain."

Admiral Singh also said the Navy was looking at establishment of maritime theatre command in the near future which would further buttress joint planning and application of force in the maritime domain. He said the Andaman and Nicobar tri-services command will be part of the proposed maritime command.

"The COVID-19 pandemic disrupted and permeated every aspect of our lives. The near simultaneous attempt to change the status quo at our northern borders has significantly increased the complexities in our security situation. This dual challenge scenario continues as we speak and the country collectively continues to battle the pandemic and tackle the security challenges," he said.

Referring to the situation along the Line of Actual Control (LAC) in eastern Ladakh, the Naval chief said Indian Navy's surveillance aircraft P-8I and Heron drones were deployed in the region on several occasions.

"The P-8I is a potent platform. Based on the requirements of the Army and the IAF we have deployed the P-8I on several occasions. We have also deployed the Heron Unmanned Aerial Vehicle (UAV) from one of the northern bases," he said.

"Whatever we are doing is in close coordination and synergy with the Army and the Indian Air Force to produce desired results." India and China are locked in a nearly seven-month long military standoff in eastern Ladakh.

On acquisition of a third aircraft carrier, Admiral Singh said the Navy considers it as an absolute necessity, and it will make a formal case to the government after collating technical details.

India currently has one aircraft carrier -- INS Vikramaditya, and a second one --INS Vikrant-- is under construction. The construction of INS Vikrant is at an advanced stage and its sea trials are expected to commence in early 2021.

Admiral Singh said the Navy will soon take forward the process of acquiring six more submarines as well as a plethora of other assets including six P-8I maritime surveillance aircraft. He also said the issue of procuring 30 medium-altitude long-endurance (MALE) Predator drones for the Navy, the Indian Air Force and the Army is moving forward, and added his force is looking at taking on lease various platforms like unmanned aerial vehicles and helicopters.

The Navy Chief also said the Naval Utility Helicopters (NUH) programme has been taken under the strategic partnership model.

The Indian Navy had issued a global request for information (RFI) or an initial tender for the procurement of 111 naval utility helicopters under the strategic partnership model that involves a foreign entity and a domestic defence major.

"We are going to the government for shortlisting of the companies."

Admiral Singh said the Navy was also planning to procure SMASH 2000 rifles which will be deployed for anti-drone role.

Elaborating on the plan to acquire six submarines under the Project75-I programme, he said the matter will be taken up at the next meeting of the Defence Acquisition Council (DAC). The DAC is the defence ministry's highest decision-making body on procurement.

Asked about plans for procurement of jets for aircraft carriers, the Navy Chief said his force was looking for an indigenously developed deck-based plane by 2023.

On the Navy's overall focus, he said it has established a persistent foot-print in its areas of interest including at various choke points in the Indian Ocean.

"Naval deployments also serve as a deterrent to inimical interests, really signalling the Navy's reach, capability and intent."

Talking about giving more responsibility to women in the Navy, he said four women officers were appointed for duties in ships this year.

On the Quad or Quadrilateral coalition among India, the US, Australia and Japan, Admiral Singh said it is not against anybody, and he personally felt that cooperation under the grouping will grow organically depending on the challenges facing the member nations.

He also noted there is a difference between the Quad drill and last month's Malabar naval exercise that featured all the four member nations of the grouping.

"I would like to differentiate between Quad and Malabar because Malabar is an exercise which has been going on since 1992 and it is more of a professional exercise among the participating navies," he said.

India had invited Australia to be part of the Malabar exercise this year that effectively made it a drill by all the Quad member nations.

Asked whether Australia will be part of next year's Malabar exercise, Admiral Singh said: "I am not ready to speculate. Next Malabar will be hosted by the US. We will have to look at what decision the government of India takes on inclusion of Australia."

On the missing pilot of the MiG-29K that had crashed recently, Admiral Singh said the search operation was going on, and "we are hoping for the best".

He said the sonar locator beacon on board the aircraft was working and that is why the Navy could trace the wreckage of the aircraft. He also said the forward seat on which the missing pilot was seated has not been found.

On military reforms, he said the creation of the post of Chief of Defence Staff (CDS) has helped in addressing a number of difficult issues.

Highlighting Indian Navy's commitment to "self reliance in defence production", he said all 24 ships and submarines commissioned into the Navy over the last six years have been built in India.

"Further, of the 43 ships and submarines, currently under construction, 41 are being built at Indian shipyards. These include the Aircraft Carrier--Vikrant, P-15B Class Destroyers, P17A class stealth frigates and scorpene class submarines," he added.

(Disclaimer: This story has not been edited by Outlook staff and is auto-generated from news agency feeds. Source: PTI)

<https://www.outlookindia.com/newscroll/indian-navy-to-procure-more-submarines-and-other-assets-to-boost-combat-prowessnaval-chief/1987002>



Fri, 04 Dec 2020

Navy Day: Why India must 'Borrow A Garden Hose' to fight China

India must rally QUAD nations, create a consensus, and motivate other nations too, to reign-in a hegemonic China

By Admiral Arun Prakash (Retd)

Navy Day is celebrated annually on 4 December to commemorate a famous Indian Naval (IN) victory, and to remind Indians of their forgotten maritime heritage. It was on this day in 1971, that a squadron of IN missile-boats stealthily approached Karachi harbour and unleashed a barrage of guided-missiles.

This audacious and unorthodox attack not only sank two Pakistani warships, and set alight a fuel storage facility, but also blockaded Karachi port. Thereafter, no unit of the Pakistan Navy ventured out, nor did any merchant shipping approach the harbour. In the Bay of Bengal, a task-force – led by the aircraft-carrier INS Vikrant – blocked seaward egress from East Pakistan, destroyed airfields, shipping and ports, thus expediting Pakistani surrender.



The Bangladesh War marked an important milestone for the Indian Navy, because the service, still smarting from the ignominy of (government imposed) inaction in 1965, had determined in advance, that it would play a pivotal role in the coming conflict.

This war should have brought home to our decision-makers, the immense potential of the navy as a potent instrument of state power. But, unfortunately, it did not. The persistent 'sea-blindness'

of our decision-makers has forced the Indian Navy to make the best of consistently minuscule budgets.

India Faces The Prospect Of A Long, Painful, Expensive Stand-Off In Ladakh

Observance of Navy Day this year, will understandably be muted, given the adverse impact of all three crises – the pandemic, the economic downturn and the military confrontation – on the service. Our Admirals will, no doubt, reflect upon the irony that it is the recent border face-off in the Himalayas, and not their entreaties, that has brought focus on India's maritime domain!

It is now clear that, statesmanship and diplomacy having failed to persuade the Chinese to resume status quo ante, we are faced with the prospect of a long, painful, and expensive stand-off in Ladakh.

India-China Crisis: Why Everyone Is Looking Seawards For Options

Given the economic, technological and military asymmetry between China and India, and the Sino-Pak axis, if hostilities do break out, the best that India can hope for is a precarious stalemate on its northern and western borders. This seems to be the reason why everyone is looking seawards for options, other than 'boots on the ground,' which could reinforce India's negotiating position.

An obvious option is to use two closely related maritime templates; the naval exercise 'Malabar' and the 'Quadrilateral Security Dialogue' or Quad (both with a common membership), for creating a more equitable balance of power vis-à-vis China.

The US Navy Chief, perhaps, went too far when he declared, during Malabar 2020, that operating with Quad partners was critical to "building a more lethal fighting force."

But India, as it prepares to fight its own battles, needs to rally this quartet of democracies, and create a consensus for ensuring that a 'rules-based order' prevails in Asia and the Indo-Pacific.

Other nations too must be mobilised and motivated to show solidarity in the common cause of reigning-in a hegemonic China.

How 'Maritime Interception Operations' Could Upset China's Economy

In terms of direct naval action, India's best option would be to employ conventional 'naval deterrence,' to dissuade China from pursuing its course(s) of action.

As the world's largest trading nation and energy importer, China's seaborne trade and energy constitute a vulnerable 'jugular vein'. While imposing blockades and waging trade-warfare are complex operations that call for naval superiority, there is a simpler form of compellence, termed, 'maritime interception operations.' It involves the stopping, seizing or diversion of suspect ships.

Regardless of buffer stocks, any disruption or delay of shipping traffic could upset China's economy, with consequent effects on industry and population.

The IN, in spite of fiscal constraints, has emerged as a compact but professional and competent force, and India's fortuitous maritime geography will enable it to dominate both – the Bay of Bengal and the Arabian Sea. We must, however, bear in mind that China's PLA Navy (PLAN) – which now outnumbers the US Navy – is backed, not only by a prolific shipbuilding industry, but also the world's largest merchant fleet and a huge coast-guard, assisted by a maritime militia. It is possible, that we may, one day, see a Chinese Indian Ocean carrier task-force, based in Djibouti or Gwadar.

Reflecting On India's Maritime Security Dilemmas

In the emerging maritime scenario, the IN will need warships, submarines, helicopters, minesweepers and much else. Some of these are under construction, or on order. But given the dismal state of India's economy, warship retirements, and a lethargic shipbuilding industry, the IN is unlikely to get a significant force-levels boost in the foreseeable future.

Therefore, on Navy Day 2020, as we reflect on India's maritime security dilemmas, let us hark back to two historical events.

In August 1971, in a major deviation from its policy of non-alignment, India signed the 20-year Indo-Soviet Treaty of Peace, Friendship and Cooperation, specifying 'mutual strategic cooperation'.

This alliance sent a strong signal to both Washington and Beijing, to remain ‘hands off,’ and was a crucial factor in India’s 1971 victory.

It served India’s vital interests, at a crucial juncture, and did no harm to its image or standing.

India Must ‘Borrow A Garden Hose’ To Pre-empt Flare-Ups In The Indo-Pacific

In 1941, when the Allied nations – reeling under the German onslaught – sought US help, President Roosevelt signed the ‘Lend-Lease Act,’ under which the US ‘lent’ war materiel, including warships, tanks and aircraft, to the UK, France, China and even the Soviet Union. In return, the US received leases on naval bases during the war.

Roosevelt explained it thus: “Suppose my neighbour’s home catches fire, and I have a garden hose... if he can borrow my hose... it may help him put out the fire.”

It would be a fitting demonstration of India’s ‘strategic autonomy,’ in supreme national interest, if we could ‘borrow a garden hose’ to pre-empt any conflagrations in the Indo-Pacific.

Especially if it buys us a breathing spell for attainment of ‘Atmanirbharta.’

(Admiral Arun Prakash (Retd) has formerly been Chief of the Naval Staff of the Indian Navy, and Chairman of the Chiefs of Staff Committee. He tweets @arunp2810. This is an opinion piece and the views expressed above are the author’s own. The Quint neither endorses nor is responsible for the same.)

<https://www.thequint.com/voices/opinion/indian-navy-maritime-strategy-options-india-china-border-standoff-quad-countries-solidarity-consensus#read-more>



Fri, 04 Dec 2020

‘HALE’ and hearty: What the Navy has been doing with its newly leased US drones | India Today Insight

The service has deployed the MQ-9B SeaGuardian drones in patrols off the Malacca Straits. Future acquisitions will be part of a US-built submarine-hunting network

By Sandeep Unnithan

Delhi: One of the swiftest and most unusual acquisitions of military platforms this year has been the induction of two MQ-9B SeaGuardian drones acquired from the US and deployed in long-range missions over the Indian Ocean and the Bay of Bengal. Navy chief Admiral Karambir Singh, on December 3, confirmed that the navy had acquired two ‘pre-production model’ US-built MQ-9B SeaGuardians on lease and had been operating them over the past three weeks. “They have an endurance of 33 hours and we have been using them for sustained surveillance over large reaches of the Indian Ocean Region,” Admiral Singh said at his annual press conference ahead of Navy Day (December 4).

The drones were being maintained by personnel from US military firm General Atomics, the navy chief said. He sought to alleviate concerns raised by one of the other services on the security of the sensor data obtained by the leased drones. “The picture comes only to us,” Admiral Singh said. “We have safeguarded that part.”

The drones are based at INS *Rajali*, a naval airbase at Arakkonam, 80 km east of Chennai.



Navy chief Admiral Karambir Singh addresses a press conference on the eve of Navy Day, in New Delhi, Dec. 3

The lease option was concluded in less than two months. The Defence Acquisition Procedure unveiled by the defence ministry in September this year has a provision for leasing military equipment to bridge equipment shortfalls. “Leasing helps us greatly as it allows us to bridge equipment shortfalls without having to wait for lengthy procurements to be concluded,” a senior naval official said.

The SeaGuardian is called a High Altitude Long Endurance (HALE) platform as it can fly 40,000 feet above the sea and remain airborne for over 30 hours. Admiral Singh confirmed that the navy is the lead service in a tri-services proposal to acquire up to 30 SeaGuardian/ SkyGuardian Remotely Piloted Aircraft Systems (RPAS). The deal, first reported by INDIA TODAY, will see each of the three services acquiring 10 drones each for a total order size of Rs 22,000 crore.

The SeaGuardian, which will eventually be purchased, will allow the navy to perform broad area maritime surveillance at a fraction of the cost of the bigger US-built P-8I ‘Poseidon’— a militarised variant of the Boeing 737 passenger jet. General Atomics says the per hour operating costs of the SeaGuardian are only about 15 per cent of that of the P-8I—\$5,000 (about Rs 3.7 lakh) per hour versus \$35,000 (about Rs 26 lakh) per hour. The drones will also form part of an elaborate Anti-Submarine Warfare (ASW) grid that the navy is putting in place with three US-built platforms—shore-based SeaGuardians and P-8Is and shipborne MH-60R multirole helicopters. All three platforms ‘talk’ to each other and carry identical sonobuoys which, when dropped into the water, are capable of detecting enemy submarines. Contacts obtained by one of these platforms can be attacked by the other platforms using torpedoes and depth charges.

The navy’s present fleet of Israeli-built Heron Medium Altitude Long Endurance (MALE) UAVs has a ceiling of 30,000 feet and an endurance of over 30 hours but lack the ability to be steered by satellite—which means they have to be deployed in line of sight of ground stations.

<https://www.indiatoday.in/india-today-insight/story/-hale-and-hearty-what-the-navy-has-been-doing-with-its-newly-leased-us-drones-1746425-2020-12-03>

The Tribune

Fri, 04 Dec 2020

India no threat or gets threatened by anyone: Defence Secretary

*The remarks came both in the backdrop of continuing stand-off with
China in Ladakh region and the recent expanded Malabar naval exercise*

By KV Prasad

New Delhi: Emphasising that India’s defence relations with other countries is based on free, open and inclusive, rules-based order, the government on Thursday said emergence of the country is neither a threat to any country nor does New Delhi get threatened by anyone.

“Our defence relationships are based on free, open, inclusive and rules based order, economic growth to meet aspirations of 1.3 billion people of India and about 2 billion people of the region; emergence of India is not a threat to anyone. Nor do we get threatened by anyone,” Defence Secretary Ajay Kumar said delivering the annual YB Chavan Lecture at the Manohar Parrikar Institute of Defence Studies and Analyses on “Defence Policy- Contours and Challenges”.

The remarks came both in the backdrop of continuing stand-off with China in Ladakh region and the recent expanded Malabar naval exercise that added Australia back to the trilateral India-US-Japan trilateral annual engagement.

The previous exercise in 2007 resulted in China raising a flag of protest and later Australia pulled out of such an engagement. The expanded Malabar also comes in the wake of reinforcing of Quad meeting at the Foreign Minister-level.

Visualising a major potential for India to increase its share in the multi-billion dollar defence and aerospace sector and establish the country as player of consequence, the government wants to promote private sector while improving efficiency of public sector undertakings.

“The defence and aerospace sector is US \$300 billion opportunity of which presently we form a small pie. India needs to increase its share in the sector. For India to be able to make its mark in a global stage of defence production ecosystem, we need to promote our private sector in defence and aerospace while increasing the efficiency and productivity of our public sector,” he said.

Information technology and software development, he said is one field where the country has expertise and can leverage.

He said many international defence manufacturers source information communication technology from India. There is scope for India to step up engagement in the field of both Artificial Intelligence and Block Chain technology.

A country with large scale of defence requirements, he said, cannot afford to continue with being dependent on others for its equipment and remain one of the biggest importers of arms

“The answer lies in greater self reliance. Atmanirbhar Bharat is a key foundation of our defence policy. India cannot emerge as a major defence player, unless we create the requisite self-reliance within the defence industry and emerge as a manufacturing hub. Indigenous production of our defence requirements is the ideal situation and has to be the long term vision for India,” he said.

<https://www.tribuneindia.com/news/nation/india-no-threat-or-gets-threatened-by-anyone-defence-secretary-179484>



Fri, 04 Dec 2020

Army Chief to visit Saudi Arabia, UAE from Sunday

Naravane will spend two days each in both West Asian countries and hold meetings with the senior military and civilian leadership

By Rezaul H Laskar

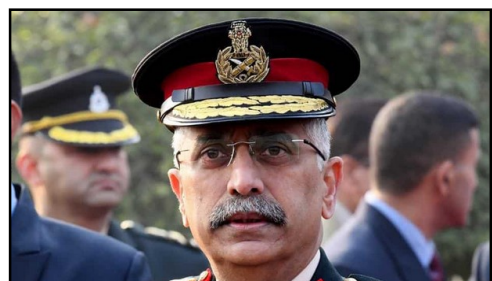
New Delhi: Indian Army Chief General MM Naravane is set to make a four-day visit to Saudi Arabia and the United Arab Emirates (UAE) from December 6. This is his third foreign trip this year with diplomatic overtones, people familiar with developments said on Thursday.

Naravane will spend two days each in both West Asian countries, home to a majority of the nine million Indian expatriates in the region, and hold meetings with the senior military and civilian leadership, the people cited above said on condition of anonymity.

The visits are being seen as part of the Indian government's outreach to West Asia, which is seen by New Delhi as part of its extended neighbourhood, and come close on the heels of external affairs minister Jaishankar's visit to Bahrain and the UAE during November 24-26. This outreach has dramatically expanded defence and security cooperation, especially counter-terrorism, in recent years.

Naravane is set to travel first to Saudi Arabia, where his engagements will include an address at the National Defence University, the people said. He will then travel to the UAE, whose defence ties with India have been expanded in recent years, the people added.

Details of the trips were being kept tightly under wraps by all the three countries though the visits were confirmed by diplomats and other officials in New Delhi and Riyadh.



File photo: Chief of Army Staff General Manoj Mukund Naravane. (R Raveendran)

Former Indian foreign secretary Kanwal Sibal described the visits as “very significant” in a tweet.

“Apart from deepening bilateral ties in sensitive area, signals loosening of [Saudi Arabia-UAE] ties with Pak. With Raheel Sharif employed by SA to head Islamic counterterrorism coalition, inviting Naravane sends piquant message,” he said, referring to the former Pakistan Army chief who currently heads the Islamic Military Counter Terrorism Coalition, an alliance of 39 Muslim countries with headquarters in Riyadh.

In October, Naravane accompanied foreign secretary Harsh Shringla on a visit to Myanmar, where they held talks with the senior leadership, including Aung San Suu Kyi and Senior Gen Min Aung Hlaing, on security and development cooperation.

Last month, Naravane travelled to Nepal for a visit that was seen as preparing the grounds for Shringla’s subsequent trip, with both engagements helping nudge bilateral ties towards normalcy after a border row over a new political map issued by Kathmandu that included Indian territories.

The visits also come at a time when Pakistan’s ties with both Saudi Arabia and the UAE are strained. Angered by Islamabad’s criticism of Riyadh’s position on the Kashmir issue, Saudi Arabia recently sought the early repayment of a \$3-billion loan provided to the Imran Khan government in 2018.

After being rebuffed by the Saudi leadership on the Kashmir issue, Prime Minister Imran Khan had made an unsuccessful attempt to forge a new grouping of Islamic countries with Turkey and Malaysia – a move that further irked Riyadh.

<https://www.hindustantimes.com/india-news/army-chief-to-visit-saudi-arabia-uae-from-sunday/story-jUeO4u0ywaDjxp2SEHNPNO.html>

live**mint**

Fri, 04 Dec 2020

US approves sale of \$90 mn worth of military equipment and services to India

By Lalit K Jha

- ***In a major sales notification to Congress, DSCA said that India continues to be an important force for political stability, peace and economic progress in the Indo-Pacific and South Asia region***

Washington: The US has approved India’s request to purchase USD 90 million worth of military hardware and services in support of its fleet of C-130J Super Hercules aircraft.

This proposed sale will support the foreign policy and national security of the United States by helping to strengthen the US-Indian strategic relationship and improve the security of a “Major Defence Partner”, said Defence Security Cooperation Agency (DSCA) of the Department of Defence.

In a major sales notification to Congress, DSCA said that India continues to be an important force for political stability, peace and economic progress in the Indo-Pacific and South Asia region.

Among the requests made by India include aircraft consumables spares and repair/return parts; Cartridge Actuated Devices/Propellant Actuated Devices (CAD/PAD) fire extinguisher cartridges; flare cartridges; Advanced Radar



Indian Air Force (IAF) C-130J Super Hercules aircraft during the 88th Air Force Day parade at Hindon Air Force Station in Ghaziabad on Thursday. (ANI Photo)

Warning Receiver shipset; 10 Lightweight Night Vision Binocular; 10 AN/AVS-9 Night Vision Goggle; GPS; Electronic Warfare; instruments and lab equipment support. The estimated total amount is USD 90 million.

The Pentagon said that the proposed sale ensures the previously procured aircraft operates effectively to serve the needs of the Indian Air Force (IAF), the Army and the Navy transport requirements, local and international humanitarian assistance, and regional disaster relief.

This sale of spares and services will enable the IAF to sustain a mission-ready status with respect to the C-130J transport. India will have no difficulty absorbing this additional sustainment support, it said.

According to the Pentagon, the proposed sale of this equipment and support will not alter the basic military balance in the region. The prime contractor will be Lockheed-Martin Company, Marietta, Georgia.

In a major move in 2016, the US had designated India a "Major Defence Partner" intending to elevate defence trade and technology sharing to a level commensurate with that of its closest allies and partners.

<https://www.livemint.com/news/india/us-approves-sale-of-90-mn-worth-of-military-equipment-and-services-to-india-11607017823895.html>

THE TIMES OF INDIA

Fri, 04 Dec 2020

India-Vietnam's growing relations: Future prospects

By SD Pradhan

India sees Vietnam as a trustworthy friendly foreign country with shared strategic concerns and common interests. Both countries are collaborating in multiple domains of defence cooperation like ship-building, surface and subsurface capacities at sea and have plans for enhancing their collaboration in the above field.

Indian Union Defence Minister Rajnath Singh on 27th November in his interaction with his Vietnamese counterpart General Ngo Xuan Lich over video-conferencing assured Vietnam of India's help in modernisation of its armed forces, with a focus on enhancing maritime capabilities, as both sides work on a new joint vision statement. Vietnam is keen on acquiring a host of military equipment, including India's Akash air defence system and the Dhruv helicopters, besides the BrahMos. India has been in talks with Vietnam, which has maritime border issues with China in the South China Sea, over Hanoi's interest in acquiring the Indo-Russian supersonic cruise missile BrahMos.

There is overwhelming convergence on international and regional issues between the two nations. This stems from the principles both countries follow. They both believe in multi-lateralism based on equality, respect for territorial integrity and sovereignty of all nations, respect for international law and order and building economic relations with other countries for mutual benefits but not based on exploitation and coercion, providing humanitarian assistance during the pandemic without any selfish motive.

The above has brought the two nations very close, which has four pillars. First is the diplomatic-political that envisages close coordination on critical bilateral, regional and international issues. Both support each other on various international and regional forums. Second is the trade and economic relations for mutual benefit, which have significantly improved over the years particularly after ASEAN- India Free Trade Agreement was signed. India realises that Vietnam is a potential regional power in the South East Asia with great political stability and substantial economic growth. Its average 7% annual economic growth is very attractive. Even during the

pandemic, its economic growth is commendable at the 3% while other nations are registering negative growth. This indeed constitutes a miracle. Even more impressive is its growth which is driven by a record trade surplus, despite the collapse in global trade. The growing middle class also assures a stable market.

The third is the defence dimension. While Vietnam is interested in modernising its armed forces, India is interested in developing defence capabilities of its South East Asian friends sufficiently to maintain peace in the strategic region and in this Vietnam occupies the most important place as it has always stood up against the Chinese coercion. The defence relations include capacity building, dealing with common security concerns, training of personnel, and cooperation in defence R&D. In addition, people to people contacts, which are fairly old, have been strengthened over time.

Fourth, China factor also weighs heavily in the respective strategic calculus of India and Vietnam. Both had fought wars with China and both have border problems with that country. Both had noted that despite the Chinese claim that what we are witnessing is the peaceful rise of China, its aggressive activities reflect a different picture. China as part of its strategic plan, has created pressure points for both India and Vietnam. It aggressively continues to encroach in the territories of the two countries. Hence, it is natural for both the countries to come closer with a view to restrain China from its aggressive actions.

While defence cooperation has been one of the most significant pillars of the Comprehensive Strategic Partnership initiated by the two countries in 2016, the relationship between the two countries were established much earlier. India had established Consul General's office in Hanoi as early as 1956. Vietnam established its diplomatic mission in 1972. India had stood by Vietnam in opposing US intervention in that country at the cost of embittering Indo-US relations. The relationship was further strengthened when India, in early 1990s, initiated its "Look East Policy" with specific objective of economic integration and political cooperation with South East Asia.

Future prospects for deepening the relations between the two countries are very bright. Both countries, are committed for maintenance of security and stability in the region and also addressing non-traditional security threats. The Indian Defence Minister has stated that India remains resolved to capability-building and modernise the armed forces of Vietnam. Joint training involving pilots of the respective air forces and training of forces for deployment on UN assignments are another area of focus. Collaboration in defence industry capability-building, training, and cooperation in UN Peacekeeping Operations were also discussed by the Defence Ministers on the 27th November. Bilateral trade between India and Vietnam has seen continuous growth over the past few years. Both sides have agreed on a new trade target of US\$ 15 bn. Five key items exported to India were mobile phones and components, machinery, computers & electronic hardware, natural rubber, chemicals and coffee. The biggest products imported from India were meat and fishery products, corn, steel pharmaceuticals, cotton and machinery. While India has not joined RCEP, this is not likely to be a barrier in the growth of trade between the two countries.

In the recent meeting, the two countries indicated that they are now looking for a joint vision statement next year, with the five-year term envisaged in the earlier one — the 'Joint Vision Statement for 2015-2020', signed May 2015 — ending in 2020. This suggests that both sides are committed to further deepen the relationship. The current dimensions of the security environment demand further strengthening of relationship. As there is overwhelming acceptability for the rule-based Indo-Pacific, which is in the interest of all countries, a greater push needs to be given to this aspect. In addition, the economic opportunities available because of anti-China sentiments and several manufacturing firms deciding to shift from China, a joint strategy needs to be evolved to take the benefit of this trend.

<https://timesofindia.indiatimes.com/blogs/ChanakyaCode/india-vietnam-relations-future-prospects/>

ISRO's Chandrayaan looks to catch-up in space race as China surges ahead with Chang'e-5 moon mission

By Younus Dar

China's Chang'e-5 probe has successfully landed on the moon, in a landmark mission to bring lunar surface samples back to earth. Netizens in India have suddenly remembered the country's ambitious Lunar mission – Chandrayaan.

With this effort, China will become the third country after the US and the former Soviet Union to bring back samples from the moon. The mission will attempt to collect 2 kg of samples, or the regolith, in a previously unvisited area known as Oceanus Procellarum, or 'Ocean of Storms'.

The country has made exceptional progress in its lunar mission, and currently has seven operational spacecraft on or around the Moon: Chang'e-3 lander, Chang'e-4 lander and Yutu-2 rover, Queqiao relay satellite, CE-5 T1 orbiter, CE5 orbiter, and CE-5 lander/ascent vehicle. No other country has an operational rover on the surface of the moon at present.

China is the only country that has successfully put a robotic spacecraft on the moon in the 21st century. Its Chang'e-4 spacecraft made history when it landed on the far side of the moon in January 2019, the only one to do so. The country also landed Chang'e-3 in December 2013 which incorporates a robotic lander and China's first lunar rover.

Chang'e-4 explorer became the first man-made spacecraft to soft-land on the far side of the moon, and the mission comprising a communication relay satellite, a lander, and a rover Yutu-2, is still operating and studying lunar geology even after two years.

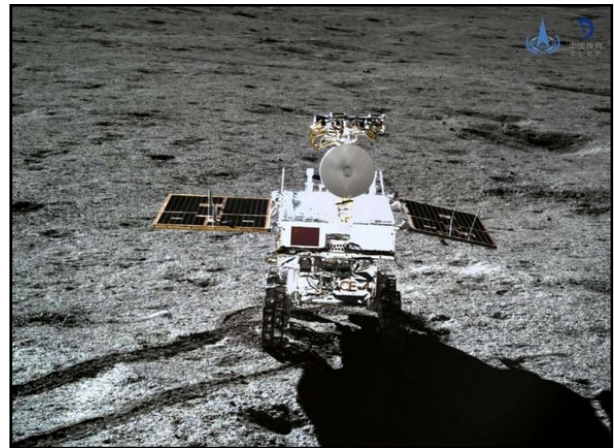
Unlike its previous lunar missions, China relayed the live broadcast of the landing on its state television, indicating the growing confidence in its space capabilities.

How Is ISRO Faring

China's neighbor, and formidable space power, India, too, is making remarkable strides in its deep-space missions. The Indian Space Research Organisation (ISRO) has mastered the technologies knowhow for space launches with decades of successes and failures, and today, the space agency helps many countries send their satellites to orbit.

The ISRO has sent multiple missions to deep space, to planet Mars and our neighboring moon, with the agency now gearing up to send a maiden mission to Venus.

India launched the Chandrayaan-2 mission in September last year, which successfully deployed a lunar orbiter that relays scientific data back to earth. But ISRO's hopes were dashed when it for the first time tried to land the remote-controlled Vikram Lander on the moon after the contact with



Yutu-2 rover image taken by the Chang'e 4 lander. (Image credit: CNSA/CLEP)

the landing craft was lost just before the touch-down. The orbiter, however, continued its journey around the moon, sending crucial science data back to ISRO's mission control room.

India's first lunar mission, Chandrayaan-1, launched in 2008, operated for almost a year before ISRO lost contact with the orbiter. According to the space agency, the mission was intended to be a technology demonstrator, which was to also return scientific information about the moon. The major goal of Chandrayaan-1 was to collect data about the moon's geology, mineralogy, and topography.

The most notable contribution of Chandrayaan-1 was its discovery of water on the surface of the moon. The data supplied by the spacecraft helped the scientists confirm the presence of water on the moon, which was officially announced by NASA around the same time in September 2009. According to ISRO, the mission carried five scientific payloads from India, with several other scientific instruments from other countries.

India's ambitious next mission to the moon, the Chandrayaan-3, will attempt to soft-land on the moon after its predecessor faced a setback with the maneuver. The mission was lined up for 2020 itself, but due to the Covid-19 pandemic, India's Chandrayaan-3 lost the race to China's Chang'e-5 probe, and will now be launched by early 2021, as confirmed by Jitendra Singh, India's minister of state for the department of space, in September 2020.

So who's ahead?

Although China started its space missions much later than the US and the erstwhile Soviet Union, the country has made immense progress in space exploration with a wide range of launch missions in the last decade. The country now stands in the club of elite space-faring nations, with multiple working robotic crafts on the surface of the moon. The Chinese astronauts have also docked with their own space station multiple times.

Apart from its multiple missions to the moon, the country this year set its eyes on the red planet, sending its first-ever 5000-kg Tianwen-1 spacecraft to Mars. Blasting off from the Wenchang Satellite Launch Center aboard a Chinese Long March-5 rocket on 23 July, the craft contains a lander, orbiter, and rover.

Experts view China's rise in the space exploration domain as the most significant change in the post-Cold War era. The country has conducted 207 launches between 2010 and 2019, which is more than one-and-a-half times the number of launches it carried out in the previous four decades, according to the Washington-based Center for Strategic and International Studies (CSIS).

The CSIS report says that more than one-fifth of China's total launches took place in 2018 and 2019 alone. The country's 38 launches in 2018 stand as the highest amount in a single year by any country in the 21st century.

While India too is making significant progress in space exploration, it lags behind the swift advancements of the Chinese space agency, which has pursued an aggressive policy. China has developed its indigenous rocket capabilities to the point where all of its space launch requirements are met domestically, where it surpasses even the US, which has to depend on other country's rockets to launch some of its satellites. Nearly all the satellites launched by China into orbit have been carried by its indigenous rockets.

At the core of the country's space capabilities is the Long March series of rockets, which includes several variants with different capabilities. These rockets are designed and developed by the state-owned defense industry giant, China Aerospace Science and Technology Corporation (CASC). Through 2019, the Long March series completed a whopping 307 successful launches and experienced 7 partial failures and 9 failures.

India Is Yet To Clear Hurdles

India is far from reaching those capabilities, although the country has been successful almost in all the missions it has pursued so far. Experts argue this has not been enough to match China's capabilities in space. India's attempt to land a rover on the moon was unsuccessful, while China had already done that multiple times.

What remains the foremost concern about the Indian space missions is the lack of scientific knowledge that the probes normally bring back from their expeditions. Although ISRO develops and launches the missions at the fraction of the cost expended on US or Russian missions, the quality of scientific output is not up to the mark.

Writing for *The Wire*, Jatan Mehta observes, “ISRO’s official list of publications say there have been only 27 peer-reviewed papers relating to Mangalyaan (India’s Mars mission) after six years in orbit. In contrast, MAVEN (NASA’s Mars mission) has helped produce many seminal scientific results about the Martian atmosphere, with a repository of at least 500 papers and growing.”

“What’s more concerning about Mangalyaan’s short publications list is that about half of those are simply engineering descriptions of the mission, not scientific results *from* the mission,” Mehta says.

Mehta highlights certain failures of the Mangalyaan mission, which hampered scientific observations of Mars, including the breakdown of methane sensors aboard the craft.

“There also seem to be no published results from the Lyman Alpha Photometer. By looking for hydrogen escaping the Martian atmosphere, it was supposed to tell us how much water Mars lost since its formation and at what rate.”

He wonders why ISRO was in such a hurry to launch in 2013 when it could have targeted the 2016 launch opportunity instead. “The reason may be political: the urge to successfully orbit Mars before China or Japan does,” he adds.

It has been a concern among the scientific community that the Indian missions don’t share much of the data retrieved from their observations. Compared to NASA missions, where every small detail is instantly published worldwide, little is known about the Indian space endeavors, especially the Mangalyaan, which has spent almost five years in the orbit of Mars.

ISRO is gearing up for its Gaganyaan launch, expected to carry astronauts into earth’s lower orbit, something the country is trying for the first time ever. Other important future missions include the Chandrayaan-3 mission to the moon and the Shukrayaan mission to Venus. ISRO is working day-and-night to aim for higher echelons in the global space quest, however, it cannot match up to the aggressive Chinese space march, which is backed by a humongous budget from the Chinese government and the combined technological effort from the country’s commercial space companies and the publicly-owned organizations.

China has set an ambitious agenda for itself and aspires to become the world’s leading space power by 2045. Towards that direction, the country is giving a major thrust to mastering independent innovation in the space industry. The country has invested heavily in research and development (R&D) in the sector.

The official government figures put China’s rising R&D spending for “spacecraft manufacturing” at \$386.6 million in 2016, from \$22.6 million in 2000, which is a staggering figure. On the other hand, innovation in Indian space industries has weakened due to economic problems the country is facing.

There has been little effort to streamline smaller players in the sector into the national effort to build space capabilities. The Indian dedication isn’t matching the Chinese quest to conquer the boundaries of outer space.

<https://eurasianimes.com/isros-chandrayaan-looks-to-catch-up-in-space-race-as-china-surges-ahead-with-change-5-moon-mission/>

Supercharge your microscope: Researchers share guide for ultra-precise 3-D imaging

UNSW Sydney researchers have shared step-by-step instructions to empower other scientists to enhance the resolution and stability of single-molecule microscopes.

Researchers will be able to build ultra-precise microscopes to visualize and explore the interactions between individual molecules within cells, thanks to a system made available to the scientific community by UNSW medical researchers.

Their system simply and practically overcomes the challenges associated with movement during imaging, exceeding current limits of super-resolution microscopes.

When the sample or the microscope set-up moves during imaging, errors are introduced that degrade molecular resolution—this is called drift.

"Drift is a major barrier to achieving resolution beyond the 20–30 nm set by Nobel-prize winning super-resolution fluorescence microscopy," says Scientia Professor Katharina Gaus from UNSW Medicine's Single Molecule Science.

"The longer it takes to image a sample, the more drift there will be. The biggest cause in drift is vibrations from people walking by, or cars driving outside the building," she says.

Prof. Gaus explains that for single-molecule imaging, researchers typically label molecules with fluorescent dyes and get them to blink on and off using lasers.

"We can't image them all at the same time. So, when the sample drifts on the microscope then the position of the glowing molecules at the beginning of the experiment will be different from the position at the end of the experiment, introducing an artifact," she says.

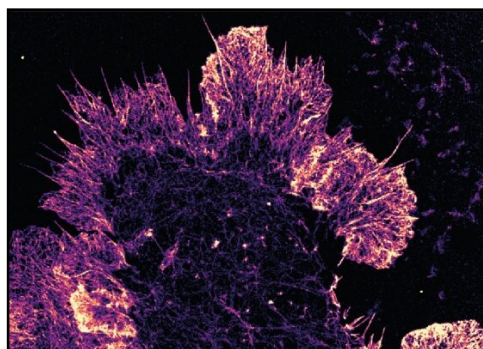
The active stabilization system the team of biophysicists at UNSW developed tackles this issue by adding sensors to the microscope with a feedback system to re-align the optical path when it detects the slightest change. The stabilization system automatically returns the optical path to within one nanometre of its original position in all three dimensions continuously while the samples are being imaged.

After outlining the design of their autonomous feedback system in a *Science Advances* publication earlier this year, the team now describe in *Nature Protocols* how to implement a stabilization system to actively correct the alignment of super-resolution microscopes and eliminate drift.

"It is a how-to guide for using our feedback system on different setups. We implemented it on a range of systems, including on commercially available microscopes," says Dr. Simao Pereira Coelho, who led this project.

The protocol is designed to enable even users without specialist optical training to upgrade existing microscopes, including a guide for using the software and integrating the hardware onto a custom built or standard microscope.

"We can now image for as long as we want, to get more information out of one sample—without compromising the quality of the data. Not only does this make experiments more precise, but it opens up this new idea that you can run this completely autonomously," says Prof. Gaus.



The researchers describe how to implement a stabilisation system to actively correct the alignment of super-resolution microscopes. Credit: Simao Pereira Coelho and Jongho Baek

"The same approach can also be used in other instruments that require high precision, for example in atomic force microscopy or DNA sequencers, or where servicing and realigning an instrument manually is not so straightforward," she says.

More information: Simao Coelho et al. 3-D active stabilization for single-molecule imaging, *Nature Protocols* (2020). DOI: [10.1038/s41596-020-00426-9](https://doi.org/10.1038/s41596-020-00426-9)

Simao Coelho et al. Ultraprecise single-molecule localization microscopy enables in situ distance measurements in intact cells, *Science Advances* (2020). DOI: [10.1126/sciadv.aay8271](https://doi.org/10.1126/sciadv.aay8271)

Journal information: [Nature Protocols](#) , [Science Advances](#)
<https://phys.org/news/2020-12-supercharge-microscope-ultra-precise-d-imaging.html>



Fri, 04 Dec 2020

Researchers measure electron emission to improve understanding of laser-based metal 3-D printing

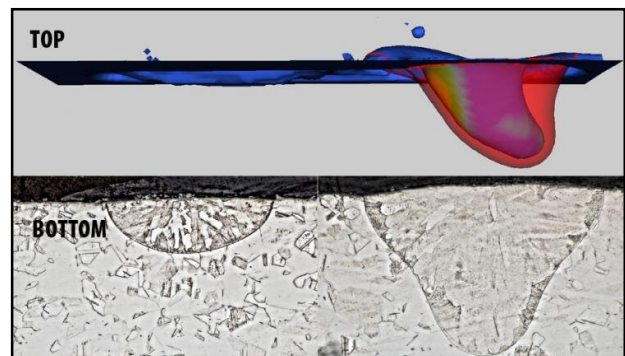
By Jeremy Thomas

Lawrence Livermore National Laboratory (LLNL) researchers have taken a promising step in improving the reliability of laser-based metal 3-D printing techniques by measuring the emission of electrons from the surface of stainless steel during laser processing.

Researchers collected thermionic emission signals from 316L stainless steel under laser powder bed fusion (LPBF) conditions using a custom, testbed system and a current preamplifier that measured the flow of electrons between the metal surface and the chamber. Then they used the generated thermionic emission to identify dynamics caused by laser-metal interactions. The journal *Communications Materials* published the work online on Nov. 27.

The team said the results illustrate the potential for thermionic emission sensing to detect laser-driven phenomena that can cause defects in parts, optimize build parameters and improve knowledge of the LPBF process while complementing existing diagnostic capabilities. Researchers said the ability to capture thermal emission of electrons will help advance basic understanding of the laser-material interaction dynamics involved in the LPBF process and support the broader technology maturation community in building confidence in parts created using the technique.

"Producing defect-free parts is a major hurdle for widespread commercial adoption of metal additive manufacturing (AM)," said principal investigator Aiden Martin. "LLNL researchers have been addressing this problem by developing processes and diagnostic tools for improving the reliability of metal AM. This new methodology complements these existing diagnostic tools to increase our understanding of the 3-D printing process. Our next steps are to expand this technology into a sensor operating on a full-scale LPBF system to increase confidence in the quality of built parts."



Researchers measured the emission of electrons from the surface of stainless steel under laser powder bed fusion (LPBF) conditions, demonstrating the potential for using thermionic emission signals to detect phenomena that can produce defects in parts and improve understanding of the LPBF process. The top image shows a multi-physics simulation of laser-induced melting of stainless steel, showing the electron emission signal primarily produced at the front of the surface depression. The bottom image depicts cross-sections of laser tracks produced in stainless steel. Monitoring of the thermionic emission can detect transition between conduction (left) and keyhole (right) mode welding regimes. Credit: Aiden Martin/LLNL

Researchers said while significant research has been done to understand and measure how parts are printed with LPBF through optical imaging, X-ray radiographs or measuring thermal or acoustic signal emissions, thermionic emission has been overlooked. But by observing and analyzing the electrons emitted during laser processing, Lab researchers demonstrated they could tie increases in thermionic emission to surface temperature and laser scanning conditions that cause pore formation and part defects.

Through experimental data and simulation, researchers reported the thermionic emission signal increased exponentially, and melt pool depth increased linearly, with local energy density, demonstrating the "critical dependence" of the metal's surface temperature on thermionic emissions and the utility of using thermionic signals as a way to optimize laser focus in LPBF.

"Electron emission in metal additive manufacturing has generally been overlooked by the community, and we were excited to observe its extreme sensitivity to process conditions," said first author and LLNL engineer Phil DePond.

The team's observations revealed that plasma formation during the LPBF process, which they previously ascribed to the ionization of vaporized metal by the laser beam, also could be caused by electrons ejecting from the metal surface into the argon gas atmosphere and interacting with the laser.

Researchers said the high sensitivity of thermionic emission to surface temperature and surface morphology allows them to determine the exact transition point between conduction and keyhole formation, which results in pore formation in parts. They concluded the results show thermionic signals can be used effectively with traditional LPBF data collection and processing methods, improve scientific knowledge of laser-material interactions and identify where defects might arise.

More broadly, the work "represents an important step toward establishing effective in situ monitoring capabilities that can accelerate qualification and certification of LPBF components," said co-author and Laser Material Interaction Science Group Leader Manyalibo "Ibo" Matthews.

More information: Philip J. DePond et al. Laser-metal interaction dynamics during additive manufacturing resolved by detection of thermally-induced electron emission, *Communications Materials* (2020). DOI: [10.1038/s43246-020-00094-y](https://doi.org/10.1038/s43246-020-00094-y)
<https://phys.org/news/2020-12-electron-emission-laser-based-metal-d.html>



Fri, 04 Dec 2020

Searching for sub-eV sterile neutrinos using two highly sensitive detectors

By Ingrid Fadelli

The standard model of particle physics only accounts for 20% of matter in the universe. Physicists have theorized that the remaining 80% is made up by so-called dark matter, which consists of particles that do not emit, absorb or reflect light and thus cannot be directly observed using any existing instruments.

The existence of dark matter is indirectly inferred by astronomical observations of its gravitational effects. So far, researchers have been unable to observe this mysterious type of matter directly, but they have introduced a number of theoretical models delineating possible 'traces' that dark matter could leave when interacting with known standard model particles through unknown forces, also referred to as dark forces.

According to some of these theoretical models, dark matter could be indirectly observed by detecting the effects of its extremely rare interactions with normal matter. Recent astronomical data gathered by the Planck telescope, launched into space over a decade ago and operated by the

European Space Agency (ESA), hinted at the existence of an inactive (i.e., sterile) type of neutrino with a mass in the sub-eV-scale, which could be promising dark matter candidates.

The RENO (Reactor Experiment for Neutrino Oscillation) Collaboration, a group of researchers at different institutes in South Korea, recently conducted a search for light, sub-eV sterile neutrino oscillations, which was based on data gathered by two identical detectors located in South Korea over the course of 2200 days. While they were unable to detect these oscillations, their findings, published in *Physical Review Letters*, could inform future searches for sterile neutrinos.

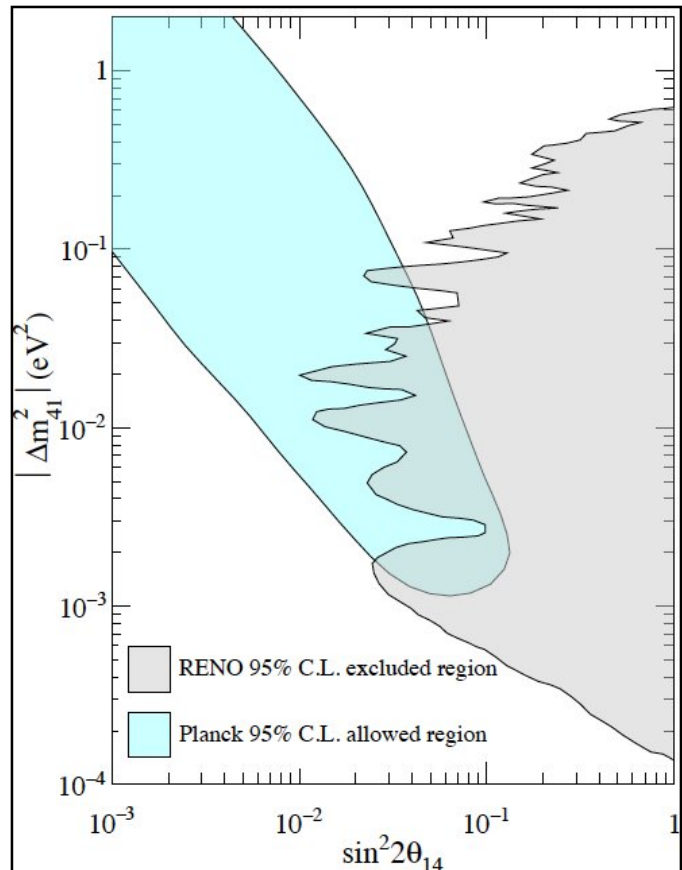
"Sterile neutrinos, if they exist, may be mixed with active neutrinos and thus leave observable effects in the data gathered in reactor neutrino experiments," Soo-Bong Kim, one of the researchers who carried out the study, told Phys.org. "The experiments of RENO in Korea and Daya Bay in China, which use multiple and identical detectors at the different locations, have sensitivities high enough to test the Planck results."

So far, experimental efforts aimed at detecting hints of sub-eV scale sterile neutrino interactions were unable to pick up signals of these elusive particles. Previous findings thus appear partially to rule out the validity of the recent hypothesis based on data collected by the Planck telescope. To fully confirm or disconfirm this hypothesis, physicists will first need to conduct searches that cover the remaining parameter space, collecting very precise measurements.

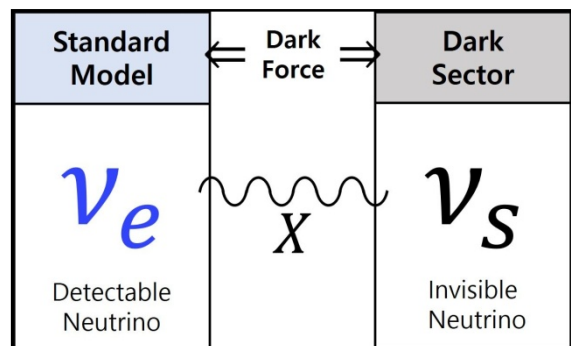
In their study, Kim and his colleagues analyzed a vast amount of data gathered by two identical detectors placed at ~300m and ~1400m from six reactors that are situated at the Hanbit Nuclear Power Plant, in Korea. This data was accumulated over the course of eight years, as part of the RENO experiment. The main objective of the RENO experiment is to measure or set a limit on the so-called neutrino mixing matrix parameter θ^{13} , which is responsible for the oscillations that would arise from mixing among different neutrino flavors.

"The large data sample allows us to reduce the uncertainties related to the statistical fluctuations and our two identical detector setup is useful for substantially reducing uncertainties associated with the measurement systems and methods," Kim explained. "They substantially improved the accuracy of the neutrino energy-spectrum measurement. The mixing with unobservable sterile neutrino results in disappearance of active neutrinos in the data, so we tried to probe the sterile neutrino effects by comparing the spectral shapes from the two detectors."

Overall, the recent work by Kim and his colleagues confirms the possibility of conducting dark matter searches using man-made instruments that can measure oscillations with high levels of precision. So far, the researchers were unable to detect any significant features that could result



Credit: RENO Collaboration.



Credit: RENO Collaboration.

from sterile neutrino interactions. Therefore, their findings suggest that if these particles did exist, their interactions with other particles would be extremely weak.

"The results gathered by us and by the Daya Bay Reactor Neutrino Experiment provide a road map for future precision measurements aimed at detecting sterile neutrino interactions," Kim said. "We now plan to continue the sterile neutrino search in sub-eV scale. In addition, we recently reported the results of an eV-scale sterile neutrino search that showed an interesting indication of mixing with sterile neutrino in the observed neutrino spectra. We plan to continue these efforts using the RENO reactor neutrino complex."

More information: Search for Sub-eV sterile neutrino at RENO. *Physical Review Letters*(2020). DOI: [10.1103/PhysRevLett.125.191801](https://doi.org/10.1103/PhysRevLett.125.191801).

Search for sterile neutrino oscillation using RENO and NEOS data. arXiv: 2011.00896 [hep-ex]. arxiv.org/abs/2011.00896

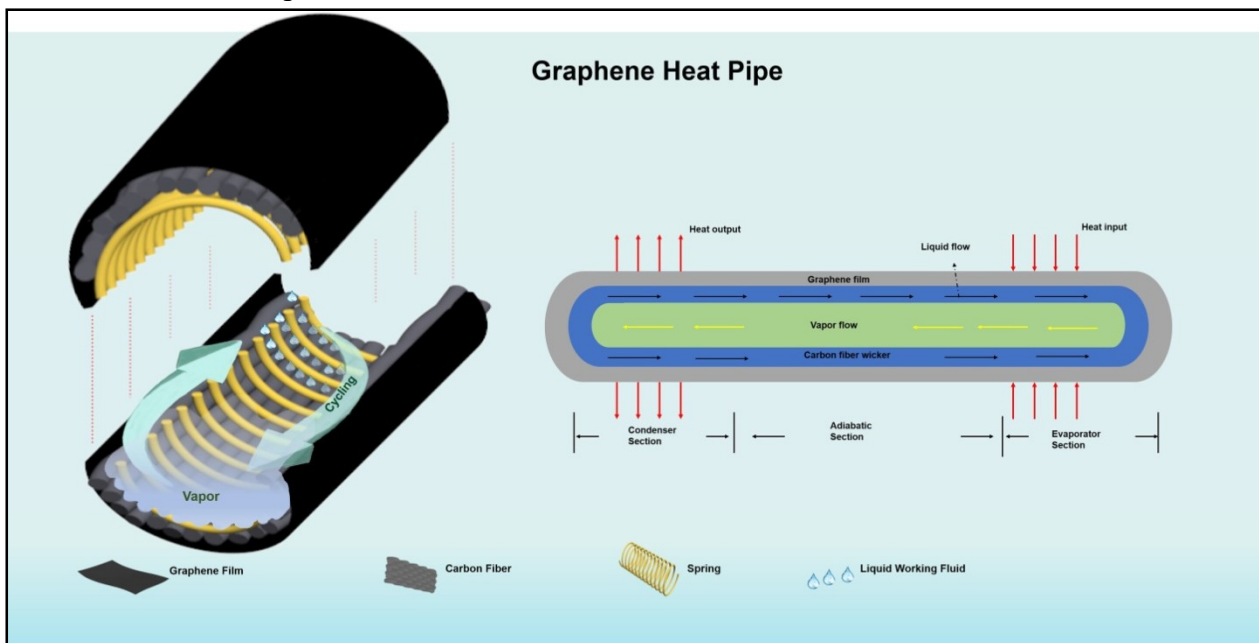
Journal information: *Physical Review Letters*
<https://phys.org/news/2020-12-sub-ev-sterile-neutrinos-highly-sensitive.html>



Fri, 04 Dec 2020

Cooling electronics efficiently with graphene-enhanced heat pipes

Researchers at Chalmers University of Technology, Sweden, have found that graphene-based heat pipes can help solve the problems of cooling electronics and power systems used in avionics, data centers and other power electronics.



Graphene enhanced heat pipes can efficiently cool power electronics. Credit: Ya Liu/Johan Liu/Chalmers University of Technology

"Heat pipes are one of the most efficient tools for this purpose, because of their high efficiency and unique ability to transfer heat over a large distance," says Johan Liu, Professor of Electronics Production, at the Department of Microtechnology and Nanoscience at Chalmers.

The results, which also involved researchers in China and Italy, were recently published in the open access journal *Nano Select*.

Electronics and data centers need to be efficiently cooled in order to work properly. Graphene enhanced heat pipes can solve these issues. Currently, heat pipes are usually made of copper, aluminum or their alloys. Due to the relatively high density and limited heat transmission capacity of these materials, heat pipes are facing severe challenges in future power devices and data centers.

Large data centers that deliver, for example, digital banking services and video streaming websites, are extremely energy-intensive, and an environmental culprit with greater emissions than the aviation industry. Reducing the climate footprint of this industry is therefore vital. The researchers' discoveries here could make a significant energy efficiency contribution to these data centers, and in other applications too.

The graphene enhanced heat pipe exhibits a specific thermal transfer coefficient which is about 3.5 times better than that of copper-based heat pipe. The new findings pave the way for using graphene enhanced heat pipes in lightweight and large capacity cooling applications, as required in many applications such as avionics, automotive electronics, laptop computers, handsets, data centers as well as space electronics.

The graphene enhanced heat pipes are made of high thermal conductivity graphene assembled films assisted with carbon fibre wicker enhanced inner surfaces. The researchers tested pipes of 6mm outer diameter and 150mm length. They show great advantages and potential for cooling of a variety of electronics and power systems, especially where low weight and high corrosion resistance are required.

"The condenser section, the cold part of the graphene enhanced heat pipe, can be substituted by a heat sink or a fan to make the cooling even more efficient when applied in a real case," explains Ya Liu, Ph.D. Student at the Electronics Materials and Systems Laboratory at Chalmers.

More information: Ya Liu et al, A lightweight and high thermal performance graphene heat pipe, *Nano Select* (2020). DOI: [10.1002/nano.202000195](https://doi.org/10.1002/nano.202000195)
<https://phys.org/news/2020-12-cooling-electronics-efficiently-graphene-enhanced-pipes.html>



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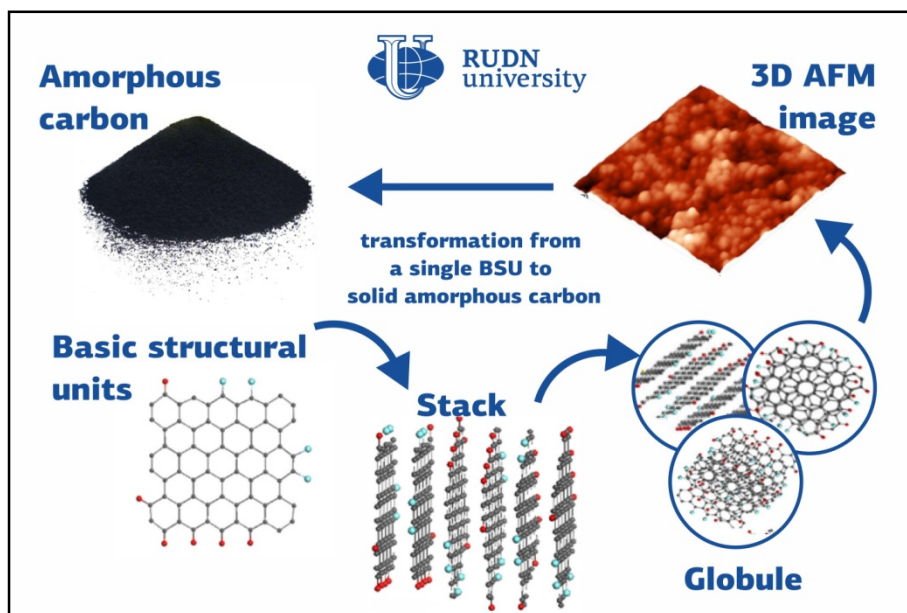
Physicists describe a new type of amorphous solid bodies

Many substances with different chemical and physical properties, from diamonds to graphite, are made up of carbon atoms. Amorphous forms of solid carbon do not have a fixed crystal structure and consist of structural units—nanosized graphene particles. A team of physicists from RUDN University studied the structure of amorphous carbon and suggested classifying it as a separate type of amorphous solid bodies: a molecular amorphous with enforced fragmentation. The results of the study were published in the *Fullerenes, Nanotubes and Carbon Nanostructures* journal.

Solid carbon has many allotropic modifications. It means that substances with different chemical and physical properties can be built from one and the same atoms arranged in different structures. The variety of carbon allotropes is due to the special properties of its atoms, namely their unique ability to form single, double, and triple valence bonds. If, due to certain reaction conditions, only single bonds are formed (i.e. the so-called sp^3 -hybridization takes place), solid carbon has the shape of a three-dimensional grid of tetrahedrons, i.e. a diamond. If the conditions are favorable for the formation of double bonds (sp^2 -hybridization), solid carbon has the form of graphite—a structure of flat layers made of comb-like hexagonal cells. Individual layers of this solid body are called graphene. These two types of solid carbon structures are observed both in ordered crystals and non-ordered amorphous bodies. Solid carbon is widely spread in nature both

as crystalline rock (graphite or diamond) deposits and in the amorphous form (brown and black coal, shungite, anthraxolite, and other minerals).

Unlike its crystalline form, natural amorphous carbon belongs to the sp^2 type. A major study of the structure and elemental composition of sp^2 amorphous carbon was conducted at the initiative and with the participation of a team of physicists from RUDN University. In the course of the study, the team also took spectral measurements using photoelectronic



spectroscopy, inelastic neutron scattering, infrared absorption, and Raman scattering. Based on the results of the study, the team concluded that sp^2 amorphous carbon is a fractal structure based on nanosized graphene domains that are surrounded by atoms of other elements (hydrogen, oxygen, nitrogen, sulfur, and so on). With this hypothesis, the team virtually re-wrote the history of amorphous carbon that has been known to humanity since the first-ever man-made fire.

Many substances with different chemical and physical properties, from diamonds to graphite, are made up of carbon atoms. Amorphous forms of solid carbon do not have a fixed crystal structure and consist of structural units—nanosized graphene particles. A team of physicists from RUDN University studied the structure of amorphous carbon and suggested classifying it as a separate type of amorphous solid bodies: a molecular amorphous with enforced fragmentation. Credit: RUDN University

"The discovery and experimental confirmation of the graphene nature of the 'black gold' will completely change the theory, modeling, and interpretation of experiments with this class of substances. However, some questions remain unanswered. What does solid-state physics make of this amorphous state of solid carbon? What role does amorphous carbon with sp^2 -hybridization play in the bigger picture? We tried to find our own answers," said Elena Sheka, a Ph.D. in Physics and Mathematics, and a Consulting Professor at the Faculty of Physics and Mathematics and Natural Sciences, RUDN University.

The team spent two years thoroughly studying the nature of amorphous carbon. Other results of this ambitious project were published in *Fullerenes, Nanotubes and Carbon Nanostructures*, *Journal of Physical Chemistry C*, and *Journal of Non-Crystalline Solids, Nanomaterials*. Together, these works confirm a breakthrough achieved by the physicists of RUDN University in this complex field of physics.

"We have analyzed many studies on amorphous sp^2 carbon from the point of view of our general understanding of amorphous solid bodies. Based on our research, we can confirm that it belongs to a new type of amorphous substances," added Elena Sheka from RUDN University.

More information: E. F. Sheka et al, Amorphous state of sp^2 solid carbon, *Fullerenes, Nanotubes and Carbon Nanostructures* (2020). DOI: [10.1080/1536383X.2020.1815713](https://doi.org/10.1080/1536383X.2020.1815713)

Journal information: *Journal of Physical Chemistry C*
<https://phys.org/news/2020-12-physicists-amorphous-solid-bodies.html>

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As world edges closer to vaccines, recent research hints at new Covid-19 symptom

By Kunal Kambali

The world appears to be on the cusp of beginning an all-out attack on COVID-19, with England, Russia, and the US set to begin their vaccination drives in just a matter of weeks. But even as the vaccines begin to rollout, research on novel coronavirus has continued, and now, we may well have found a new symptom of COVID-19 at these late stages.

A recent study has come across a new nose-related symptom of COVID-19—deemed a “strange sensation in the nose”—which could potentially facilitate early diagnosis of the disease, along with the initial social distancing efforts.

Researchers at the University of Barcelona reviewed 35 cases of COVID-19, wherein these patients were surveyed about the nasal symptoms they experienced while being infected with the virus. While these patients were categorised into the clinical group, the researchers also used a control group to compare the results.



Rapid testing kit (Pravin Barnale/BCCL Indore)

Subsequently, more than 68% of the patients reported at least one “nasal” symptom. These patients also experienced “a strange sensation in the nose” and excessive nasal dryness significantly more often than the control group. Furthermore, about 52% of the patients from the clinical group experienced constant nasal irritation, as opposed to just 3% from the control group.

The study also found that these nasal symptoms predominantly co-occurred with the reduced ability to detect smells and the loss of taste functions—two already prevalent COVID-19 symptoms—while also appearing principally before or during the other symptoms of the viral disease. These nasal signs also lasted for about twelve days on an average.

Health agencies like CDC or WHO are yet to confirm the new symptoms. Fever, dry cough, and tiredness remain the most common symptoms of COVID-19, but the infected individuals may also experience aches and pains, sore throat, diarrhoea, conjunctivitis, headache, a rash on the skin, or discolouration of fingers or toes, along with the aforementioned loss of taste or smell. Symptoms like difficulty breathing or shortness of breath, chest pain or pressure, and loss of speech or movement can also be seen in severe cases.

Meanwhile, the Centers for Disease Control and Prevention (CDC) has also revised its COVID-19 quarantine guidelines. Now, instead of the standard 14-day quarantine, it has been recommending, the CDC has said that individuals that do not develop any symptoms need only quarantine for 10 days. And if they test negative, that period can be further reduced to just one week.

The study is yet to be published in a peer-reviewed journal and the pre-print can be accessed [here](#).

<https://weather.com/en-IN/india/coronavirus/news/2020-12-03-recent-research-finds-new-covid-19-symptom-as-vaccines-approach>

