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

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Press Information Bureau
Government of India

Ministry of Defence

Mon, 15 March 2021 5:01PM

Equipment manufactured under 'Make-In-India' programme

'Make in India' initiative in defence sector is implemented through various policy initiatives which promotes indigenous design, development and manufacture of defence items. These initiatives, inter-alia, include priority to procurement of capital items from domestic sources under Defence Acquisition Procedure (DAP) 2020; notification of 'Negative list' of 101 items for which there would be an embargo on the import beyond the timeline indicated against them; simplification of Industrial licensing process; liberalization of FDI policy; simplification of Make Procedure; launch of Innovations for Defence Excellence (iDEX) scheme; and implementation of 'Public Procurement (Preference to Make in India), Order 2017.

During the last two financial years i.e. from 2018-19 to 2019-2020 and the current financial year 2020-21(till December 2020), the Government has accorded Acceptance of Necessity (AoN) to 112 Defence proposals, worth Rs. 1,99,860 Crore approximately, under the various categories of Capital Acquisition, which promotes domestic manufacturing as per the Defence Acquisition/Procurement Procedure.

Many significant projects including 155mm Artillery Gun system 'Dhanush', Bridge Laying Tank, Thermal Imaging Sight Mark-II for T-72 tank, Light Combat Aircraft 'Tejas', 'Akash' Surface to Air Missile system, Submarine 'INS Kalvari', 'INS Chennai', Anti-Submarine Warfare Corvette (ASWC), Arjun Armoured Repair and Recovery Vehicle, Landing craft utility, etc. have been produced in the country under 'Make in India' initiative of the Government in last few years.

Based on the export Authorisations/ Licenses issued by Department of Defence Production and actual exports done by Ordnance Factory Board (OFB) & Defence Public Sector Undertakings (DPSUs) and private industries, some of major items exported in the past few years, are Fast Patrol Vessels, Coastal Surveillance System (CSS), Light Weight Torpedoes, Light Weight Torpedo Launcher and Parts, Do-228 Aircraft, Wheeled Infantry Carrier, Light Specialist Vehicle, Mine Protected Vehicle, Passive Night Sights, Battle Field Surveillance Radar Extended Range, Integrated Anti-Submarine Warfare, Advanced Weapons Simulator, Personal Protective items, 155mm Artillery Gun Ammunition, Small Arms and Ammunitions, Weapon locating Radars, Identification of Friend or Foe (IFF) –Interrogator etc. Considering the strategic sensitivity of the matter and in the interest of national security, the country-wise details of exports cannot be divulged.

The contracts for various capital acquisition requirements of the Government in the Defence Sector are awarded to domestic, public & private sector companies including those situated in State of Uttar Pradesh, as per the extant provisions prescribed in Defence Acquisition Procedure. In addition, the OFB & DPSUs place orders on Indian vendors including those situated in Uttar Pradesh for supply of various items, components etc. as per their requirements. Moreover, the

Government has established a Defence Industrial Corridor in the State of Uttar Pradesh with 6 nodes at Aligarh, Agra, Chitrakoot, Jhansi, Lucknow and Kanpur to develop defence manufacturing ecosystem and promote indigenous manufacturing.

This information was tabled in a written reply by Raksha Rajya Mantri Shri Shripad Naik to a question asked by Shri Rajmani Patel in Rajya Sabha today.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1704883>



Press Information Bureau
Government of India

Ministry of Defence

Mon, 15 March 2021 4:59PM

Steps taken to enhance capacity of security Forces

The Government has taken several policy initiatives and reforms to promote indigenous design, development and manufacture of defence equipment in the country and enable development or transfer of technologies in the country.

The salient steps undertaken to achieve self sufficiency in defence sector are as under:-

- Defence Procurement Procedure (DPP)-2016 has been revised as Defence Acquisition Procedure (DAP) -2020, which is driven by the tenets of Defence Reforms announced as part of 'Atmanirbhar Bharat Abhiyan'.
- Opened North & South Defence Industrial corridors to promote setting up of industries supporting defence equipment.
- Permitted acceptance of "Suo Moto" proposals from industry for undertaking indigenous design & development for items needed for defence services.
- Formulated the iDEX (Innovation in Defence Excellence) framework to provide an ecosystem for Startups/individual innovators/MSMEs to engage with Ministry of Defence/Academia and other such agencies for manufacture of defence related items.
- Institutionalised the Technology Development Fund and its processes to facilitate the DRDO to engage with Indian industry for technology development needs.
- **Army Design Bureau (ADB):** Indian Army (IA) launched the ADB on 31st August, 2016. The role of the ADB is to act as a facilitator for research & development efforts and procurement of indigenously developed weapons and equipment extensive outreach programme for industry, MSMEs, Startups and Academia across the country for promoting 'Make in India'. The outreach programmes, apart from generating awareness about the modernization requirements, will help to meet the technology needs of the IA from within the confines of domestic resources and talent
- **Army Technology Board (ATB):** The ATB enables indigenous Research and Development efforts in accordance with the operational needs of the IA.
- **Technology Development Fund (TDF):** TDF has been launched by the Government to giving impetus to research and development projects beyond the proof of concept stage. It has been provided with a budget of Rs. 100 crores.
- The Indian Navy in coordination with Aeronautical Development Agency (ADA) is pursuing the indigenous development and acquisition of a Twin Engine Deck Base Fighter (TEDBF).
- Ministry of Defence has notified a 'First Positive Indigenisation List' of 101 items for which there would be an embargo on the import beyond the timeline indicated against them. This is a big step towards self-reliance in defence. This would offer a great opportunity to the Indian

defence industry to manufacture these items using their own design and development capabilities to meet the requirements of the Armed Forces in the coming years.

Modernisation, upgradation and sustenance of military equipment and weapons is a continuous process and constant endeavour to equip the Armed Forces with modern weapon systems/equipment being carried out under various procurement provisions (DAP & DPM). Also in emergencies as in the prevailing situation, special procurement powers to enhance the operational capability are given to Service Headquarters.

DRDO has played a major role in the development of state-of-the-art platforms, weapon systems and sensors and upgradation of defence equipment in the country which in turn has enhanced capacity of the Armed Forces to tackle the present security scenario of the country efficiently.

This information was tabled in a written reply by Raksha Rajya Mantri Shri Shripad Naik to a question asked by Shri Vijay Pal Singh Tomar and Shri Harnath Singh Yadav in Rajya Sabha today.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1704881>

Outlook

Tue, 16 March 2021

Road transport min inks pact with DRDO

New Delhi: The road transport and highways ministry has inked a pact with DRDO to utilise its expertise in providing sustainable measures to mitigate landslide and avalanche hazards on the national highways.

In a written reply to Rajya Sabha on Monday, Union minister Nitin Gadkari said a Memorandum of Understanding (MoU) was signed between Ministry of RTH (Road Transport and Highways) and DRDO on January 20.

The pact is intended at utilising the expertise of DRDO in providing sustainable landslide, avalanches and other geo-hazard mitigation measures on the national highways, the minister of Road Transport, Highways and MSMEs said.

According to him, Defence Geo-informatics Research Establishment (DGRE) -- a premier laboratory of DRDO (Defence Research and Development Organisation) -- is known for its expertise in the area of landslide and snow avalanche mitigation techniques, terrain modelling and trafficability using geo spatial intelligence.

The role and charter of the DGRE is mapping, forecasting, monitoring, control and mitigation of avalanches in Indian Himalayas and landslides mapping/ monitoring in all types of terrain, he added.

Further, the minister said the pact intends to outline the general framework of collaboration between MoRTH and DGRE, including detailed investigation of the existing critical avalanches/ geo hazards such as landslides, slope instability, sinking problems etc. It will also outline planning, designing and formulation of sustainable mitigation measures for geo-hazards for the national highways, including tunnels.

The cooperation will be monitored through joint periodic half-yearly review and each party will provide funding to their own personnel, Gadkari said.

The initiative is expected to evolve a long-term strategy for sustainable geo-hazard mitigation measures on the national highways, which will result in safer transportation for commuters, he noted.

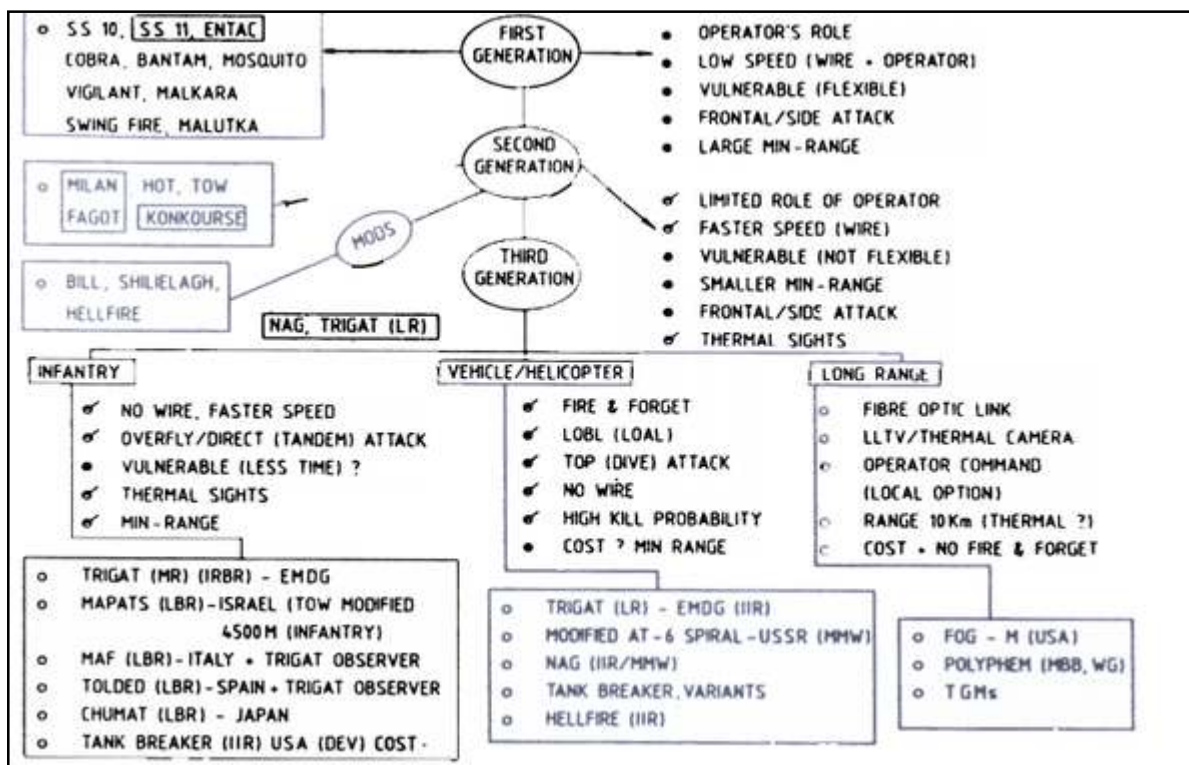
(Disclaimer: This story has not been edited by Outlook staff and is auto-generated from news agency feeds. Source: PTI)

<https://www.outlookindia.com/newscroll/road-transport-min-inks-pact-with-drdo/2047156>

India's new anti tank missile "SANT" surpass American "Hellfire" missile

We all know that DRDO currently was in the mood of celebrating Diwali by bursting firecrackers. Among those firecrackers, one cracker of a missile that DRDO tested recently was the SANT (Stand-off Anti-tank) missile, also called HELINA.

SANT or Standoff Anti-tank Guided Missile is a fourth generation upgraded variant of HELINA missile developed for long distance airborne anti-armour role. In November 2018, DRDO developed SANT was successfully tested at Pokhran range. The upgraded version of the missile is equipped with a new nose-mounted active radar homing seeker with an extended range of up to 7 km to 8 km.



Generation of Anti tank Missile

On 19 October 2020, SANT was again test fired by the DRDO at Chandipur test range. It is developed for the Indian Air Force and Army Aviation Corps with Lock-on after launch and Lock-on before launch capabilities

Diving deep into the technical details of this missile, SANT is an improved version of the HELINA missile which stands for Helicopter launched NAG missile which is an air-launched version of the NAG anti-tank missile. Just like the HELINA, this missile also has 'fire-and forget' capabilities along with 'lock-on before launch' and 'lock-on after launch' capabilities as well.

Lock-on before launch feature

- In this, the operators of the missile identify the enemy tanks first with the help of thermal imaging and then the image is captured and uploaded on the Nag's seeker system.
- Thereafter, the missile is launched towards the target which continues capturing target images and cross-checks them continuously with the reference image.

- The missile operators can deviate the missile from its original path as and when required.

Lock-on after launch feature

- This feature allows the missile operators to lock-on the target after launching the missile in a general direction.
- In this, the missile scans the area before acquiring the target, lock-on itself and changes its path accordingly.
- This helps the helicopters from which they are launched to effectively shoot and scoot.

This missile has a range of 15 – 20 kilometres whereas the original HELINA was have a range of 7-8 kilometres, while the range of Amrican Hellfire missile is 8km only. SO this missile can be considered as a considerable upgrade over the original HELINA missile. This missile carries as wideband millimetre wave radar (seeker) in its nose cone which provides exceptional accuracy for this missile in neutralizing its target in stand-off ranges. This missile is touted to have a speed of 830 mph.

Details about the existence of this missile started to flow into the public domain for the first time in 2018 when this missile was tested aboard an IAF's Mi-35 helicopter. The recent test conducted is the final development trial and from this stage the missile will move on to user trails. As IAF's help was used for this trail, it is believed that this trial was conducted from Mi-35.

Parallels can be drawn between SANT and US's Hellfire missile which also has millimetre wave radar. SANT is better in terms of range when compared to Hellfire missile. There are a lot of variants in the Hellfire missile and this missile is way better than Hellfire in many ways. This can also have a price advantage over Hellfire missiles as these can be produced cheaply.

Key Specification

The SANT Missile is equipped with the MM wave seeker that allows the missile to have a larger stand off range. This stand off range allows the launch platform to launch the offensive without getting into the range of the target platform.

IIR guidance system offers the advantage of high resolution. However, in bad weather, the attenuation of the IR radiation even at 8-12 micron increases, thereby deteriorating the range performance considerably. On the other hand, an MMW-based guidance system has relatively less attenuation, thereby enabling all-weather capability.

The use of such high frequencies at MMW is essential to accommodate active seeker. especially the antenna within the permissible diameter /dimensions of the ATGM. For the antitank role, the use of a W-band seeker is considered essential to achieve the required beam width with the limited size of the antenna.

According to many defence experts associated with the missile, SANT is one of the best airborne anti-armour guided missiles in the world.

Use cases

As this is an air-launched anti-tank missile, this can provide close air support to our ground forces on the battlefield. This can be mounted on different platforms such as Rudra, Rustom, LCH, ALH and Mi-35. This can also be mounted on the upcoming Ghatak stealth UCAV and Rustom-2 male UCAV which can increase the armament capability of the UCAV. If this missile can be integrated with Apache helicopters, this can make the Apaches even more deadly.

<https://defenceview.in/indias-new-anti-tank-missile-sant-surpass-american-hellfire-missile/>

Hypersonic and directed-energy weapons: Who has them, and who's winning the race in the Asia-Pacific?

By Mike Yeo, Nigel Pittaway, Usman Ansari, Vivek Raghuvanshi and Chris Martin

Melbourne, Australia, Islamabad, New Delhi, and Washington — A number of countries in the Asia-Pacific region are caught up in the global hypersonic and directed-energy weapons race, with these regional powers having either developed or publicly stated intentions to develop such technology.

Defense News has contacted regional government and military officials, businesses, and analysts to find out who is keeping pace in the worldwide contest.

China

Unsurprisingly, China is one of those countries that is focused on both fields. It is widely acknowledged to be the leader in the field of hypersonic systems, having already fielded such weapons in the form of the DF-17 hypersonic glide vehicle.

The DF-17 HGV made its first public appearance at a military parade held in China's capital Beijing in late 2019. The weapon appears to use a standard ballistic missile booster in its first stage for the initial boost of a glide vehicle, which is used to attack a target following reentry.

The DF-17s at the parade were mounted on a wheeled, five-axle transporter-erector-launcher. This makes the system road-mobile like much of the ballistic missile arsenal of China's People's Liberation Army. This could potentially complicate any attempt by an adversary to strike the systems prior to launch.

U.S. government sources have said China carried out several tests of HGVs, including the DF-17, since 2014. The DF-17 is the first system of its type known to be operational in the world, although several other nations including the U.S. are developing similar systems.

In addition, China is also believed to be developing an air-launched HGV, with a video briefly posted on Chinese social media in October last year showing a People's Liberation Army Air Force Xi'an H-6N bomber landing at an air base carrying what appeared to be a boost-glide HGV — or at least a mock-up used for carriage and other flight tests.

Pentagon officials had long suspected China was developing an air-launched ballistic missile for carriage onboard H-6 bombers, although specific details were unknown until the emergence of the video. It's still unclear, however, if this air-launched weapon is the one referenced by the Pentagon, or if China is developing another system with a more conventional warhead.

The deployment of road-mobile and air-launched HGVs broadens China's ability to hold an adversary's targets at risk, giving missile defenses another threat vector to think about in addition to China's existing arsenal of ballistic, cruise, land-attack and anti-ship missiles.

The Pentagon has also claimed China carried out several tests of rail guns on land. These use electromagnetic forces to launch high velocity projectiles by means of a sliding armature that is accelerated along a pair of conductive rails. While the projectiles do not contain explosives like



Chinese military vehicles carry DF-17 ballistic missiles during a parade in Beijing on Oct. 1, 2019. (Mark Schiefelbein/AP)

one would find on hypersonic missiles, the projectile's extremely high speed inflict significant damage.

It is also believed a PLA Navy amphibious ship, photographed on several occasions mounting a large turret and gun barrel on its bow, is the test bed of a naval rail gun. The ship made several voyages believed to be for tests, although this could not be independently verified and its development status is unclear.

China has also made efforts in developing directed-energy weapons, with state media and manufacturers releasing images and videos of hand-held and vehicle-mounted laser systems. These include a hand-held destructive laser weapon offered for domestic law enforcement — ostensibly crowd control — although its designers say when set to maximum power, the laser can instantly scar human skin and tissue. It can also reportedly ignite clothing, knock a small drone out of the sky or blow up a fuel tank.

One Chinese academic has claimed the PLA used microwave weapons to incapacitate Indian troops during last year's standoff over part of the two countries' disputed border, although these claims have not been independently verified.

India

India is also pursuing both hypersonic and directed-energy weapons. The second edition of India's "Technology Perspective and Capability Roadmap," released in 2018 by the Ministry of Defence, previewed more than 200 pieces of equipment envisaged for induction in the military in the late 2020s. Among the list of projects that industry was encouraged to pursue was a "Tactical High Energy Laser System" for the Army and Air Force.

The ministry foresaw a high mobility vehicle-based laser weapon system able to "cause physical damage/destruction to [electronic warfare] systems, communication systems and non communication systems/radars and their antennas." Eventually, the weapon should reach a minimum range of 20 kilometers, have a target-locking capability, and be able to serve in an anti-satellite role from land- and air-based platforms.

An official review of the MoD's affairs from 2020 cited an anti-drone system made by the government's Defence Research and Development Organisation. The Jan. 1, 2021, news release said the system was deployed for Prime Minister Narendra Modi's security as he addressed the nation for its 74th Independence Day.

"It can bring down micro drones through either jamming of command and control links or by damaging the drones through laser-based Directed Energy Weapon," according to the release.

The DRDO is currently requesting \$100 million from the MoD for the 2021-2022 budget to produce a high-power laser weapon.

The classified project, dubbed DURGA II (Directionally Unrestricted Ray-Gun Array), will see the Indian Army receive the 100-kilowatt, lightweight directed-energy system, a service official told Defense News.

A senior DRDO scientist said on condition of anonymity that the DURGA II program is currently in the concept stage. He added that the organization is developing and improving various laser-generation techniques using solid state, fiber and chemical lasers for defensive and offensive use.

The scientist also said DURGA II is to be integrated with land-, sea- and air-based platforms.

Another DRDO scientist said 50 defense scientists have been charged with developing new directed-energy weapons. The organization also aims to start work on non-nuclear electromagnetic pulse technology, he added.



Watch India test its fully indigenous hypersonic technology demonstrator vehicle on Sept. 7, 2020. (Indian Press Information Bureau)

DRDO laboratories engaged in the development of directed-energy technology include the Laser Science and Technology Centre, the Defence Electronics Research Laboratory, the Defence Research and Development Laboratory, and the Centre for High Energy Systems and Sciences.

The Laser Science and Technology Centre is the lead laboratory in this effort, and it is currently engaged in the development of multiple laser technologies using chemical oxygen iodine lasers and high-power fiber lasers. The center has so far made a 25-kilowatt laser that can target a ballistic missile during its terminal phase at a maximum distance of 5 kilometers.

In addition, the DRDO established a firing range at its Terminal Ballistics Research Laboratory at Ramgarh in Haryana state, near New Delhi.

Meanwhile, the country's focus on hypersonic technology has seen the creation of a wind tunnel for testing in Hyderabad and its first successful test of a fully indigenous hypersonic technology demonstrator vehicle powered by an air-breathing scramjet engine. The MoD announced the Sept. 7, 2020, flight test that month.

The demo vehicle was indigenously developed by the DRDO, and it has the ability to fly at six times the speed of sound, according to defense scientists in the country.

The MoD said the hypersonic cruise vehicle was launched using a solid rocket motor, which took it to an altitude of 30 kilometers. Then the cruise vehicle separated from the launch vehicle and the air intake opened as planned, the ministry added.

"The successful demonstration proved several critical technologies including aerodynamic configuration for hypersonic manoeuvres, the use of scramjet propulsion for ignition and sustained combustion at hypersonic flow, thermo-structural characterisation of high-temperature materials, separation mechanism at hypersonic velocities, etc.," DRDO said in a statement.

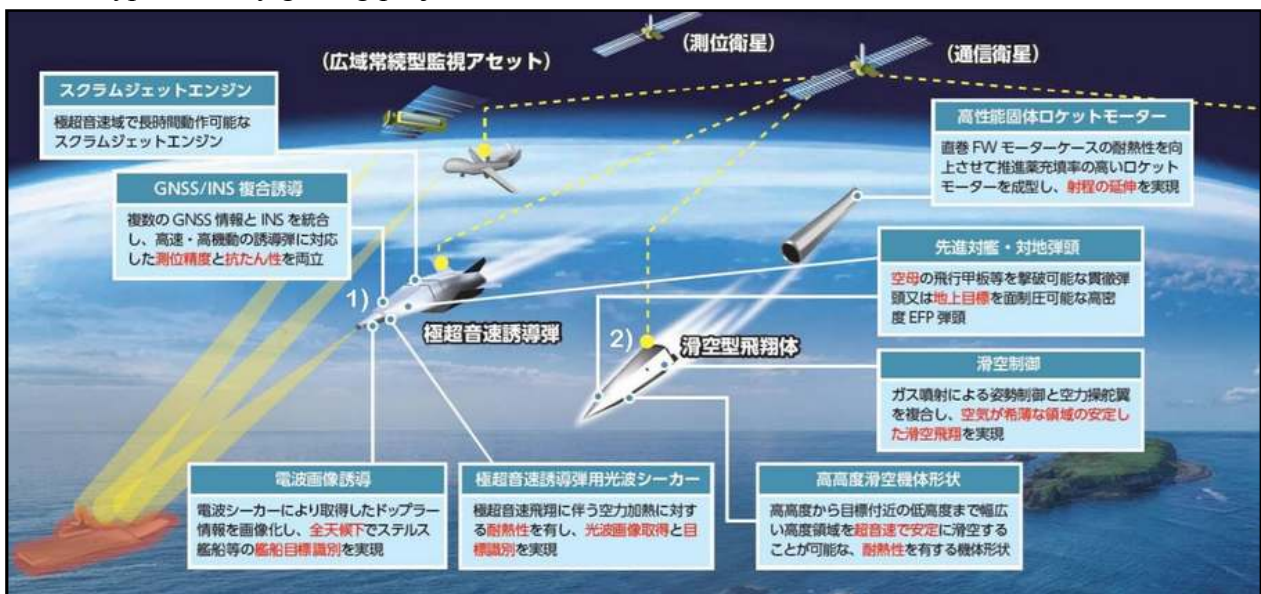
A top DRDO scientist told Defense News that the vehicle will be used to launch both hypersonic and long-range cruise missiles. "DRDO has spent around \$4.5 million on its [HTDV] prototype development cost, and three more tests will be carried out in the next five years to make this platform into a full-fledged hypersonic weapon that is capable of carrying both conventional and nuclear warheads," he said.

DRDO spent about \$30 million on the design and development phases.

India is also developing the hypersonic BrahMos II missile.

Japan

The northeast Asian nation of Japan started its pursuit of hypersonic weapons in the late 2010s. It has set its sights on two classes of hypersonic systems: the hypersonic cruise missile, or HCM, and the hypervelocity gliding projectile, or HVGP.



This Japanese-language graphic shows the country's two planned hypersonic weapons: (1) the hypersonic cruise missile and (2) the hypervelocity gliding projectile. (Japan's Acquisition, Technology and Logistics Agency)

The former will be powered by a scramjet engine and appears similar to a typical missile, albeit one that cruises at a much higher speed while capable of traveling at long ranges.

The HVGP, on the other hand, will feature a solid-fuel rocket engine that will boost its warhead payload to a high altitude before separation, where it will then glide to its target using its altitude to maintain high velocity until impact.

The government's Acquisition, Technology and Logistics Agency also provided details regarding warhead payloads, with different warheads planned for both maritime and land targets. The former will be an armor-piercing warhead designed specifically for penetrating "the deck of the [aircraft] carrier," while a land-attack version will use multiple high-density, explosively formed projectiles for area suppression.

Japan's government is continuing research and development in hypersonic technology, with 240 billion yen (U.S. \$2 billion) in its latest defense budget allocated for the program. ALTA has contracted Mitsubishi Heavy Industries to collaborate on research in both the HCM and HVGP, with the latter expected to enter service around 2026.

ATLA says research on the HCM is planned to continue until 2025, although at this time it is not guaranteed that it will be developed into an operational system. Japan, whose constitution limits the ability of its self-defense forces to conduct offensive operations, has framed the development of its hypersonic weapons as a means by which it can provide defense for "remote islands." The country is likely referring to the Senkaku Islands in the East China Sea, which it currently administers but are also claimed by China.

Korean Peninsula

The divided Korean Peninsula is also racing to develop hypersonic weapons. U.S. ally South Korea is pushing ahead with plans to develop its own hypersonic missiles as it seeks a viable missile strike capability in response to North Korea's extensive ballistic missile arsenal. That arsenal remains the one area in which the impoverished, isolated nation's military has surpassed its southern neighbor.

In August 2020, South Korean Defense Minister Jeong Kyeong-doo said the country will accelerate development of long-range and hypersonic missiles, as well as more powerful warheads for such weapons. South Korea has already developed short-ranged ballistic missiles and is seeking newer types to hold North Korean targets — including its mobile ballistic missiles — at risk during a conflict.

For its part, the nuclear-armed North has claimed it is also developing such weapons. The government made the announcement during the 8th Congress of the Workers' Party of Korea in January, with reports saying the North has created a new research center for hypersonic missiles under its Academy of National Defense Science.

However, there is little verifiable or detailed information available about the development of hypersonic weapons by both the countries at the moment.

Australia

In July 2020, the Australian government released two defense documents that together provide midcourse guidance to the country's 2016 Defence White Paper and its Integrated Investment Program. Included in the new documents are a AU\$9.3 billion (U.S. \$7.1 billion) investment in hypersonic weapons and the further development of capabilities such as directed-energy systems.

As such, the 2020 Defence Strategic Update and associated Force Structure Plan will oversee funding to develop disruptive weapons technology. The effort follows a pledge of AU\$730 million in the earlier whitepaper for research into targeted science and technology, including hypersonic weapons, advanced sensors and directed-energy capabilities.

Acknowledging the rapidly changing balance of power in the Asia-Pacific region, the strategic update notes that previous defense planning does not provide adequate assurance that Australia would come out on top in a modern conflict.

“Coercion, competition and grey-zone activities directly or indirectly targeting Australian interests are occurring now,” the document stated. “Growing regional military capabilities, and the speed at which they can be deployed, mean Australia can no longer rely on a timely warning ahead of conflict occurring.”

While the government still considers the prospect of a high-intensity conflict in the region unlikely, it noted the chances are less remote now than five years ago, including conflict between the U.S. and China. The reduced warning time, coupled with a realization that Australia no longer has the luxury of choosing when or where military action occurs, is driving future weapons requirements, such as rapid threat detection and response as well as greater standoff capabilities.

“That’s why we will continue to invest in advanced capabilities to give the Australian Defence Force more options to deter aggression against Australia’s interests, including the \$9.3 billion earmarked in the Force Structure Plan 2020 for high-speed long-range strike and missile defence, including hypersonic development, test and evaluation,” Defence Minister Linda Reynolds said.

Australia has conducted research into hypersonic flight for several years, most notably through the Hypersonic International Flight Research Experimentation program, or HIFiRE, which began in 2007. The program was a collaboration between the government’s Defence Science and Technology Group, the University of Queensland, the U.S. Air Force Research Laboratory, and industry partners BAE Systems and Boeing.

The aim of HIFiRE was to gain a deep understanding of the technologies required for sustained hypersonic flight and solve related scientific problems. In defense terms, HIFiRE has been succeeded by the Australia-U.S. Southern Cross Integrated Flight Research Experiment program, or SCIFiRE, announced in December 2020.

Australia’s investment in SCIFiRE comes from the AU\$9.3 billion promised in the Force Structure Plan. The program aims to develop and test a hypersonic cruise missile prototype, leveraging work done with the U.S. over the last 15 years on scramjets, rocket motors, sensors and advanced manufacturing materials.

The weapon will be a propulsion-launched, scramjet-powered, precision strike missile able to reach Mach 5. It is expected to enter service in the late 2020s or early 2030s.

The joint effort was finalized in July 2020 and announced in December that year by Reynolds.

“The SCIFiRE initiative is another opportunity to advance the capabilities in our Air Combat Capability program to support joint force effects to advance Australia’s security and prosperity,” chief of the Royal Australian Air Force, Air Marshal Mel Hupfeld, said at the time of the announcement. “We are maximizing our learning during development to better define the capabilities and needs as the system matures, and we are gaining insights as we go that will help us integrate it into the future joint force.”

While the Australian Defence Force is closely watching developments, it is yet to publicly announce a formal hypersonic weapons acquisition program. However, the Force Structure Plan forecasts Australia’s clear desire for a high-speed, long-range strike and missile.

The Defence Ministry did not provide comment to Defense News by press time.

Another disruptive weapons capability specifically named in the Force Structure Plan is the development of a directed-energy weapons system. It’s to be integrated into the military’s protected and armored fighting vehicles for defeating vehicles as big as a main battle tank.

The plan also forecasts a similar capability to protect naval vessels against advanced and emerging weapons systems.

Australian defense company Electro Optic Systems has more than 35 years’ experience in the use of lasers through its so-called Space Domain Awareness service, which provides a tracking capability in space for Australia and its allies. The company is also developing a scalable, directed-energy counter-UAV weapon for the Australian Defence Force, initially based on a 26-kilowatt continuous wave laser. It’s expected to enter service later this year. The technology can supposedly be scaled up to provide a theater-level capability should a future military requirement emerge.

Pakistan

The present level of development in directed-energy and hypersonic weapons by Pakistan is uncertain, and despite a greater focus on strengthening local industry, the country may require significant foreign input in these fields.

In October, outgoing naval chief Adm. Zafar Mahmood Abbasi revealed plans to equip future warships with directed-energy weapon systems and the P282 hypersonic missile.

“In the hypersonic domain, the ship-based, long-range, anti-ship and land-attack P282 ballistic missile is under development” he said at the time, and the newly established Naval Research and Development Institute was developing “laser-based directed-energy weapons.”

Neither the Ministry of Defence Production nor the Navy responded to Defense News’ requests for information on these programs. Their stage of development or how and when they will be employed is unknown. Nevertheless, Mansoor Ahmed, a senior research fellow at Islamabad’s Center for International Strategic Studies, believes these developments must be reasonably advanced for them to have been revealed at all.

Whether Pakistani warships have sufficient power-generation capacity to operate directed-energy weapons may be inferred from Chinese and Turkish programs. Pakistan has ordered Type 054A/P frigates (similar to those in Chinese service) and Milgem corvettes (similar to Turkey’s Ada class), and is designing the related Jinnah-class frigate (possibly similar to Turkey’s Istanbul class).

Chinese destroyers have had an operational directed-energy capability since at least 2018, but frigates are not similarly equipped. However, an expert on China’s military believes this will change.

“Based on my interviews with Chinese sources, I conclude that China will be pacing most U.S. directed-energy weapon developments, be they solid-state lasers or microwave weapons,” said Richard Fisher, a senior fellow at the International Assessment and Strategy Center. “They were marketing a 30-kilowatt, mobile, solid-state laser weapon five years ago, so it is reasonable to expect they will soon have much more powerful land-, sea- and air-deployable laser weapons.”

Similarly, the installation of the Roketsan-made Alka laser weapon on Turkish warships would infer Pakistan receiving a similar setup. Roketsan literature indicates the Alka can be fitted to warships to destroy or disable drones and similar targets. The company says the system can destroy a target with a laser at 500 meters, and destroy a target at 1,000 meters with its electromagnetic weapon.

STM and fellow Turkish contractor Afsat signed an agreement “on engineering solutions for supplying and integrating the main propulsion system” for Pakistan’s corvettes in June 2020. Their propulsion/power-generation system was previously a CODAD (combined diesel and diesel) system before the U.S. cleared the export of gas turbines, allowing a CODAG (combined diesel and gas) system similar to the Ada corvettes to be fitted.

When asked, STM would not say whether this could produce sufficient power to support a directed-energy weapon.

Given the delivery timetable for Pakistan’s new frigates and corvettes, a directed-energy capability may be reality by mid-decade, but Ahmed, the expert at the Center for International Strategic Studies, believes the hypersonic program is more urgent. He said hypersonic technology is part of Pakistan’s “emerging menu of long-range [anti-access, area denial] capabilities that are increasingly going to be needed for maintaining a credible deterrent” against India’s Navy.

This is backed by reports that an Azeri surface-to-air Barak-8 missile system — a weapon also installed on some of India’s destroyers — downed an Armenian Iskander tactical ballistic missile last year, potentially rendering Pakistan’s present subsonic anti-ship missile arsenal vulnerable to interception.

Though Pakistan has acquired CM-302/YJ-12 supersonic anti-ship missiles for its Type 054A/P frigates, Ahmed said the hypersonic P282 will enable Pakistan to “leapfrog” to a similar level of

capability to India, which already has different BrahMos supersonic missile variants and is developing the hypersonic BrahMos II.

Irrespective of whether the P282 will be a wholly indigenous or collaborative effort, Ahmed views it as a critical program that will spawn land and air weapons potentially “deployed across a variety of platforms.”

However, this could depend on whether the weapon is a hypersonic cruise missile (a la Russia’s Zircon) or some type of hypersonic glide vehicle. Describing the P282 as a ballistic missile may imply it is more likely to be a land-based hypersonic glide vehicle (like China’s DF-100), or perhaps a ballistic missile acting as a booster for a scramjet-powered hypersonic cruise missile. Adm. Abbasi’s description of the P282 is the only information presently in the public domain.

According to James Acton, co-director of the Nuclear Policy Program at the Carnegie Endowment for International Peace, a ship-based ballistic missile is most feasible. “I don’t know anything about the P282 specifically, but a ship-based ballistic missile is perfectly possible. Indeed, India has such a missile — the Dhanush.”

Like the Dhanush, he suspects the P282 will turn out to be similar to the Chinese DF-21D and DF-26B anti-ship ballistic missiles.

“It’s possible — likely, perhaps — that the missile would have some kind of a maneuverable reentry vehicle, though I’d be surprised if it had a long-range gliding capability,” he added.

Acton also highlighted the launch platform doesn’t need to be a surface vessel. “It’s also worth bearing in mind that a submarine is a type of ship, and so it’s possible that the delivery platform would be a submarine rather than a surface ship.”

He is less convinced the P282 will end up being a hypersonic cruise missile. “Given the description, I’d doubt it’d be a cruise missile. Small rocket boosters are used to accelerate scramjet-powered missiles, but it’d be very odd to describe the system as a ‘ballistic missile.’ ”

The expert at the International Assessment and Strategy Center suspects China as a direct source of the P282, saying it’s reasonable to believe China would sell directed-energy weapons and ship-launched, anti-ship ballistic missile technology to Pakistan just like it “would also assist North Korea and Iran to obtain the same capabilities.”

“In 2017, retired [Chinese People’s Liberation Army] Navy Rear Adm. Zhao Dengping revealed that the PLAN was working on a ship-launched, anti-ship/land-attack ballistic missile, and my sources indicate that by 2018 they had started testing such a missile” Fisher added. “It could be based on a current surface-to-air-missile or something larger, as they have anti-ship-capable versions of some of their newer short-range ballistic missiles.”

One candidate in particular was shown at the 2018 Zhuhai Airshow in China, he said, where the country revealed the CM-401 horizontally launched anti-ship ballistic missile made by China Aerospace Science and Industry Corporation. “As it is a ship-launched, hypersonic-speed ballistic missile and Pakistan has a long relationship with CASIC, there is a good possibility that P282 will be next in the long line of Pakistan’s CASIC-assisted solid-fuel ballistic missiles.”

If so, fielding a hypersonic missile capability may not be Pakistan’s greatest challenge. Ahmed points to Pakistan’s need to fill a “real-time target acquisition” gap to address India’s aircraft carrier fleet and other major surface combatant forces, especially as “India’s offensive and [intelligence, surveillance and reconnaissance] ISR superiority in the naval domain has been enhanced through the India-U.S. basic exchange and cooperation agreement.”

Pakistan’s planned Sea Sultan long-range patrol aircraft as well as its access to China’s BeiDou satellite navigation network will likely be critical to its hypersonic efforts. Nevertheless, “given these growing asymmetries, the P282 is a much-needed addition to an increasingly complex offense defense imbalance in the Indian Ocean region,” Ahmed said.

<https://www.defensenews.com/global/asia-pacific/2021/03/15/hypersonic-and-directed-energy-weapons-who-has-them-and-whos-winning-the-race-in-the-asia-pacific/>

Madhya Pradesh: To get rid of sewage problem, bio-digester used at Dal Lake could be used at Upper Lake, suggests DRDO Scientist

DRDO-developed 'bio-digester' being used in Siachen and railway toilets; it could replace sewage treatment plant (STP)

By Shahroz Afridi

Bhopal: Bhopal Municipal Corporation (BMC) could save crores of rupees annually to keep the water of Upper Lake fit for drinking. The 'bio-digester' developed by the Defence Research and Development Organisation (DRDO) that has been installed at several places in Dal Lake in Kashmir Valley can also be used at the Upper Lake in Bhopal.

"Scientists from the DRDO have developed a 'bio-digester' that converts human waste into water. The Indian Railways has used it successfully, replacing traditional toilets with it. It's also being used in Siachen and Dal Lake in Kashmir Valley," said Arvind Tomar, defence scientist at the DRDO.

The bio-digester was innovated considering problems faced by the army at high altitudes, such as Siachen. They used soak pits for toilets, but, at sub-zero temperatures, human waste remained as it is and caused health hazards.



Arvind Tomar, defence scientist at the DRDO, demonstrates a biological warfare prevention toolkit.FPJ

The DRDO developed the bio-digester that utilises anaerobic bacteria which feed upon the faecal matter inside the tank and finally degrade the matter. Army units stationed at high altitudes are now using this technique to keep the place hygienic and environment friendly.

Differences between bio-digester & STP

Comparing it with the sewage treatment plant (STP), Tomar said that the STP uses aerobic bacteria and degrades the matter in four stages. Moreover, it uses electricity, whereas the biodigester technology is environment friendly, maintenance-free and efficient without depending upon conventional energy sources. The effluent gets rid of most of the pathogens. The STP requires recurring costs to run.

The same experiment was repeated at the houseboats in Dal Lake in Shrinagar that has made the lake cleaner. "Biodigesters are now extensively used in the coastal areas to stop effluents from flowing into the sea. Now, it's being installed at apartments, hospitals, hotels and schools, as well," said the DRDO scientist.

Considering the population of a place, multiple units of biodigesters could be installed. The scientist said that the DRDO could be approached through phone or email by anyone interested in it, including the state government.

How does bio-digester work?

- The DRDO developed the bio-digester that utilises anaerobic bacteria which feed upon the faecal matter inside the tank and finally degrade the matter
- Army units stationed at high altitudes are now using this technique to keep the place hygienic and environment friendly

DRDO ready for chemical, biological, or nuke warfare

- The DRDO has developed various kits to detect and protect any type of chemical, biological or nuclear warfare

- It has put up a stall at the ongoing Sarthak EduVision event at the RCPV Academy of Administration
- ‘Corona could be an example of bio-warfare. If such gases, viruses or bacteria attack, the Indian Army is well-equipped to deal with it,’ said scientist Tomar
- Kits on anthrax, glanders and so forth are on display to attract students for research in the field
<https://www.freepressjournal.in/bhopal/madhya-pradesh-to-get-rid-of-sewage-problem-bio-digester-used-at-dal-lake-could-be-used-at-upper-lake-suggests-drdo-scientist>

Defence News

Defence Strategic: National/International



Press Information Bureau
Government of India

Ministry of Defence

Mon, 15 March 2021 5:00PM

Privatisation of Defence PSUs

The Government is planning to decrease shareholding in Defence Public Sector Undertakings (DPSUs) namely, BEML Ltd., Garden Reach Shipbuilders & Engineers Limited (GRSE) and Mishra Dhatu Nigam Limited (MIDHANI). The completion of a transaction depends on market conditions. Therefore, it is not possible to predict a timeline.

Details of PSUs making defence-related equipment in which Government has already decreased its shareholding and funds collected by decrease in shareholding through each one of the PSUs in last five year:-

Name of Defence PSU in which Government has decreased its shareholding in last five years	Funds collected (in Rs. Crore) by decrease in shareholding by various modes (ETF/IPO/OFS/Buyback-BB) and combinations thereof in last five years
Bharat Electronics Limited (BEL)	8073.29
Bharat Dynamics Limited (BDL)	2371.19
Hindustan Aeronautics Limited (HAL)	14184.70
Mishra Dhatu Nigam Limited (MIDHANI)	434.14
Garden Reach Shipbuilders & Engineers Ltd. (GRSE)	420.52
Mazagon Dock Shipbuilders Limited (MDL)	974.15

Policy of disinvestment of minority stake without transfer of management control is being followed for priority sector including defence to unlock value, promote public ownership, to meet the minimum public shareholding norms of SEBI and for ensuring higher degree of accountability.

This information was tabled in a written reply by Raksha Rajya Mantri Shri Shripad Naik to a question asked by Dr Santanu Sen in Rajya Sabha today.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1704882>

ThePrint

Tue, 16 March 2021

Buy weapons from us, India says as it pushes exports to compete with China in neighbourhood

Modi govt is learnt to have decided to present itself as an 'alternative to China' in providing quality defence items to nations in Indian Ocean Region, ASEAN

By Nayanima Vasu and Snehesh Alex Philip, Edited by Sunanda Ranjan

New Delhi: It's a strategic outreach perfected by the big powers, including by China in India's neighbourhood. Now, New Delhi has set out to join the bandwagon – of countries that seek to expand their reach and influence by offering arms and military equipment on sale to smaller nations that depend on imports to meet their needs.

India is increasingly reaching out to countries in the neighbourhood, the Indian Ocean Region (IOR) and ASEAN that mostly depend on China for defence procurements, and is positioning itself as a more “reliable security partner” under the overarching Indo-Pacific strategic initiative, multiple government sources have told ThePrint.



The Narendra Modi government, the highly placed sources said, has taken a decision that it will be making a serious effort in presenting itself as an “alternative to China” when it comes to providing quality defence items. This, the sources added, will not only help New Delhi check China's policy of encircling India but also bolster its image as a security partner for friendly countries.

Sources said it will also provide a massive push to the Prime Minister's 'Atmanirbhar Bharat' Mission, or the policy of self-reliance, in the defence sector.

As part of its intention to emerge as the preferred military partner for IOR and Africa, India has come out with a list of 152 defence items that are available to friendly nations. This includes the Tejas fighter aircraft, Dhruv and Rudra choppers, besides the Light Combat Helicopter, the BrahMos supersonic cruise missiles, and the Akash air defence systems.

Apart from this, the sources said, India is also looking to secure military bases in some countries located within the Indo-Pacific region in an effort to become a “net security provider”.

India's plans to increase its defence footprint in countries such as Bangladesh, Afghanistan, Maldives, Seychelles, Mauritius, Vietnam, the Philippines and Indonesia, among others, as it puts greater focus on securing the maritime domain, amid China's growing military adventurism not just in the Himalayas but also in the seas.

Speaking to ThePrint, defence and security experts said India's push comes late but is welcome nevertheless. China, they said, had left India with no option but to go down this route.

Big export push

India, sources said, has told countries within its immediate neighbourhood and some of its ASEAN (Association for Southeast Asian Nations) partners as well as a few African countries to consider making defence purchases, be it guns, tanks and choppers, or other equipment, from New Delhi even as they approach China with such demands.

Sources in the defence and security establishment said every region has its own dynamics. Thus, while the IOR countries require helicopters, naval vessels, coastal radars and air defence systems, the African continent offers opportunities for land systems and small arms besides radars and rotary wings, both armed and unarmed.

The defence attaches posted at Indian missions have been instructed to work “more closely” with the defence forces in their respective country of operation to explore potential export opportunities, the sources said.

During last month’s Aero India showcase, India had pitched itself as a defence partner to countries in the IOR.

Defence Minister Rajnath Singh said India was ready to supply various types of weapons systems to other countries, a stark difference from India’s earlier policy of focusing on its soft power alone.

R. Madhavan, chairman of the state-run defence manufacturer Hindustan Aeronautics Limited (HAL), said in February that India is actively scouting for export potential for the Tejas at a vanilla price of Rs 309 crore per aircraft, as countries from Southeast Asia and West Asia have evinced interest.

Rajiv Bhatia, a distinguished fellow at Gateway House, a Mumbai-based foreign policy think tank, said “this is a policy on the right lines”. “We’ve come a long way from the Nehruvian or the Indira Gandhian idea of doing everything for partner countries but to sell arms. But now we have no choice,” he added.

Bharat Karnad, a research professor at the Delhi-based think tank Centre for Policy Research (CPR) and a national security expert, said India is “already too late in trying to square China”.

“It has already encircled us. But we can come into the picture even now by providing quality products which the Chinese don’t want to give or don’t have. Had we equipped the Philippines, Indonesia and Vietnam with BrahMos missiles about 30 years back, we could have finished the chapter on the South China Sea then and there,” he added, referring to the maritime conflicts triggered by Chinese expansionism in the South China Sea.

Over the past few years, China has emerged as one of the largest defence exporters along with the US, Russia, France and Germany. Besides armed drones, China is exporting fighter aircraft, missiles, small arms and even submarines.

Latest data from Swedish arms watchdog SIPRI shows that exports by China decreased by 7.8 per cent between 2011-15 and 2016-20. Even so, it was the world’s fifth largest arms exporter in 2016-20.

Chinese arms exports accounted for 5.2 per cent of the total arms exports in the time period from 2016-20. Pakistan, Bangladesh and Algeria were the largest recipients of Chinese arms, SIPRI said in its latest report published Monday.

Indian military bases

India is currently engaged in developing a military base on the Agalega Island in Mauritius and a naval base at Seychelles’ Assumption Island, to boost its maritime presence.

“This development is a manifestation of Modi’s 2016 vision for the Indian Ocean, articulated as Security and Growth for All in the Region (SAGAR),” stated a report by the Lowy Institute, an Australia-based think tank, earlier this month.

According to the report, the new base that is coming up in Mauritius will be “essential for facilitating both air and surface maritime patrols in the south-west Indian Ocean, and as an intelligence outpost”.

In February, External Affairs Minister S. Jaishankar visited Mauritius and the Maldives in an effort to boost trade as well as defence ties.

India and the Maldives subsequently signed an agreement to “develop, support and maintain” a Coast Guard harbour at Sifvaru.

The neighbourhood focus was also borne out by Army chief General M.M. Naravane and IAF chief Air Chief Marshal R.K. Bhadauria's visits to nations such as Myanmar, Nepal and Bangladesh in recent days.

This year, which marks the 50th anniversary of the 1971 India-Pakistan war that led to the formation of Bangladesh, the latter sent a contingent of its armed forces to participate in the Republic Day parade, for the first time.

India, meanwhile, sent two of its warships to Bangladesh's Mongla ports to celebrate 'Mujib Borsho' — birth centenary celebrations of Sheikh Mujibur Rahman, their 'Father of the Nation' — and for the golden jubilee of the 1971 war.

"China has left us with no option but to set up military infrastructure in other countries. If we have to compete with them, this is something we have to do," said Bhatia. "But we also have to procure the land for such bases in a manner that there is local support."

Pricing issues

Defence ministry figures show that India more than doubled its defence exports between FY18 and FY19, to Rs 10,745 crore from Rs 4,682 crore.

So far, India has shied away from exporting weapons and believed in creating strategic heft through soft power. However, the government has now come around to seeing the benefit of military exports in building strategic heft.

But pricing is a major concern. While India may be ready to export defence items to other countries, it may not be possible for the intended buyers to make the purchases as they look to bounce back from the economic hit of the Covid-19 pandemic.

To this end, defence sources said, India can look at different financing options, including extended Lines of Credit (LoC). The focus, the sources added, is also on maintenance and servicing and not just delivery.

Earlier this month, India's Ambassador to the Philippines, Shambhu Kumaran, told a local news channel there that New Delhi is willing to offer soft loans for their defence requirements.

The Philippines could eventually emerge as the first export destination for the BrahMos cruise missiles. While India has increased the range and is working on enhancing it further, the export variant will have a 290-km range.

"Russia used to give us 'friendship prices', we can follow that model. We can give our friends the armaments they need and we can buy something they want to sell us in exchange. We can have currency arrangements..." said Karnad.

"We continue to be on a slippery slope. Look, China is now all over the place. Our entire military effort got wasted on the western front and we lost focus of China. But we cannot waste any more time," he added.

<https://theprint.in/defence/buy-weapons-from-us-india-says-as-it-pushes-exports-to-compete-with-china-in-neighbourhood/622216/>

Centre approved 112 defence proposals for domestic sector in last 3 years

New Delhi: The government accorded Acceptance of Necessity (AoN) to 112 defence proposals worth Rs 1,99,860 crore under various categories of capital acquisition to promote domestic manufacturing, Minister of State for Defence, Shripad Naik, said on Monday.

Replying to a question asked by Congress MP Rajmani Patel in the Rajya Sabha, Naik said that AoN to 112 defence proposals was accorded during the last two financial years -- from 2018-19 to 2019-2020 -- and the current financial year till December 2020.

He said the 'Make in India' initiative in the defence sector is implemented through various policy initiatives that promote indigenous design, development and manufacturing of defence items.

These initiatives include priority to procurement of capital items from domestic sources under the Defence Acquisition Procedure (DAP) 2020, notification of 'negative list' of 101 items for which there would be an embargo on import beyond the timeline indicated against them, and simplification of the industrial licencing process.

He also said that many significant projects, including the 155 mm artillery gun system 'Dhanush', Bridge Laying Tank, Thermal Imaging Sight Mark-IIA for T-72 tank, Light Combat Aircraft Tejas, Akash Surface to Air Missile system, Submarine INS Kalvari, INS Chennai, Anti-Submarine Warfare Corvette (ASWC) and others have been produced in the country under the 'Make in India' initiative in the last few years.

The minister also stated that the contracts for various capital acquisition requirements of the government in the defence sector are being awarded to domestic, public and private sector companies, as per the extant provisions prescribed in the defence acquisition procedure.

In addition, the OFB and DPSUs place orders on Indian vendors, including those situated in Uttar Pradesh, for supply of various items, components etc. as per their requirements.

Moreover, the government has established a Defence Industrial Corridor in Uttar Pradesh with six nodes at Aligarh, Agra, Chitrakoot, Jhansi, Lucknow and Kanpur to develop defence manufacturing ecosystem and promote indigenous manufacturing, he stated.

<https://www.daijiworld.com/news/newsDisplay?newsID=812530>

India's arms imports down by 33%, says Sipri report

The report on international arms transfers attributed the drop in India's arms imports mainly to an attempt to reduce its dependence on Russian arms and complex procurement processes

By Rahul Singh

India's arms imports fell 33 % between 2011-15 and 2016-20, said a report released by the Stockholm International Peace Research Institute (Sipri) on Monday, at a time the country has taken a raft of measures to cut dependence on imported military hardware.

The report on international arms transfers attributed the drop in India's arms imports mainly to an attempt to reduce its dependence on Russian arms and complex procurement processes.

"Russia was the most affected supplier, although India's imports of US arms also fell by 46%," the report said, adding that India is planning large-scale arms imports in the coming years from several suppliers.

India's top three arms suppliers during 2016-20 were Russia (accounting for 49% of India's imports), France (18%) and Israel (13%), the report said.

According to Sipri, India accounted for 0.2% of the share of global arms exports during 2016-20, making the country the world's 24th largest exporter of major arms. This represents an increase of 228% over India's export share of 0.1 % during the previous five-year period of 2011-15. Myanmar, Sri Lanka and Mauritius were the top recipients of Indian military hardware, the report said.

The latest import data is a clear indicator that the country's drive towards Atmanirbharta is showing results, said Air Marshal Anil Chopra (retd), director general, Centre for Air Power Studies. "India is finally at an inflection point and the Indian defence industry is coming of age," he said.

Arms exports by Russia, which accounted for 20% of all exports of major arms in 2016-20, dropped by 22%, the report said. "The bulk -- around 90% -- of this decrease was attributable to a 53% fall in its arms exports to India," Sipri said. India was the biggest importer of Russian military hardware during the last five years, accounting for 23% of Russia's total exports.

It also said that exports by China, the world's fifth largest arms exporter in 2016-20, fell 7.8% between 2011-15 and 2016-20. China accounted for 74% of Pakistan's military imports during the last five years, up from 61% in 2011-15. "Pakistan is now firmly in China's hold for its arms requirements," Chopra said.

But the United States, the world's largest arms exporter, saw its exports rise. Its global share of exports went up from 32% to 37% between 2011-15 and 2016-20.

The five largest arms exporters in 2016-20 were the US, Russia, France, Germany and China, while the top importers were Saudi Arabia, India, Egypt, Australia and China.

India has set aside ₹70,221 crore - 63% of the military's capital budget for 2021-22 for buying locally produced weapons and systems to boost defence indigenisation.

The allocation for indigenous procurement -- made for the second consecutive year -- will power the purchase of Tejas LCA (light combat aircraft) Mk-1A jets, light combat helicopters (LCHs), basic trainer aircraft, Arjun Mk-1A tanks, Astra beyond-visual-range missiles, Pinaka rocket systems and anti-tank missiles, as previously reported by Hindustan Times.



IAF Tejas flies past during the inauguration of the 13th edition of Aero India, at Yelahanka air base in Bengaluru. (File photo)

The budget will be used for making milestone payments for several domestic acquisitions through the year. Such payments refer to a certain percentage of the total deal amount that has to be paid at different stages of the execution of a contract.

Last year, the ministry spent over ₹51,000 crore, or 58% of the capital budget, on domestic purchases.

The ₹48,000-crore contract for 83 LCA Mk-1A jets, awarded to Hindustan Aeronautics Limited last month, is the biggest indigenous defence procurement deal so far.

Basic trainers and LCHs figure on the government's negative import list that seeks to ban the import of 101 different types of weapons, systems and ammunition over the next five years. This year, the government is likely to notify a second list of weapons, systems and ammunition that cannot be imported.

India will sign a \$2.5-billion contract this year for buying 56 medium transport aircraft for IAF to replace its fleet of ageing Avro-748 planes.

Airbus Defence and Space and Tata Advanced Systems Limited will jointly execute the project to equip the air force with 56 C-295 transport aircraft under the Make-in-India initiative in the aerospace sector.

But Sipri said India's military imports are likely to grow over the next five years. "As India perceives increasing threats from Pakistan and China and as its ambitious plans to produce its own major arms have been significantly delayed, it is planning large-scale programmes for arms imports. Based on its outstanding deliveries of combat aircraft, air defence systems, ships and submarines, India's arms imports are expected to increase over the coming five years," the report said.

It is a clear indicator that the country's drive towards Atmanirbharta is showing results, said Air Marshal Anil Chopra (retd), director general, Centre for Air Power Studies. "India is finally at an inflection point and the Indian defence industry is coming of age," he said.

<https://www.hindustantimes.com/india-news/indias-arms-imports-down-by-33-says-sipri-report-101615806230302.html>

Western Naval Chief visits Goa and Karwar, reviews ops

Panaji: The chief of the western naval command Vice Admiral R Hari Kumar, who took over as flag officer commanding-in-chief of western naval command in February, visited the Karwar and Goa naval areas recently to review operational readiness.

Kumar was at the Karwar naval base on March 13 and 14 and also went aboard the INS Vikramaditya to take stock of the Sword Arm of the Indian Navy.

During this maiden visit, Kumar reviewed operational preparedness of ships and units based at Karwar. He also reviewed the development of phase II-A of Project Seabird.

Prior to that, Kumar was on a two-day visit to Goa where he interacted with officers, sailors and defence civilians at INS Hansa. Upon his arrival on March 11, the admiral was received by the Flag Officer Commanding Goa Naval Area Rear Admiral Philipose George Pynumootil and accorded a guard of honour.

Meanwhile, as part of the recent 'Azadi Ka Amrut Mahotsav' launched by the government of India, various fishermen community interaction programmes were conducted in Goa by the Indian Navy and the Indian Coast Guard. The objective was to strengthen the bond between coastal security agencies and fishermen who operate in the same environment.

Activities like lectures on safety aspects, coastal security and the vital role of fishermen in supporting security agencies were conducted.

While naval teams from Karnataka Naval Area visited the coastal villages of Karwar, the Goa Naval Area carried out interaction programmes with the fishermen community at Chapora and Chicolna villages.

<https://timesofindia.indiatimes.com/city/goa/western-naval-chief-visits-go-and-karwar-reviews-ops/articleshow/81519406.cms>



India commissions secretive nuclear missile tracking vessel

By Manu Pubby

Synopsis

Called the VC 11184, the specialized Ocean Surveillance Ship was commissioned in October last year in a ceremony that was not made public, sources have told ET. The ship delivery was delayed by a few months due to the Covid-19 crisis but all tests and trails were cleared in 2020 to ensure it is ready to enter service.

India has quietly commissioned its secretive nuclear missile tracking vessel that had been under construction since 2014, entering a select league of nations with the capability to monitor missile launches at long distances, enhancing the testing programme and adding a crucial part to a national missile defence system.

Called the VC 11184, the specialised Ocean Surveillance Ship was commissioned in October last year in a ceremony that was not made public, sources have told ET. The ship delivery was delayed by a few months due to the Covid-19 crisis but all tests and trails were cleared in 2020 to ensure it is ready to enter service.

The ship — only four other nations operate similar vessels — will be operated by a joint crew of the National Technical Research Organisation (NTRO), the Defence Research and Development Organisation and the Indian Navy.

At present, only the US, France, China and Russia operate similar vessels that are used to track missile launches at sea. The vessel will be able to monitor India's developmental trials of missiles of greater range than ever before — virtually unlimited due to its ability to traverse the oceans.

Besides, it will have the ability to detect launches by adversaries like Pakistan and China, giving India an early warning capability. The 15,000 tonne ship, which has specialised surveillance systems of three dome-shaped antennas packed with sensors, has been extensively tested since 2018 by the joint team.

As reported by ET, the complex vessel will generate over 14 MW of power just to power up its tracking radars, which will have multiple roles from tracking enemy missiles to accurately giving data on tests that are routinely carried out of indigenous strategic missiles.

The 15,000 tonne class vessel was initially constructed in a covered dry dock at the Hindustan Shipyard Ltd, the Country's largest, to keep roving satellites and spying attempts at bay. However, since 2018 the vessel has been docked in the open, with its large globe shaped radar placed on the aft giving a distinctive visibility to visitors at Vizag.

The ₹725 crore project is a showcase under the Make in India initiative, with high secrecy being maintained on details, including the capabilities and systems on board. It is also one of the largest warships to be built at an Indian yard.

<https://economictimes.indiatimes.com/news/defence/india-commissions-secretive-n-missile-tracking-vessel/articleshow/81517925.cms>



Called the VC 11184, the specialised Ocean Surveillance Ship was commissioned in October last year in a ceremony that was not made public, sources have told ET.

ISRO to offload most activities to industry, enhance focus on advanced research

He said ISRO can share its technologies with private players and is giving them opportunity to utilise its facilities

Bengaluru: The Indian Space Research Organisation (ISRO) intends to offload most of its space-related activities to industry and enhance focus on advanced research, its Chairman K Sivan has said, as the government opens up the sector to get private players onboard.

Mr. Sivan, also Secretary in the Department of Space (DoS), said the reforms initiated in the sector by the government in June last year to promote enhanced private participation in the space domain has generated enthusiasm among the industry.

“Future of space activities is now changing. Otherwise (earlier), all the space activities were done by only ISRO.

Now, we are giving equal opportunity to private players to also do it”, he said.

Mr. Sivan was addressing a webinar organised by the University of Petroleum and Energy Studies (UPES) on “Future of Aerospace & Avionics in India”.



He said ISRO can share its technologies with private players and is giving them opportunity to utilise its facilities.

“We want to hand-hold them to bring them to our (ISRO’s) level so that most of activities that ISRO is doing can be offloaded to industry and we can spend more time on advanced research to take India to the next level (in the space sector), he said.

As part of space reforms for “Unlocking the space potential of India” to enable private players to carry out end-to-end space activities, the establishment of Indian National Space Promotion and Authorisation Centre (IN- SPACe) has also been announced.

An autonomous body under the DoS, IN-SPACe acts as a single window nodal agency for enabling and regulating space activities and usage of ISRO facilities by NGPEs (non- government private entities).

It works out a suitable mechanism to offer sharing of technology, expertise and facilities free of cost wherever feasible or at reasonable cost basis to promote NGPEs.

Mr. Sivan, however, made it clear in the interaction with students and faculty of the Dehradun-based private university last Friday that Bengaluru-headquartered ISRO is not looking at collaboration with NGPEs at this stage.

ISRO can only have collaboration with partners with equal strength, like international space agencies, he argued, noting that NGPEs in the space sector are still in the growth stage.

The space agency at present is enabling industry to “come up to our level”.

“That is a process. We are hoping that once they grow to our level, then definitely we will be able to have collaboration,” he added.

Union Minister Jitendra Singh, who heads DoS, has said 35 space startups and industries were in consultation with ISRO for support related to various domains of space activity such as

development of satellites, launch vehicles, develop applications, and providing space based services.

ISRO's commercial arm NewSpace India Limited (NSIL), incorporated two years ago, is also proactively working to improve the potential of Indian industries by way of technology transfer from ISRO in several identified areas.

“This will definitely help them play an increasing role in the emerging space markets both nationally and globally.

So far, we have entered into 14 such technology transfer agreements and you will see much more such transfers in the days to come”, NSIL Chairman and Managing Director G Narayanan told PTI last week.

<https://www.thehindu.com/news/national/isro-to-offload-most-activities-to-industry-enhance-focus-on-advanced-research/article34074637.ece>



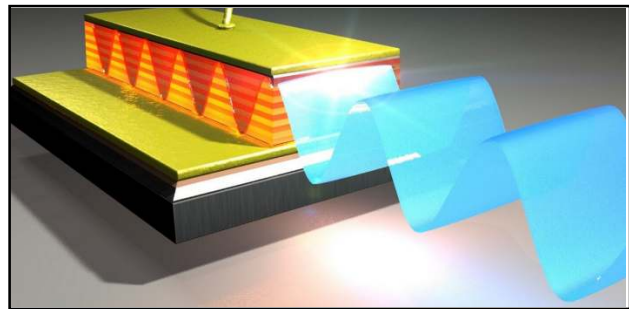
Tue, 16 March 2021

Millimeter wave photonics with terahertz semiconductor lasers

By Sukhdeep Dhillon

The volume of wireless telecommunication traffic is expected to surge in the near future with a continual increase in data traffic and corresponding necessary increases in bandwidth. It has therefore become imperative to increase the photon frequency into the upper reaches of the millimeter (mmWave) region, which corresponds to frequencies between 30 GHz to 300 GHz.

Millimeter wave generation using photonic techniques has so far been limited to the use of near-infrared lasers that are down-converted to the mmWave region. However, such methodologies do not currently benefit from a monolithic architecture and suffer from the high difference in photon energies between the near-infrared and mmWave region, that we called the quantum defect, which can ultimately limit the conversion efficiency. Terahertz (THz) wave region, with photons of lower energies, is however highly adapted. Moreover, we know how to generate them thanks to a compact miniaturized device, the quantum cascade lasers (QCLs). These lasers have inherent other advantages in this respect: their ultrafast dynamics and high nonlinearities open up the possibility of innovatively integrating both laser action and mmWave generation in a single device.



Artistic impression of a THz QCL as a nonlinear mmWave source, where mmWaves are generated within the cavity (red) that radiate into free space (blue waves) Credit: David Darson

In this article, LPENS researchers of the Nano-THz group, in collaboration with teams of C2N, NEST in Pisa, ONERA in Palaiseau and the University of Leeds have demonstrated intracavity mmWave generation within THz QCLs over the unprecedented range of 25 GHz to 500 GHz. Importantly, this work opens up the possibility of compact, low noise mmWave generation using THz frequency combs.

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More information: Valentino Pistori et al. Millimeter wave photonics with terahertz semiconductor lasers, *Nature Communications* (2021). DOI: [10.1038/s41467-021-21659-6](https://doi.org/10.1038/s41467-021-21659-6)

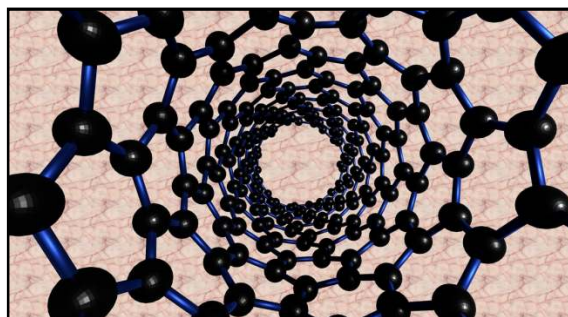
Journal information: [Nature Communications](https://www.nature.com)

<https://phys.org/news/2021-03-millimeter-photonics-terahertz-semiconductor-lasers.html>

The importance of international standards for the graphene community

NPL, in collaboration with international partners, has developed an ISO/IEC standard, ISO/TS 21356-1:2021, for measuring the structural properties of graphene, typically sold as powders or in a liquid dispersion. The ISO/IEC standard allows the supply chain to answer the question 'what is my material?' and is based on methods developed with The University of Manchester in the NPL Good Practice Guide 145.

Over the last few years, graphene, a 2D material with many exciting properties and just one atom thick, has moved from the laboratory into real-world products such as cars and smartphones. However, there is still a barrier affecting the rate of its commercialisation, namely, understanding the true properties of the material. There is not just one type of material, but many, each with different properties that need matching to the many different applications where graphene can provide an improvement.



Credit: Pixabay/CC0 Public Domain

With hundreds of companies across the globe selling different materials labeled as "graphene," and manufacturing it in different ways, end users who want to improve their products by incorporating few-layer graphene flakes are unable to compare and subsequently select the right material for their product.

Through standardized methods to enable the reliable and repeatable measurement of properties, such as the lateral flake size, flake thickness, level of disorder and specific surface area, industry will be able to compare the many materials available and instill trust in the supply chain. In conjunction with the international ISO/IEC terminology standard led by NPL, ISO/TS 80004-13:2017, it will be possible for commercially available material to be correctly measured and labeled as graphene, few-layer graphene or graphite.

As the UK's National Metrology Institute, NPL has been developing and standardizing the required metrologically-robust methods for the measurement of graphene and related 2D materials to enable industry to use these materials and realize novel and improved products across many application areas.

The continuation of the NPL-led standardization work within ISO TC229 (nanotechnologies) will allow the chemical properties of graphene related 2D materials to be determined, as well as the structural properties for different forms of graphene material, such as CVD-grown graphene. This truly international effort to standardize the framework of measurements for graphene is described in more detail in *Nature Reviews Physics*, including further technical discussion on the new ISO graphene measurement standard.

Dr. Andrew J Pollard, science area leader at NPL said: "It is exciting to see this new measurement standard now available for the growing graphene industry worldwide. Based on rigorous metrological research, this standard will allow companies to confidently compare technical datasheets for the first time and is the first step towards verified quality control methods."

Dr. Charles Clifford, senior research scientist at NPL said: "It is fantastic to see this international standard published after several years of development. To reach international consensus especially across the 37 member countries of ISO TC229 (nanotechnologies) is a testament both to the global interest in graphene and the importance of international cooperation."

James Baker, CEO of Graphene@Manchester said: "Standardization is crucial for the commercialisation of graphene in many different applications such as construction, water filtration, energy storage and aerospace. Through this international measurement standard, companies in the UK and beyond will be able to accelerate the uptake of this 21st Century material, now entering many significant markets."

More information: Charles A. Clifford et al. The importance of international standards for the graphene community, *Nature Reviews Physics* (2021). DOI: [10.1038/s42254-021-00278-6](https://doi.org/10.1038/s42254-021-00278-6)
<https://phys.org/news/2021-03-importance-international-standards-graphene.html>



Tue, 16 March 2021

Rare open-access quantum computer now operational

By Troy Rummler

A new Department of Energy open-access quantum computing testbed is ready for the public. Scientists from Indiana University recently became the first team to begin using Sandia National Laboratories' Quantum Scientific Computing Open User Testbed, or QSCOUT.

Quantum computers are poised to become major technological drivers over the coming decades. But to get there, scientists need to experiment with quantum machines that relatively few universities or companies have. Now, scientists can use Sandia's QSCOUT for research that might not be possible at their home institutions, without the cost or restrictions of using a commercial testbed.

"QSCOUT serves a need in the quantum community by giving users the controls to study the machine itself, which aren't yet available in commercial quantum computing systems. It also saves theorists and scientists from the trouble of building their own machines. We hope to gain new insights into quantum performance and architecture as well as solve problems that require quantum computation," said Sandia physicist and QSCOUT lead Susan Clark.

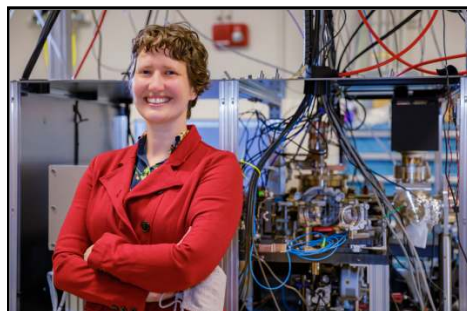
She said the new testbed is a rare machine in three ways: first, as a free, open-access testbed; second, as one made with trapped ion technology; and third, as a platform that gives users an uncommon amount of control over their research.

Last month, Sandia began running the testbed's first user experiment for scientists from Indiana University. Researchers from IBM, Oak Ridge National Laboratory, the University of New Mexico and the University of California, Berkeley, have also been selected to begin experiments soon. Their projects range from testing benchmarking techniques to developing algorithms that could someday solve problems in chemistry too complex for normal computers.

Sandia soliciting proposals

Now, Sandia is getting ready for more research proposals. Anyone can submit a proposal to use QSCOUT, and computing time is free thanks to funding from the DOE Office of Science, Advanced Scientific Computing Research program. The next group of projects is expected to be selected in the spring.

On top of providing an exceptional research opportunity, QSCOUT has a rare design for a testbed. Most commercial testbeds use technology called superconducting circuits. Such machines



Sandia National Laboratories physicist Susan Clark leads the team that built the Quantum Scientific Computing Open User Testbed. The ion-based quantum computer was made for outside researchers to use. Credit: Bret Latter

need to be kept at ultralow temperatures, making them expensive to build and operate. But Sandia's testbed uses what is called an ion trap instead. This means Sandia's testbed can run at warmer temperatures. Trapped ions also yield clearer signals than circuits and hold on to information longer, enabling scientists to perform different types of experiments and compare the two platforms.

Trapped ions are held inside QSCOUT in a so-called "trap on a chip," a flat, bow tie-shaped device, about 2 cm (0.8 inches) long, overlaid on a semiconductor chip. Three electrically charged atoms of the element ytterbium are suspended in place by radio waves and an electric field above a hairline channel that runs down the center of the device. Lasers encode information in each ion as a qubit, comparable to a bit in a conventional computer, to perform calculations.

Sandia plans to expand the system from three to 32 qubits over the next three years so scientists can perform more sophisticated tests.

QSCOUT resides at Sandia's Microsystems Engineering, Science, and Applications complex, which also produces microelectronics for the nation's nuclear stockpile.

More information: Researchers interested in using the Quantum Scientific Computing Open User Testbed are invited to sign up for notifications by emailing qscout@sandia.gov. Sandia expects to select the next round of projects in the spring, subject to change.

<https://phys.org/news/2021-03-rare-open-access-quantum.html>

COVID-19 Research News



Tue, 16 March 2021

COVID-19 Linked to Depressive Symptoms

By Kenny Walter

Following an acute COVID-19 infection, patients can and have felt persistent symptoms involving mood, sleep, anxiety, and fatigue.

These symptoms, while present following a COVID-19 infection, contribute to markedly elevated rates of major depressive disorder found in recent epidemiological studies

A team, led by Roy H. Perlis, MD, MSc, Massachusetts General Hospital, published a new research letter investigating if the symptoms of a COVID-19 infection are linked to the probability of subsequent depressive symptoms.

The Survey

The researchers conducted a survey with data from adults in the US in 8 waves of an internet-based nonprobability survey conducted by Qualtrics with multiple panels of respondents.

The surveys were conducted monthly between June 2020 and January 2021, with 82,319 overall respondents who completed the Patient Health Questionnaire-9 (PHQ-9). There was a total of 3904 nonoverlapping individuals reported prior COVID-19 illness and completed the survey questions used in the final analysis.

Along with standard sociodemographic questions, which included self-identified race and ethnicity in 5 prespecified categories, each respondent was asked whether they had been diagnosed with COVID-19 illness by a clinician or received a positive test results.

The respondents were also asked what months they were ill and to indicate specifics on the presence or absence of symptoms and overall perceived severity of COVID-19 illness.

The participants also completed the PHQ-9, a common screening for symptoms of depression, with each of the 9 items scored from 0-3.

The investigators incorporated indicator variables for each symptom, as well as overall severity using a logistic regression model with PHQ-9 score of 10 or greater as the dependent variable.

The researchers then adjusted for sociodemographic features, such as age, gender, race/ethnicity, geographic region, urban vs suburban or rural, and household income. The mean time since initial COVID-19 symptoms was 4.2 months.

Results

A little more than half of the participants (n = 2046; 52.4%) met the criteria for symptoms of major depressive disorder, while 288 individuals lacked overall COVID-19 severity data.

In the fully adjusted models, the researchers found the presence of headaches was linked to a greater probability of moderate or greater depressive symptoms (aOR, 1.33; 95% CI, 1.10-1.62). This was also linked to greater overall severity (somewhat vs not at all severe: aOR, 2.59; 95% CI, 2.04-3.30; very vs not at all severe: OR, 5.08; 95% CI, 3.93-6.59).

The researchers also found women were less likely to have symptoms than men (aOR, 0.72; 95% CI, 0.61-0.84). The probability of symptoms also decreased with increasing age (aOR, by decade, 0.76; 95% CI, 0.72-0.81).

“In regression models, these symptoms were more likely among younger respondents compared with older respondents and among men compared with women as well as among those with greater self-reported overall COVID-19 severity compared with those with lower severity,” the authors wrote.

Limitations

However, the study differed from previous studies looking at the relationship between the loss of smell and taste and depressive symptoms among 114 participants, but rather headache was the crucial symptom to watch for.

However, 1 limitation of the study was that the researchers cannot exclude the possibility that individuals with baseline depression would be more likely to report symptoms of a headache. The researchers also couldn't attribute the symptoms to new onset depression.

“Nevertheless, our results add to a growing body of evidence suggesting the importance of considering potential neuropsychiatric sequelae of COVID-19 infection,” the authors wrote. “Our results also suggest the importance of considering strategies that might mitigate the elevated risk of depressive symptoms following acute infection.”

<https://www.hcplive.com/view/covid-19-depressive-symptoms>

