

Oct
2020

समाचार पत्रों से चयित अंश Newspapers Clippings

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

खंड : 45 अंक : 250 27 अक्टूबर 2020

Vol.: 45 Issue : 250 27 October 2020



रक्षा विज्ञान पुस्तकालय
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Aditya Project: DRDO'S Directed Energy Weapon (DEW) Program

Move aside Darth Vader and Luke Skywalker, DRDO is trying to develop its own set of Star Wars-like weapons. From laser dazzlers to control rioting crowds to high-powered lasers to destroy incoming missiles, DRDO is working on a slew of directed energy weapons (DEWs), India's own Star Wars Project called Aditya.



DRDO's CHES (Centre for High Energy Systems and Science), Hyderabad is developing Directed Energy Weapon (DEW) systems for use by the Indian Armed Forces (AFs).

Laser Science and Technology Centre (LASTEC) is developing laser source technologies for Directed Energy Weapon (DEW), as also for dazzling and imaging applications.

LASTEC Capability Development

LASTEC has developed core technologies including Gas Dynamic Laser (GDL) and Chemical Oxygen Iodine Lasers (COIL) and demonstrated 100 kW (multi mode) GDL and 20 kW (single mode) COIL sources.

LASTEC's Aditya Gas Dynamic High Power Laser based Directed Energy System

LASTEC's Aditya project was an experimental test bed to seed the critical DEW technologies. The Gas Dynamic High Power laser based Directed Energy System can be broadly divided into two major subsystems:

- Laser Power Source
- Beam Delivery System of Aditya



DRDO's Laser Dazzler mounted on a Mahindra Marksman armoured vehicle

The Laser beam used in a DEW is subject to attenuation (loss of intensity) due to atmospheric air and jitter due to the turbulence within the atmospheric air. The damage caused by the beam progressively reduces with target distance.

In order to cause the stipulated damages at 0.8 km and 2.5 km distance using a 0.7 m aperture telescope, laser power of the order of 100 kW is required. The beam delivery system has to simultaneously perform several



roles. It acquires and tracks the distant static and moving target in real time and points and focuses the laser beam on the target. The adaptive optical system has to compensate for the jitter and wave front distortion of the laser beam from the source.

The technology related to laser source, beam delivery and issues related to system integration on mobile platforms were addressed during the execution of the Aditya project which will provide useful input to future laser weapon programs of DRDO.

DEW For Use against UAVs

One of the DEW weapon systems being developed would target UAV's.

Project Progress

In July 2015, CHES invited tenders for 3 radio control (RC) aero models with minimum wingspan of 1600-mm, min. wing area of 800 sq in., and min fuselage length of 1200-mm. The aero-models should be able to fly at altitudes in excess of 400-m.

It's likely that the procurement is aimed at field testing the IIR sight CHES has developed for its anti UAV weapon. Typically battlefield mini UAVs fly at around 1000-ft AGL in order to stay clear of small arm fire.

Earlier on March 2, 2015 CHES invited tenders for Off-axis concave and convex parabolic mirrors.

The concave mirror is required to have a parent focal length of 2000mm and mirror diameter of 150mm, while the convex mirror is required to have a parent focal length of 200mm and a mirror diameter of 25mm.

In early July 2015, DRDO's IRDE (Instruments Research & Development Establishment), Dehradun invited tenders for supply of High Resolution thermal imager for CHES platform.

The IRDE tender seeks a Thermal Imager based on Pelican-D 640x512 MWIR IDDCA with 14.5X zoom capability. The Imager is required to have recognition range capability of 5-km against a 1.5m x 3m UAV target.

IDDCA (Interleaved Double Dynamical Clustering Analysis) is a sampling algorithm based on clustering.

It appears that the imager being sought by IRDE would be used to aim a DEW developed by CHES for use against UAVs.

Further Developments

Lethal Systems:

Air defence dazzlers to take on enemy aircraft and helicopters at range of 10 km. Status: Will take 2 more years.

25-kilowatt laser systems to destroy missiles during their terminal phase at range of 5 to 7 km. Status: Will take 5 more years.

At least 100-kilowatt solid-state laser systems, mounted on aircraft and ships, to destroy missiles in their boost phase itself.

Killing missiles in their terminal phase. Status: to be ready by 2025 or before.

Indian Navy's Interest in DEW

An HT report dated July 20, 2015 quoted a senior navy officer as saying that the Navy plans to develop and deploy high-energy lasers and high-power microwave weapons on Navy ships.

"The navy's policy and plans wing has identified directed-energy weapons as a key long-term development project. We are sharpening focus on it," said another officer familiar with the plan.

IDP Sentinel members can read additional details on DRDO's DEW project at Directed Energy Weapon (DEW) Systems (IDP Sentinel)

<http://www.indiandefensenews.in/2020/10/aditya-project-drdo-directed-energy.html>

Defence News

Defence Strategic: National/International

THE TIMES OF INDIA

Tue, 27 Oct 2020

Will fight on our soil as well as on foreign soil, says Ajit Doval

New Delhi: India will fight not only on its own territory but also on foreign soil which becomes the source of a security threat, national security advisor Ajit Doval said in remarks that struck many as significant in the context of the military standoff on the Line of Actual Control.

Addressing the Parmarth Niketan ashram in Rishikesh, Doval said while India has never attacked anyone first, the new strategic thinking holds that perhaps we could have acted proactively to nip security threats. "It is not necessary that we only fight where you want to. India will take the battle to where the threat originates," the NSA said, summing up the doctrine of what he called "New India".



Official sources, however, emphasised that Doval was speaking more in the context of civilisational ethos and his remarks were not directed against anyone in the current context. "We never became aggressors to serve our personal interests. We will surely fight, on our soil as well as on foreign soil, but not for our personal interests. But in the interests of Parmarth spirituality," Doval said.

"Ours is a civilisation state. It is not based on any religion, language or sect. What cannot be seen, what is the foundation of this nation... is its culture," he added.

However, coming on a day when RSS chief Mohan Bhagwat talked about China's encroachment, Doval's remarks struck many as reflecting the government's intent to apply the doctrine of pre-emption to nip security threats.

Chinese President Xi Jinping put out an equally stirring nationalistic message on the anniversary of the Korean War. "We will never sit back and allow damage to national sovereignty, security and development interests, and will never allow anyone or any force to invade and divide the sacred territory of the motherland. If such a serious situation occurs, the Chinese people will surely attack

it head-on,” he said. It could have been about the US, Taiwan or India, the three big challenges to China at present.

<https://timesofindia.indiatimes.com/india/will-fight-on-our-soil-as-well-as-on-foreign-soil-says-ajit-doval/articleshow/78863843.cms>



Tue, 27 Oct 2020

Gen Rawat asks tri-services to curb peace-time activities in deference to deployed troops in Ladakh

Marine commandos have been asked to be deployed with Army's special forces in Ladakh and Navy asked to focus on Andaman and Nicobar Islands

By Shishir Gupta

New Delhi: At a time when Prime Minister Narendra Modi asked Indians to light a “diya (lamp)” for soldiers deployed on Ladakh borders, Chief of Defence Staff (CDS) Gen Bipin Rawat has asked the three services to curb all peace-time activities in deference to deployed troops and be ready in case of a worst case scenario.

It is understood that Navy's marine commandos have been asked to be deployed in East Ladakh where the Indian Army is locked in a stand-off with People's Liberation Army (PLA) at Gogra-Hot Springs and both banks of Pangong Tso Lake. The MARCOS will be deployed with the Indian Special Forces to gain experience in polar desert conditions with high wind chill factor and heavy snow.



Chief of Defence Staff (CDS) Gen Bipin Rawat has asked the three services to curb all peace-time activities.(Twitter/@proudhampur)

The deployed troops are waiting for last shipment of polar winter clothing and face masks, which are expected to arrive from US Army own reserve stocks by the first week of November. Just like the PLA, the Indian Army is prepared for a long haul and is in no mood to cede an inch of territory to the aggressive Chinese Army. The PLA has already deployed strategic jammers in Arunachal Pradesh and is going in for a massive infrastructure and storage capacity upgrade in both Xinjiang and Tibet.

According to senior military commanders, Gen Rawat has made it clear to all the three services that these are not normal times with troops, artillery and tanks deployed along the 1597 km Line of Actual Control (LAC) in Ladakh and hence all peace-time activities must be curbed. “As situation in east Ladakh can get worse any time in case of an accident, the armed forces must be ready for any scenario. It cannot be that while the entire northern army command and western air command is battle deployed in frozen condition, the rest of us are celebrating the festival season and playing golf. Let nobody forget there is a war on in Ladakh,” said a South Block official.

In lieu of this, the Indian Navy has been asked to focus on Andaman and Nicobar Island to monitor Chinese warship activity in Indian Ocean rather than get concerned about PLA Navy deployments off the coast of Africa. Indian Island territories of Lakshadweep and ANC are the key to national maritime security as they dominate the most important shipping lanes - from Persian Gulf to Malacca Straits—in the world.

<https://www.hindustantimes.com/india-news/gen-rawat-asks-tri-services-to-curb-peace-time-activities-in-deference-to-deployed-troops-in-ladakh/story-TGSzOq5AxnQYe9878sGUrN.html>

‘Aircraft carrier trials to begin soon’

October marks a watershed month for Cochin Shipyard Ltd. (CSL), a Mini Ratna PSU, as India’s maiden indigenous aircraft carrier (IAC-I) being built by the company is starting basin trials in preparation for the sea trials and subsequent induction into the Navy.

The shipyard has plans to augment shipbuilding and repair capabilities and to foray into emerging segments such as urban mobility, CMD Madhu S. Nair said in an interview. Excerpts:

What is the status on the aircraft carrier?

Basin trials of the carrier [that displaces 40,000 tonnes] are set to begin this month. This is when its propellers are being turned for the first time using the vessel’s own power. In fact, along with this is the activation of a gamut of allied systems and controls.

For a ship of its size and complexity, it’ll be a major milestone that also signals that the sea trials are not far away. But that depends on a number of factors including the opening up of international travel as commissioning engineers are to arrive from various overseas locations.

How has the firm fared during the pandemic?

Working in two shifts since April, we have been able to return to about 75% of capacity. We have orders worth ₹14,000 crore. Last year, we bagged an order from the Jindal group for four mini bulk carriers and another from the Union Home Ministry for nine floating border outposts for the BSF. Then the pandemic struck, but we were able to get this order for autonomous vessels from Norway.

From a value point of view, it’s just about ₹125 crore, but this contract, signed amidst the pandemic in July, is significant for us because of its technology and because it offers us a strong learning curve. We think there’s a market in India for boats and vessels that aren’t very large but where technology will stand out.

With appropriate partnerships, we can build for the world too. This autonomous vessel, for instance, was developed by Kongsberg Maritime in Norway. It has a 1,800 KWh battery system and it is not easy to integrate and prove such systems in a marine environment. We are already building hybrid electric ferries for the Kochi Water Metro.

Have your off-campus ventures begun to look up?

The ship repair facility in Mumbai, in the dock leased from the port trust, had done well last year doing business worth ₹55 crore. We were bolstering the infrastructure when the pandemic hit the city hard, which hit our work too. It’s just a matter of time before it gets into a stable phase, though.

In Kolkata, unlike Mumbai, there was no developed ship repair ecosystem. But it was better than what we expected. We are handling the fifth project there now, a dredger of the DCI. In Port Blair, there are people on ground, but the COVID-19 situation remains bad which will further delay the maiden project by a few months.

These apart, we have taken over Tebma Shipyard in Karnataka and are going to build some fishing vessels there. We want to begin operations in January, 2021, and are in the process of recruiting hands. The Hooghly Cochin Shipyard in Kolkata where we intend to build inland vessels should be ready for commissioning by the end of this year or early next.



What does the shipyard's strategic plan for 2030 comprise?

It's an ongoing evolutionary vision plan called CRUISE 2030 prepared in collaboration with the Boston Consulting Group. It's multi-pronged and is intended to strengthen our core areas of shipbuilding and repair and to venture into adjacencies and emerging spheres targeting manifold growth. Construction of smaller, hi-tech platforms to contribute to sustainable, modern urban mobility, to cite an instance. And the orders are in large numbers.

Also part of the long-term strategy are systems to improve internal efficiencies, to unlock value. It's some time since we have introduced full digital movement of files.

Now we are creating a digital centre of excellence in which various things are looked at: maybe a chat bot to assist, a handheld app to guide contractors and people's entry into the shipyard etc.

Sensor-based tracking of material movement, digital access control and the like are all being looked at. The processes are being digitally realigned. Concurrently, we have just replaced a 25-year-old life cycle management platform, a benchmark then, with a new manufacturing excellence system developed by Dassault Systems, which will also interlink all processes.

As part of your infrastructure expansion, there's this large dry dock being built in Kochi and an international ship repair facility (ISRF) on land owned by the Cochin Port Trust. Are these projects on schedule?

Both were moving fast. We had a predominantly migrant labour force and the pandemic slowed down the work, as social distancing protocols and the ban on working at night kicked in. But we are hopeful of completing the ISRF by the end of 2021 and the dry dock in the latter part of 2022.

<https://www.defencenews.in/article/%e2%80%98Aircraft-carrier-trials-to-begin-soon%e2%80%99-982755>

THE ECONOMIC TIMES

Tue, 27 Oct 2020

MoD sets new rules for land transfer to reduce armed forces' expenditure

By Manu Pubby

Synopsis

Until now, land needed for important public works, like roads and railways, could either be exchanged for land of equivalent value, or in rare cases for payment of market prices.

The defence ministry has approved changes to land transfer rules that will allow the armed forces to receive infrastructure equivalent in value to the land under their control which is needed for public utilities. The move is expected to reduce the defence forces' expenditure on development works, including new offices and housing for soldiers.

Under the new rules on transfer of defence land for public utilities and public infrastructure projects, the forces will effectively be able to monetise their considerable land holdings for internal use. Until now, land needed for important public works, like roads and railways, could either be exchanged for land of equivalent value, or in rare cases for payment of market prices.

“NHAI (National Highways Authority of India), metros, state governments can offer equal value infrastructure in lieu of defence land required by them,” defence secretary Ajay Kumar said in a social media post. “Armed forces to benefit as their infrastructure needs get met with new policy approved by the ministry of defence.”



The defence forces have one of the largest holdings of land in India, spread across states. A recurring problem has been freeing up land for infrastructure. This includes internal roads, metros and rail networks that in the past took decades to process. A major cause for delay of land transfer in deserving cases was that state governments and public utilities were hard pressed to find adequate holdings that could be offered for exchange. And, transfer of market value funds could get stuck due to differing opinions on costing and availability of funds.

The new rules provide for land to be transferred in lieu of equal value infrastructure (EVI). In case the EVI is of lesser value than the cost of land, the balance payment would now be transferred to the defence ministry.

As per the rules, the value of land would be determined by a committee headed by the local military authority in cases falling under cantonment zones, and the district magistrate if the land is in other areas.

<https://economictimes.indiatimes.com/news/defence/mod-sets-new-rules-for-land-transfer/articleshow/78862622.cms>



Tue, 27 Oct 2020

India to start basin trials with its local-made INS Vikrant aircraft carrier

According to information published by Indian newspaper websites, India will start this month, basin trials with its local-made INS Vikrant aircraft carrier also named IAC-1 (Indigenous Aircraft Carrier), including tests of propulsion and electrical systems. The design of the new Indian aircraft carrier was started in 1999 and the keel was laid in February 2009.

The INS Vikrant aircraft carrier was designed by the Directorate of Naval Design of the Indian Navy and the first warship to be built by Cochin Shipyard. She was floated out of its dry dock on 29 December 2011 and was launched on 12 August 2013.

The INS Vikrant aircraft carrier is powered by four General Electric LM2500+ gas turbines driving two shafts. She can reach a top speed of 28 knots (52 km/h; 32 mph) with a maximum cruising range of 8,000 nautical miles (15,000 km; 9,200 mi).



India's first indigenous aircraft carrier INS VIKRANT (IAC1).
(Picture source [Twitter account Radiance](#))

The INS Vikrant will have an overall length of 262 m and a beam of 62 m and its displacement will be 40,000t. She can accommodate 1,600 personnel including ship company, airgroup and troops.

India opted for a three-carrier fleet consisting of one carrier battle group stationed on each seaboard, and a third carrier held in reserve, in order to continuously protect both its flanks, to protect economic interests and mercantile traffic, and to provide humanitarian platforms in times of disasters, since a carrier can provide a self-generating supply of fresh water, medical assistance or engineering expertise to populations in need for assistance.

The INS Vikrant aircraft carrier will be able to operate 36 to 40 aircraft including 26 Russian-made MiG-29K, a Russian-made supersonic carrier-based fighter. The MiG-29K is drastically modified from the Mikoyan MiG-29M for naval operations. The airframe and undercarriage are reinforced to withstand the stress experienced upon landing. Folding wings, an arrestor hook, and catapult attachments were added for carrier operation. Other aircraft will include Russian-made Ka-31, Westland Sea King, HAL Dhruv helicopters, and the indigenous light combat aircraft.

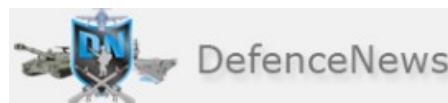
Currently, the Indian Navy has 45 Russian MiG-29K aircraft and its officials had stated that there will not be enough aircraft to operate from both carriers. The Indian has also shown interest in the acquisition of the American F-18 Super Hornet or the naval version of the French Rafale.

Citing the naval-technology website, the 110,000 sq ft flight deck of INS Vikrant will feature two take-off runways and a landing strip equipped with three arrestor wires. The STOBAR (short take-off but arrested recovery) system on an angled flight deck is used to launch and recover an aircraft from the deck of an aircraft carrier. IAC-2 will be fitted with steam catapults rather than STOBAR to launch fourth-generation aircraft.

The INS Vikrant aircraft carrier will be armed with four Otobreda 76 mm (3 in) dual-purpose cannons, 2 x32 cells VLS (Vertical Launching systems) able to launch Barak 1 and Barak 8 surface-to-air missiles and AK-630, Russian fully automatic naval close-in weapon system based on a six-barreled 30 mm rotary cannon.

The INS Vikrant aircraft carrier will be equipped with EL/M-2248 MF-STAR multifunction active electronically scanned array naval radar and a Selex RAN-40L naval 3D L band search radar developed by Italian Company Leonardo.

<https://navyrecognition.com/index.php/news/defence-news/2020/october/9192-india-to-start-basin-trial-with-its-local-made-ins-vikrant-aircraft-carrier.html>



Tue, 27 Oct 2020

U.S., India expected to sign military pact as China prompts closer ties

The U.S. and India are expected to sign a key military agreement this week, bolstering cooperation in the Pacific and Indian oceans to counter an increasingly assertive China, Indian officials said.

The satellite-intelligence pact will be completed during a visit by Secretary of State Mike Pompeo and Defense Secretary Mark Esper to New Delhi, Indian officials said, part of an annual gathering with their Indian counterparts Tuesday.

A senior U.S. defense official didn't confirm the planned signing, but cited significant progress. He also said the pact, known as the Basic Exchange and Cooperation Agreement, or Beca, would "allow for expanded geospatial-information sharing between our armed forces."

India's cabinet, which met under Prime Minister Narendra Modi early last week, approved the draft pact, setting the stage for a formal signing, according to two Indian government officials privy to the development.

The pact would give India access to advanced American map and satellite imagery, enhancing the accuracy of automated weapons, drones and missiles, the Indian officials said.

Besides India, Mr. Pompeo is visiting Sri Lanka, the Maldives and Indonesia.

The enhanced cooperation with New Delhi comes at a time of heightened tensions between India and China along their Himalayan border, where the nuclear-armed neighbors have deployed tens of thousands of troops with artillery since a deadly hand-to-hand clash in mid-June.

“In the current scenario of the border standoff with China, geospatial intelligence and real-time images will be crucial for us,” said one of the Indian officials.

Mr. Modi’s efforts to strengthen ties with partner countries—especially the others in what is called the Quad group, Australia, Japan and the U.S.—are aligning with the Trump administration’s much more assertive approach to China, said Harsh V. Pant, head of strategic affairs at Delhi-based Observer Research Foundation, which describes itself as a nonpartisan, independent research organization that promotes a “strong and prosperous India in a fair and equitable world.”

“The fact that the U.S. is spending so much diplomatic capital on enhancing ties with India when an election is a week away underscores the growing maturity of Indo-U.S. engagement and the fact that China’s rise is a challenge that cannot wait for the electoral cycle to get over,” said Mr. Pant.

The U.S. and India have grown closer over the past two decades, starting with a landmark political deal that legitimized India’s nuclear arsenal and opened the door to sales of civilian nuclear technology from the U.S.

From essentially zero dollars in defense cooperation in 2008, India-U.S bilateral defense trade has grown to more than \$20 billion in 2020, according to the State Department. American aviation and aerospace companies such as Boeing Co. and Lockheed Martin Corp. , as well as U.S. suppliers of arms and ammunition, have pursued business opportunities in India.

During the first “2+2” dialogue of top defense and foreign-policy officials in 2018, the two countries signed an agreement to allow the sharing of encrypted military intelligence. The two nations have also signed the Logistics Exchange Memorandum of Agreement, which permits their respective militaries to replenish materiel and fuel from each other’s bases.

Still, India has traditionally emphasized its nonaligned status, and most experts don’t think New Delhi is likely to become an official treaty ally of the U.S. in the same way as Australia, Japan or South Korea.

“The U.S. and India will need to craft their security partnership in a way that it stays out of the alliance system,” said Michael Kugleman, senior South Asia expert at the Wilson Center, a nonpartisan Washington policy think tank chartered by Congress. “The Quad offers one such pathway: It binds together four like-minded nations that are increasingly willing to engage in maritime cooperation.”

The U.S. is also looking for better maritime cooperation with island countries in the Pacific and Indian Oceans as China seeks to press its own claims and boost Beijing’s influence through its Belt and Road initiative, focused on building infrastructure and trade.

“We are enforcing what has been long known as international law and preventing folks from trying to dominate or monopolize access to any particular area,” said David Stilwell, assistant secretary of state for the Asia-Pacific, told reporters Thursday.

After New Delhi, Mr. Pompeo is set to visit Colombo, the largest city in Sri Lanka, and meet Prime Minister Mahinda Rajapaksa, a politician seen as friendly to China.

“We encourage Sri Lanka to review the options we offer for transparent and sustainable economic development in contrast to discriminatory and opaque practices,” said Dean Thompson, a State Department official overseeing South and Central Asian affairs.

Then Mr. Pompeo has a stop in Male, the capital of the Maldives, an island country in the Indian Ocean. The visit comes just weeks after Maldivian and U.S. defense officials signed a cooperation agreement.

Mr. Pompeo will then meet President Joko Widodo in Jakarta. The Trump administration has sought to defend the maritime and fishing claims of Indonesia and other Southeast Asian nations against competing claims by China.

“Rules provide the grease between countries so we don’t have unfortunate incidents,” Mr. Stilwell said. “So again, our support for not just Indonesia but all the claimant states in Southeast Asia and pretty much everywhere provides that, prevents instability and conflict.”

<https://www.defencenews.in/article/US,-India-Expected-to-Sign-Military-Pact-as-China-Prompts-Closer-Ties-982749>

India, US to sign BECA agreement, further expand defence cooperation

The announcement was made after the meeting between Indian Defence Minister Rajnath Singh with his American counterpart Mark Esper

New Delhi: India and the United States will hold the 2+2 ministerial meeting on Tuesday and sign Basic Exchange and Cooperation Agreement for Geo-Spatial Cooperation (BECA) with the American side welcoming the inclusion of Australia into the Malabar war games to be held next month near Indian waters.

The announcement was made after the meeting between Indian Defence Minister Rajnath Singh with his American counterpart Mark Esper, who is in India along with American Secretary of State Michael Pompeo for the dialogue.

In the meeting chaired by the Defence Ministers, the two sides discussed the potential new areas of cooperation at both service to service and joint level and called for continuing dialogue mechanisms especially at the Military Cooperation Group, the Defence Ministry said in a statement.

"The two ministers expressed satisfaction that the agreement of BECA will be signed during the visit. The American Defence Secretary welcomed Australia's participation in the Malabar 2020 exercise," the ministry said.

The two sides also reviewed the existing bilateral defence cooperation spanning from communications systems, information sharing, defence trade and industrial issues and discussed ways of taking the cooperation forward.

Meanwhile, sources said the issue of the aggression by the Chinese People's Liberation Army along the Indian borders in the month of April-May came up during the deliberations between the two sides as well as the cooperation between them during this period.

The American side, which included the representatives of the Defense Security Cooperation Agency, also made offers to expand the security cooperation between the two countries to newer areas in hardware cooperation between them, they said.

India and China have been engaged in a military standoff since April-May after the People's Liberation Army had transgressed into multiple areas into the Indian territory. India later more than matched the Chinese aggression and captured strategic heights along the Line of Actual Control along both the northern and southern banks of the Pangong lake in Eastern Ladakh.

The two sides are still negotiating disengagement and de-escalation from all friction points identified by the two countries.



U.S. Secretary of State Mike Pompeo, left, and Indian Foreign Minister Subrahmanyam Jaishankar arrive to attend their meeting in Tokyo, Tuesday, Oct. 6, 2020. (Photo | AP)

The BECA agreement will be signed during the 2+2 meeting at Hyderabad House which would enhance the geospatial cooperation between them and it is likely to help in improving the accuracy of missile systems of India.

The importance attached to the visit by the Indian side was visible from the presence of top military and defence ministry officials including Chief of Defence Staff General Bipin Rawat, the three services chiefs and DRDO chief Dr G Satheesh Reddy. The American side was represented by all four of its defence forces along with its ambassador to India Kenneth Juster.

<https://www.newindianexpress.com/world/2020/oct/26/india-us-to-sign-beca-agreement-further-expand-defence-cooperation-2215260.html>

Science & Technology News



Mon, 26 Oct 2020

How ISRO modified a lunar orbiter into Mars orbiter Mangalyaan, India's 'Moon Man' recalls

Speaking of how ISRO's launch calendar had evolved over the years, Dr Annadurai said that the organization's capacity-building efforts had come a long way - from one satellite launch in four years to 30 satellites in three years (during 2015-18)

By Sidharth MP, Edited By Pushkar Tiwari

- *"After the performance of Chandrayaan-1, which found evidence of water on the lunar surface during its one year of operation, the Indian Space agency was working on Chandrayaan-2 along with the Russians," Dr Annadurai said.*
- *"ISRO was to make a modified orbiter and Russia was to come up with a lander. But it so happened that the Russians backed out, stating that they had to modify their lander," he added.*
- *While the Russians had stepped back with regards delivering the lander, India still had an orbiter ready, but also knew that making a lander in-house would take another 7-8 years. That was when the idea of using the existing orbiter to fulfil another mission struck the ISRO team.*

New Delhi: The Indian Space Research Organization (ISRO) was working on Chandrayaan-2 (their second lunar exploration mission) around the year 2011 with the Russian space agency, but had to shelve the then plan owing to Russia backing out. Finally, it was this mission which was planned as Chandrayaan-2 that ended up being modified and launched as the Mars Orbiter Mission (MoM) or Mangalyaan in 2013, revealed ISRO's veteran satellite builder and the former Director of UR Rao Satellite Center Dr Mylswamy Annadurai.

Dr Annadurai, who currently serves as Vice President of the Tamil Nadu State Council for Science and Technology elaborated on his journey at ISRO and the projects he has been undertaking, while virtually addressing school students during Shaastra Juniors, hosted by IIT Madras.

"After the performance of Chandrayaan-1, which found evidence of water on the lunar surface during its one year of operation, the Indian Space agency was working on Chandrayaan-2 along with the Russians," Dr Annadurai said.

"ISRO was to make a modified orbiter and Russia was to come up with a lander. But it so happened that the Russians backed out, stating that they had to modify their lander," he added.

While the Russians had stepped back with regards delivering the lander, India still had an orbiter ready, but also knew that making a lander in-house would take another 7-8 years. That was when the idea of using the existing orbiter to fulfil another mission struck the ISRO team.

"We can't make an attempt for Mars every year, the opportunity only arises once in 26 months. Russians backed out in late-2011 and we had a shot at Mars in 2013-end. So we decided to put our existing lander to use and change the destination - Mars instead of Moon. With the short time we had at hand, we modified the hardware and software of our lunar orbiter to perform as a Martian orbiter," Dr Annadurai reminisced.

He added that the lessons from the short-lived Chandrayaan-1 and detailed analyses of what had gone wrong with other countries' attempts to enter Martian orbit had proved invaluable for their team.

"It is always a matter of pride that India succeeded in its maiden attempt at entering Martian orbit and this was accomplished at a shoestring budget," he said enthusiastically.

Speaking of how ISRO's launch calendar had evolved over the years, Dr Annadurai said that the organization's capacity-building efforts had come a long way - from one satellite launch in four years to 30 satellites in three years (during 2015-18).

Urging the school students to take up challenges and explore opportunities in various streams, the veteran space scientist shared anecdotes from his modest schooling in Tamil Nadu and also his engineering college years, when he hadn't even heard of the IITs.

Making a mention of his career, he said that at every turning point he had chosen to avoid complacency and treaded the lesser travelled path. He elaborated on his decision to pursue Electronics and Communication engineering, to join ISRO in 1982 (when Space science was barely known), having developed a satellite simulator, played a major role in building of INSAT series of satellites and then leading deep-space exploration missions such as Chandrayaan and Mangalyaan.

<https://zeenews.india.com/india/how-isro-modified-a-lunar-orbiter-into-mars-orbiter-mangalyaan-indias-moon-man-recalls-2320097.html>



Tue, 27 Oct 2020

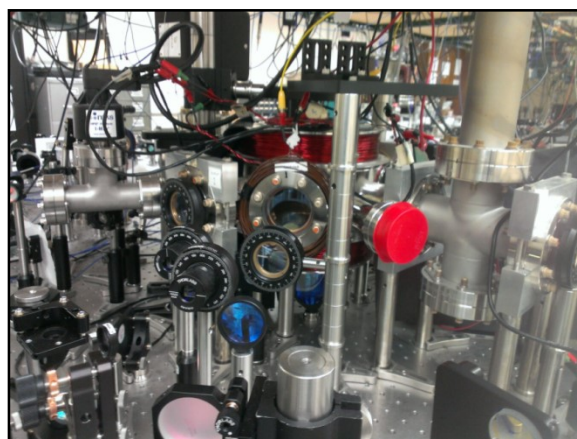
Surprising communication between atoms could improve quantum computing

By Sarah Perdue

A group of University of Wisconsin–Madison physicists has identified conditions under which relatively distant atoms communicate with each other in ways that had previously only been seen in atoms closer together—a development that could have applications to quantum computing.

The physicists' findings, published Oct. 14 in the journal *Physical Review A*, open up new prospects for generating entangled atoms, the term given to atoms that share information at large distances, which are important for quantum communications and the development of quantum computers.

"Building a quantum computer is very tough, so one approach is that you build smaller modules that can talk to each other," says Deniz Yavuz, a UW–Madison physics professor and senior author of the



The ultrahigh vacuum chamber where rubidium atoms are laser cooled and excited. Credit: Deniz Yavuz

study. "This effect we're seeing could be used to increase the communication between these modules."

The scenario at hand depends on the interplay between light and the electrons that orbit atoms. An electron that has been hit with a photon of light can be excited to a higher energy state. But electrons loathe excess energy, so they quickly shed it by emitting a photon in a process known as decay. The photons atoms release have less energy than the ones that boosted the electron up—the same phenomenon that causes some chemicals to fluoresce, or some jellyfish to have a green-glowing ring.

"Now, the problem gets very interesting if you have more than one atom," says Yavuz. "The presence of other atoms modifies the decay of each atom; they talk to each other."

If a single atom decays in one second, for example, then a group of the same type of atom may decay in less—or more—than one second. The timing depends on the conditions, but all the atoms decay at the same rate, either more quickly or more slowly. So far, this type of correlation has only been observed if the atoms are within about one wavelength of the emitted light from each other. For rubidium atoms, used by Yavuz and his colleagues, it means within 780 nanometers—right at the edge between the wavelength of red and infrared light.

The scientists wanted to see how greater distances between the atoms would affect the decay of rubidium atoms. If the prevailing idea were correct, then two rubidium atoms further apart than 780 nanometers would act like individual atoms, each giving the characteristic single-atom decay profile.

In their experiments, they first immobilized a group of rubidium atoms by laser-cooling them to just slightly above absolute zero, the temperature at which atomic motion ceases. Then, they shined a laser at rubidium's excitation wavelength to energize electrons, which decay while emitting a photon at the characteristic 780 nm. They could then measure the intensity of that emitted photon over time and compare it to the decay profile of a single rubidium atom.

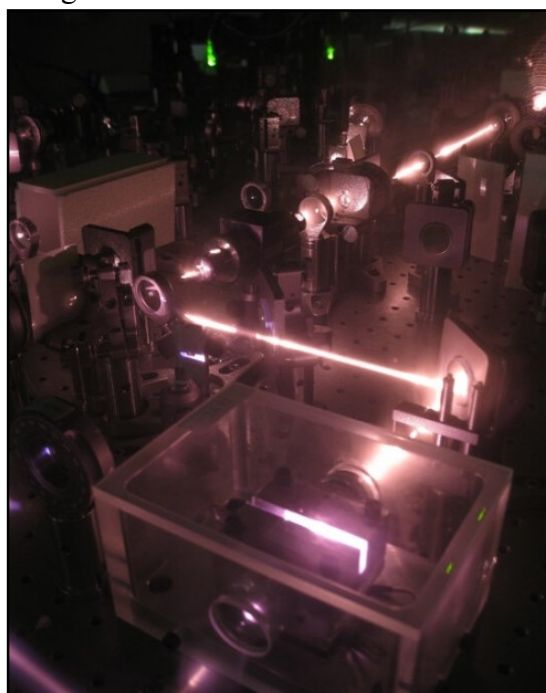
"In our case, we showed that the atoms can be as far away as five times the wavelength, and still these group effects are pronounced—the decay can be faster than if the atom were there by itself, or slower," Yavuz says. "The second thing we showed is, if you look at the time dynamics of the decay, it can start fast and then get slower. It switches, and that switch had never been seen before."

With these new insights into building correlations between atoms, Yavuz and his research group are looking into the quantum computing applications of their findings. They are investigating which experimental conditions lead to different types of correlated states, which can lead to entanglement and efficient transmission of quantum information.

More information: Diptaranjan Das et al. Subradiance and superradiance-to-subradiance transition in dilute atomic clouds, *Physical Review A* (2020). [DOI: 10.1103/PhysRevA.102.043708](https://doi.org/10.1103/PhysRevA.102.043708)

Journal information: [Physical Review A](https://doi.org/10.1103/PhysRevA.102.043708)

<https://phys.org/news/2020-10-atoms-quantum.html>



In their experiments, UW–Madison physicists led by Deniz Yavuz immobilized a group of rubidium atoms by laser-cooling them to just slightly above absolute zero. Then, they shined a laser at rubidium's excitation wavelength to energize electrons. Credit: Yavuz Lab

New catalyst turns greenhouse gases into hydrogen gas

By Jooheon Heo

A new nanocatalyst that recycles major greenhouse gases, such as carbon dioxide (CO_2) and methane (CH_4), into highly value-added hydrogen (H_2) gas has been developed. This catalyst is expected to greatly contribute to the development of various waste-to-energy conversion technologies, as it has more than twice the conversion efficiency from CH_4 to H_2 , compared to the conventional electrode catalysts.

A research team, led by Professor Gun-Tae Kim in the School of Energy and Chemical Engineering at UNIST has developed a novel method to enhance the performance and stability of catalysts, used in the reaction (i.e., dry reforming of methane, DRM) that produces H_2 and carbon monoxide (CO) from well-known greenhouse gases, such as CO_2 and CH_4 .

The conventional catalysts used for the dry reforming of methane (DRM) are nickel (Ni)-based metal complexes. Over time, however, the performance of catalysts degrade, so does the catalyst lifetime. This is because carbon accumulates on the surface of the catalysts, as the catalysts clump together or their reaction is repeated at a higher temperature.

"The uniform and quantitatively controlled layer of iron (Fe) via atomic layer deposition (ALD) facilitates the topotactic exsolution, increasing finely dispersed nanoparticles," says Sangwook Joo (Combined MS/Ph.D. in the School of Energy and Chemical Engineering, UNIST), the first author of the study.

The research team also confirmed that exsolution is promoted even with a very small amount of ALD-deposited Fe oxide (Fe_2O_3). "Notably, at 20 cycles of Fe oxide deposition via ALD, the particle population reaches over 400 particles (Ni-Fe alloys)," says Arim Seong of the School of Energy and Chemical Engineering, UNIST, the first co-author of the study. "As these particles are composed of Ni and Fe, they also exhibited high catalytic activity."

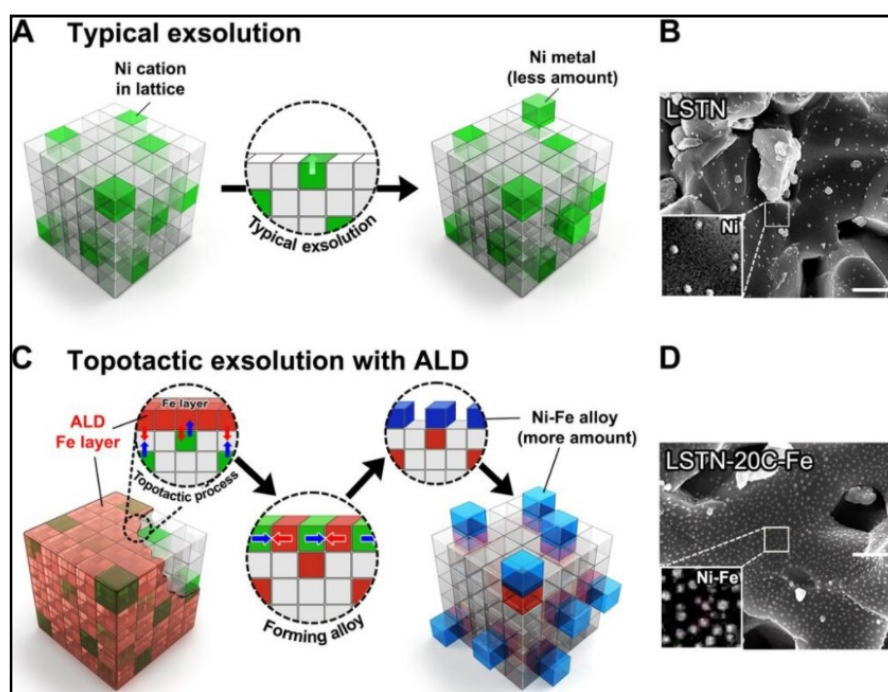
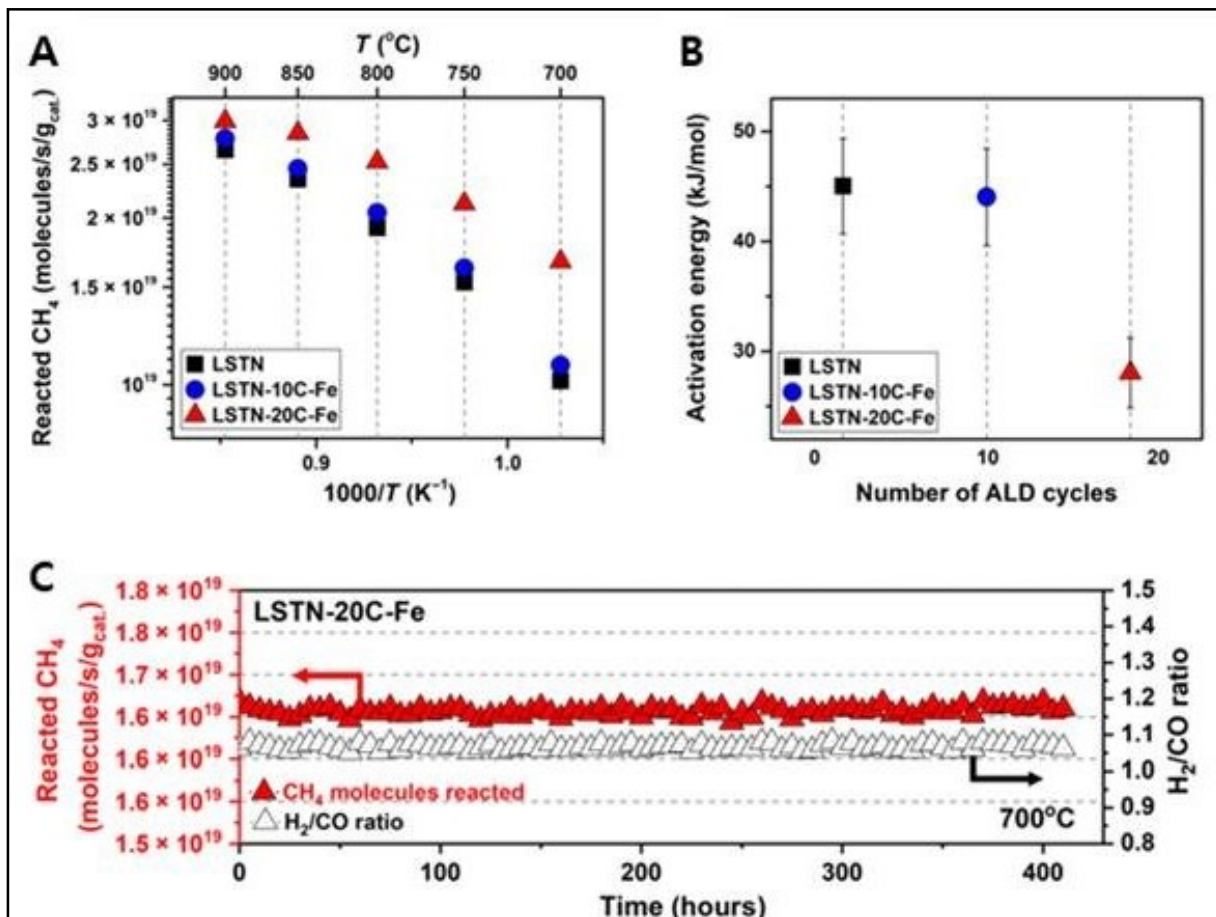


Figure 1. Schematic comparison, SEM images, the correlation between the number of ALD cycles and the particle size/population, and x-ray photoelectron curves for the samples. (A) Conventional exsolution for LSTN and (B) corresponding SEM image of LSTN. Scale bar, 500 nm. (C) Topotactic exsolution via ALD for LSTN-20C-Fe and the corresponding SEM image of (D) LSTN-20C-Fe after reduction. Scale bar, 500 nm. Credit: Ulsan National Institute of Science and Technology



The new catalyst exhibited high catalytic activity for the DRM process with no observable degradation in performance for more than 410 hours of continuous operation. Their results also showed a high methane conversion (over 70%) at 700 degrees C. "This is more than twice the power conversion efficiency that of the conventional electrode catalysts," noted Professor Kim. "Overall, the abundant alloy nanocatalysts via ALD mark an important step forward in the evolution of exsolution and its application to the field of energy utilization."

Provided by [Ulsan National Institute of Science and Technology](https://phys.org/news/2020-10-catalyst-greenhouse-gases-hydrogen-gas.html)

<https://phys.org/news/2020-10-catalyst-greenhouse-gases-hydrogen-gas.html>



Tue, 27 Oct 2020

Sensing carbon monoxide

By David Bradley

Carbon monoxide is an insidiously toxic gas. It can pervade an enclosed space and causes drowsiness and at sufficiently high concentration is lethal to anyone breathing it. As such, there is a need for efficient and fast-reacting carbon monoxide sensor devices in a variety of industrial, commercial, and domestic settings. Devices are available but a new approach is discussed in the *International Journal of Microstructure and Materials Properties* that utilizes the chemistry of a twin film of molybdenum(VI) oxide and indium(III) oxide layers.



Credit: Pixabay/CCO Public Domain

Physicists Nimba Kothawade and Arun Patil of the Arts, Science and Commerce College, and Vikas Deshmane of the SICES Degree College in Maharashtra, India, prepared thin films of $\text{MoO}_3:\text{In}_2\text{O}_3$ using the spray pyrolysis technique on a glass substrate at 400 degrees Celsius. They characterized their film using X-ray diffraction, scanning electron microscopy, and energy-dispersive X-ray spectroscopy.

Once confident of their materials, the team then tested the electrical properties of their various formulations. They found that the resistivity of the films increased with MoO_3 as the dopant in In_2O_3 . They found a maximum resistivity of $1.75 \times 10^4 \Omega\text{m}$ for 0.3N (MoO_3) and 0.1N (In_2O_3) binary oxide films.

They then tested the dual films gas-sensing characteristics against five different target gasses. The film composition ratio 0.3N:0.1N films had 70.50% sensitivity to 300 parts per million (ppm) of carbon monoxide gas at 150 degrees Celsius with high selectivity. The response time, the team reports was 15 seconds and recovery time was just 25 seconds.

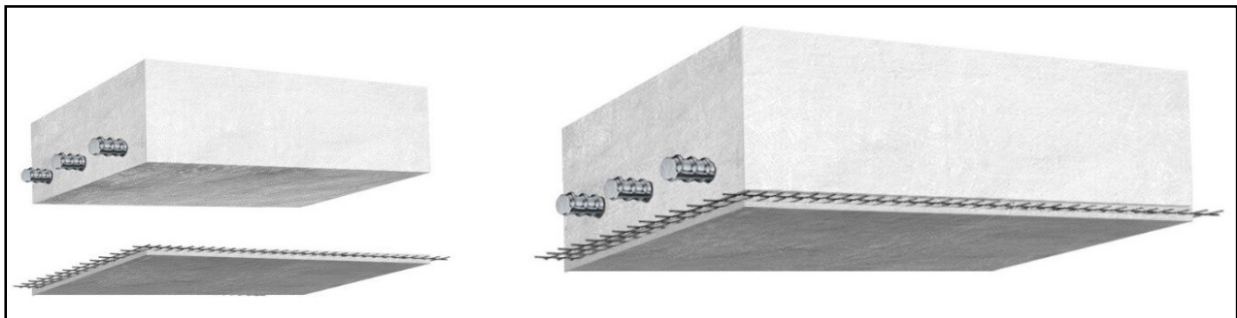
More information: Nimba B. Kothawade et al. $\text{MoO}_3:\text{In}_2\text{O}_3$ binary oxide thin films as CO gas sensor, *International Journal of Microstructure and Materials Properties* (2020). DOI: [10.1504/IJMMP.2020.110525](https://doi.org/10.1504/IJMMP.2020.110525)
<https://phys.org/news/2020-10-carbon-monoxide.html>



Tue, 27 Oct 2020

Concrete structure's lifespan extended by a carbon textile

The Korea Institute of Civil Engineering and Building Technology (KICT) has announced the development of an effective structural strengthening method using a noncombustible carbon textile grid and cement mortar, which can double the load-bearing capacities of structurally deficient concrete structures and increase their usable lifespan threefold.



(Left) Deteriorated concrete member and precast TRM panel; and (Right) Concrete member strengthened with TRM panel. Credit: Korea Institute of Civil Engineering and Building Technology (KICT)

More than 90% of the infrastructure in South Korea, including bridges, tunnels and residential buildings, was initially constructed from concrete. For deteriorated or structurally deficient concrete structures in need of structural strengthening, carbon fiber sheets are typically applied to the surface of the concrete structure using organic adhesives. However, organic adhesives are susceptible to fire and cannot be applied to structures with wet surfaces. These carbon fiber sheets may detach and fall from the structure if they are exposed to moisture.

A research team in KICT led by Dr. Hyeong-Yeol Kim has developed an effective, efficient strengthening method for deteriorated concrete structures. The method uses thin precast textile reinforced mortar (TRM) panels made of a carbon textile grid and a thin layer of cement mortar. The TRM strengthening method can be applied in the form of cast-in-place construction. Employing KICT's method, 20-mm-thick TRM panels are attached to the surface of the existing

structure, and then the space between the existing structure and the panels is filled with cement grout, which serves as the adhesive.

Both the carbon textile and cement mortar are noncombustible materials that have a high resistance to fire, meaning that they can be effectively used to strengthen concrete buildings that may be exposed to fire hazards. The construction method can also be applied to wet surfaces and winter weather conditions, and the panels do not fall off, even in the event of water ingress. Additionally, unlike steel reinforcing bars, the carbon textile does not corrode, and can thus be effectively used to strengthen highway facilities and parking buildings where deicing agents are often used, as well as to strengthen offshore concrete structures that are exposed to a chloride-rich environment.

Testing conducted in KICT indicates that the failure load of concrete structures strengthened with the TRC panel increased by at least 1.5 times compared to that of an unstrengthened structure. Furthermore, the chloride resistance of the TRM panel has been evaluated in order to assess its service life in a chloride-rich environment. The durability test and analysis of the TRM panel indicates that the lifespan of the panel is more than 100 years. This increase can be attributed to the cement mortar, developed by KICT, which contains 50% ground granulated blast furnace slag, an industrial byproduct generated at ironworks. The cement mortar, which has a higher fire resistance than conventional cement mortar, is also advantageous because its cost is half that of conventional mortar. In terms of economical efficiency, the newly developed method can reduce construction costs by about 40% compared to existing carbon sheet attachment methods.

The newly developed strengthening method uses thin TRM panels that are very versatile and can be used as building facades, repair and strengthening materials, and in other applications. In the future, if the panels can be fabricated with thermal insulators, it is expected that they will replace building insulation materials that are susceptible to fires.

Dr. Kim said, "For easier production and shipping, the TRM panels are manufactured in a relatively small size of 1 meter by 2 meters and must be connected at the construction site. A method for effectively connecting the panels is currently being developed, and performance tests of the method will be conducted by the end of 2020."

More information: Young-Jun You et al, Strengthening of Concrete Element with Precast Textile Reinforced Concrete Panel and Grouting Material, *Materials* (2020). DOI: [10.3390/ma13173856](https://doi.org/10.3390/ma13173856)
<https://phys.org/news/2020-10-concrete-lifespan-carbon-textile.html>

Study identifies 3 existing drugs that may help treat COVID-19

A team of researchers has identified three repurposed drugs that may be effective in treating COVID-19

In a new study, scientists have found three previously-available drugs that may be effective at treating COVID-19 in its early stages.

The research, which appears in the journal *ACS Pharmacology & Translational Science*, is valuable in helping researchers identify treatment candidates for clinical trials.

COVID-19 treatments

SARS-CoV-2 and its associated disease, COVID-19, have had a profoundly negative effect on global economies, culture, people's everyday lives, and above all, on people's health.

To date, there have been more than 1,150,000 recorded deaths from the disease. There is also mounting anecdotal evidence of the long-term negative health effects it can have on people who recover from the initial illness.



Due to COVID-19's lethality, and the fact that the disease is highly contagious, scientists are rushing to develop a vaccine. However, producing vaccines that are also safe and effective takes a considerable amount of time.

According to a report in *The Lancet*, on average, vaccines take 10 years to develop. Even with experts greatly accelerating research due to the urgency of the global pandemic, the report notes that an initial vaccine may take more than 18 months to be developed, manufactured, and distributed to people around the world.

Consequently, scientists have been researching vaccines and potential treatments that may ultimately reduce the chance of a person dying if they develop the disease.

This typically involves repurposing previously available drugs that may also be effective in treating COVID-19. This is important as, much like developing a working vaccine, finding new drugs that can treat COVID-19 may take a long time.

To date, the only repurposed drug that has shown signs of being effective is remdesivir, originally developed to treat Ebola in 2014.

However, a recent major World Health Organization (WHO) study has found that remdesivir has no significant effect on COVID-19 mortality.

As a consequence, identifying effective drugs that experts can repurpose to treat COVID-19 is particularly pressing.

Alternative approach

In this context, scientists behind the present study took a different approach in the search for potentially effective drugs to repurpose.

Typically, when scientists source drugs to repurpose, they use a technique called high throughput screening (HTS). This involves automating the testing of many different medications, allowing for a much more rapid process than using human teams. Researchers then analyze the results with a computer.

However, according to the current study team, there may be issues with HTS's reliability and accuracy. Drawing on an article in the journal *Patterns*, they note that there has been little overlap in the potentially effective drugs identified in HTS studies.

Instead, in their study, the scientists used a ligand-based virtual screening (LBVS) protocol to identify drugs that may act similarly to the drug hydroxychloroquine.

Studies show hydroxychloroquine is effective against SARS-CoV-2 in test-tube experiments, even if it is unlikely to be effective in real life.

Importantly, the scientists verified their findings in test-tube experiments and then had their results independently tested to ensure their findings were accurate.

Three drugs identified

After using LBVS to study approximately 4,000 drugs, then verifying their findings, the scientists identified three that may be effective against COVID-19 and, in their opinion, should be made the subject of clinical trials.

These are the antimalarial drug amodiaquine, the anti-psychotic zuclopenthixol, and the blood pressure medication nebivolol.

The scientists believe that these may be particularly effective if combined with remdesivir or the antiviral drug favipiravir.

As Prof. Tudor Oprea, senior study author and professor of Medicine and Pharmaceutical Sciences and chief of the University of New Mexico Division of Translational Informatics, says:

“Think of it as a whack-a-mole game. Instead of having one hammer, you have two hammers, which is more effective. We're trying to give the scientific community two hammers instead of one.”

As both remdesivir and hydroxychloroquine show, a drug may be effective in a test-tube while being ineffective in real life. However, in the case of the latter, the risks of treatment may outweigh the benefits.

Nonetheless, if scientists can identify an effective COVID-19 treatment, it could greatly reduce the mortality rate of the current pandemic. Therefore, the first step to doing this is identifying potential treatment candidates.

<https://www.medicalnewstoday.com/articles/study-identifies-3-existing-drugs-that-may-help-treat-covid-19#Three-drugs-identified>

