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# 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

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*Fri, 06 Nov 2020*

## **An enhanced version of Pinaka rocket system successfully flight-tested: Here's all you need to know**

*An enhanced version of the Pinaka Mk-1 Missile, developed by the DRDO has been successfully flight-tested from the Integrated Test Range in Chandipur, off the coast of Odisha  
By Arfa Javaid*

On 4 November 2020, an enhanced version of the Pinaka Mk-1 Missile, developed by the DRDO has been successfully flight-tested from the Integrated Test Range in Chandipur, off the coast of Odisha. This was in continuation of a number of missile trials conducted by the DRDO in the last two months.

As per the DRDO officials, the enhanced version of the Pinaka Mk-1 Missile was developed to achieve longer-range performance compared to the earlier design with lesser length. These six Pinaka Regiments would comprise 114 Launchers with Automated Gun Aiming and Positioning System (AGAPS), 45 command posts and 330 vehicles.

### **Key Highlights:**

The development of Enhanced Pinaka system was taken up to achieve longer range performance compared to an earlier design with a reduced length.

1. The design and development have been carried out by Pune based DRDO laboratories, namely, Armament Research and Development Establishment (ARDE) and High Energy Materials Research Laboratory (HEMRL).
2. The Enhanced Pinaka Mk-1 (range of 45 km) will replace the Pinaka Mk-1 Missiles. These are currently used by the Indian Army along India's frontiers with China and Pakistan.
3. A total of six rockets were launched in quick succession and the tests met complete mission objectives.
4. The Rockets tested have been manufactured by M/s Economic Explosives Limited, Nagpur, to whom the technology has been transferred.
5. All the flight articles were tracked by Range instruments such as telemetry, radar and Electro Optical Tracking Systems (EOTS) which confirmed the flight performance.
6. As per the Ministry of Defence (MoD), the induction of these six rockets would be completed by 2024.
7. DRDO has also developed and successfully tested Mk-II (has a range of 60 km) and the Guided Pinaka system (has a range of 75 km).



**Pinaka Missile System**

8. The Guided Pinaka system has integrated navigation, control and guidance system to enhance the range and to improve end accuracy.

### **About Pinaka Rocket System**

1. Named after Shiva's bow, Pinaka is a multi-barrel rocket launcher (MBRL) system.
2. It can fire a salvo of 12 HE rockets in 44 seconds.
3. A battery of Pinaka system can neutralise an area of 1 km by 1 km.
4. It is comprised of six launch vehicles and is accompanied by loader systems, radar and links with network-based systems and a command post.
5. The launchers of this missile have to shoot and scoot to prevent themselves from becoming the target (due to its backblast).
6. It has a maximum range of 40 km for Mark-I and 75 km for Mark-II.

### **Background**

In the late 1990s, DRDO started developing Pinaka multi-barrel rocket launcher (MBRL) systems. The system was used for the first time in the battlefield during the 1999 Kargil War and was successful in neutralising enemy positions on the mountain tops. Since then, it has been inducted in large numbers in the Indian Army.

<https://www.jagranjosh.com/general-knowledge/pinaka-rocket-system-1604584037-1>



*Fri, 06 Nov 2020*

## **Cleared for deployment on border, enhanced Pinaka rockets to add muscle power to Indian Army**

*By Vicky Nanjappa*

New Delhi: The new version of the Pinaka rocket system was developed to counter the People's Liberation Army threat along the Line of Actual Control in Eastern Ladakh.

On Wednesday, the DRDO said it successfully test-fired a new version of the Pinaka rocket system off the coast of Odisha. This is an important development as the PLA has deployed a large number of rocket regiments in support of artillery guns.

Both the enhanced Pinaka and guided Pinka have been cleared for development on the borders, officials OneIndia spoke with said.

The premier military research organisation said a total of six rockets were launched in quick succession and the tests met "complete mission objectives".

"Enhanced version of PINAKA Rocket System, developed by Defence Research and Development Organisation (DRDO) has been successfully flight-tested from Integrated Test Range, Chandipur off the coast of Odisha today," it tweeted.

The DRDO said the enhanced version of the Pinaka rocket system would replace the existing Pinaka Mk-I rockets, which are currently under production.

The Pinaka rockets have a range of around 37 km.



Image Courtesy: @DRDO\_India

In the last two months, India has test-fired a number of missiles, including a new version of the surface-to-surface supersonic cruise missile BrahMos and an anti-radiation missile named Rudram-1.

<https://www.oneindia.com/india/cleared-for-deployment-on-border-enhanced-pinaka-rockets-to-add-muscle-power-to-indian-army-3172627.html>

## Defence News

### Defence Strategic: National/International

live**mint**

Fri, 06 Nov 2020

# Indian Army Chief Naravane conferred honorary rank of 'General of Nepali Army'

By Elizabeth Roche

- *Naravane is on a three-day visit to the Himalayan country aimed at putting bilateral ties back on track after Nepal published a new map showing sections of Indian territory as lying within its borders*

New Delhi: Indian Army Chief Manoj Mukund Naravane on Thursday was conferred honorary rank of "General of Nepali Army", by Nepal's president Bidya Devi Bhandari.

The function at the presidential palace was attended by Nepalese prime minister KP Sharma Oli and key functionaries of government, a statement from the Indian embassy in Kathmandu said.

"The practice follows a seven decade old tradition of conferring Army Chiefs of each other's country with the honorary title. Commander-in-Chief General KM Cariappa was the first Indian Army Chief to be decorated with the title in 1950. In January last year, Chief of Nepali Army, General Purna Chandra Thapa, was also made the honorary General of the Indian Army by President Ram Nath Kovind at a ceremony in New Delhi," the Indian embassy statement said.

Naravane is on a three-day visit to the Himalayan country aimed at putting bilateral ties back on track after Nepal published a new map showing sections of Indian territory as lying within its borders.

Earlier in the day, Naravane presented some medical equipment to the Nepalese Army including X-Ray machines, computed radiography systems, ICU ventilators, video endoscopy units, anesthesia machines, laboratory equipment and ambulances, the Indian Embassy said. The gifting of medical equipment follows an earlier army-to-army provision of ventilators in July this year," the statement said. "Additional ventilators were also gifted to assist Nepali Army in its fight against Covid-19 pandemic," the statement added.



Gen Naravane said that there were reasons to believe that Nepal objected to the road at the behest of someone else (PTI)

On Thursday, Naravane also laid a wreath and paid homage at Bir Smarak (Martyr's Memorial) at the Army Pavilion in Tundikhel, Kathmandu. He was later accorded a ceremonial Guard of

Honour at the Nepali Army Headquarters after which he went in for talks with his counterpart General Purna Chandra Thapa. Both sides discussed enhancing bilateral defence cooperation, the Indian embassy statement said.

The army chief is expected to interact with Indian Army pensioners in Nepal during the visit. There are 136,000 pensioners in that country and form part of the strong people to people links between the two countries.

The army Chief's visit follows ties between India and Nepal coming under strain after defence minister Rajnath Singh inaugurated a key border road to Lipulekh region, which is claimed by Nepal. Kathmandu then issued a new map that showed three Indian areas -- Kalapani, Lipulekh and Limpiyadhura -- as part of Nepalese territory. In August, however, Nepal's prime minister KP Sharma Oli called Prime Minister Narendra Modi in what was seen as an effort to reach out to India.

<https://www.livemint.com/news/india/indian-army-chief-naravane-conferred-honorary-rank-of-general-of-nepali-army-11604578448746.html>



*Fri, 06 Nov 2020*

## **Amid tussle with India, China commissions new ‘armored vehicles’ for its border troops**

The Chinese Army (PLA) has reportedly commissioned new off-road armored vehicles for its border forces, giving them an upgraded and more versatile replacement for their older second-generation vehicles.

A battalion attached to the PLA Tibet Military Command recently received the delivery of a batch of assault vehicles, said the command's Sina Weibo account on Tuesday.

Notably, the Tibet Military Command is also involved in a tiring border standoff against the Indian Army in Eastern Ladakh, a no-war-no-peace situation that has claimed the lives of 20 Indian soldiers and an unconfirmed number on the Chinese side.



[CSK-131 Mengshi – Wikipedia](#)

The vehicles, called the “New Generation Assault Vehicles” are made by the Chinese Dongfeng Motor Group under the name “Mengshi”. These are, much like most other Chinese equipment, are said to be copied from the American Hummvee design and are their own equivalent of the Joint Light Tactical Vehicle.

Interestingly, the Indian Army is also testing and evaluating its own armored vehicles in Ladakh. The prime candidate undergoing testing is the Kalyani M4, which would be the closest competitor for PLA's Dongfeng Mengshi.

An APC, jointly developed by Tata and DRDO named “WhAP” is also under trials by the service to replace its aging BMPs.

However, this is not the only case where the third-generation Dongfeng Mengshi is commissioned in the PLA Tibet Military Command.

In a video on October 12, the command announced that a batch of the assault vehicles had entered service with border defense troops based in Xigaze, and in May, the vehicle was briefly seen in a CCTV report on a mortar troops unit of the command, reported GlobalTimes.

The vehicle is pre-equipped with a manually operated turret capable of mounting several types of light and heavy weapons including light- and heavy machine guns and guided missile launchers giving a boost to the PLA forces deployed in the region. These vehicles are particularly helpful in the Tibetan plateau, where the terrain is often demanding and an off-roader's paradise.

The Mengshi chassis has been completely redesigned from their humvee-derivative EQ2060 with new engines and electronics including onboard computers with digital map software and Beidou satellite communication and positioning system, one night-vision camera for the driver, and one for the rear door.

It's one of the two principal light armored vehicles currently fielded by PLA.

In a video that went viral earlier this year, a Chinese Dongfeng CSK-131 vehicle was attacked by the Indian Army during a fight at the Pangong Tso area, without any damage to the combat vehicle.

<https://eurasianimes.com/amid-tussle-with-india-china-commissions-new-armored-vehicles-for-its-border-troops/>



Fri, 06 Nov 2020

## **India determined to protect its territory, says Rajnath Singh as LAC standoff lingers**

*India and China are locked in a protracted tense standoff along the LAC in  
Eastern Ladakh where China unilaterally tried to change the status quo*

*By Mayank Singh*

New Delhi: Defence Minister Rajnath Singh on Thursday said that India has determined to protect its sovereignty and integrity against unilateralism and aggression at any cost.

Rajnath Singh said, "India is determined to protect its sovereignty and territorial integrity in the face of unilateralism and aggression, no matter what the sacrifice."

While highlighting the challenges along the borders, Singh said: "India is a peace-loving country. We believe that differences should not become disputes. We attach importance to the peaceful resolution of differences through dialogue. We are committed to respecting for various agreements and protocols that India has entered into for the maintenance of peace and tranquillity on our borders."

India and China are locked in a protracted tense standoff along the Line of Actual Control (LAC) in Eastern Ladakh where China unilaterally tried to change the status quo.

The Defence Minister was speaking at the diamond jubilee function of the National Defence College, the highest seat of strategic learning in India.

The College was established in 1960 under the Ministry of Defence and has produced many strategic leaders and practitioners, not only from India but also from many friendly foreign countries.

Some of the alumni have risen to become heads of their respective countries, Armed Forces and many have occupied prominent positions of responsibility.

Speaking on the 73 years of independence, Rajanath Singh said that the most fundamental lesson behind the rise and fall of nations taught us was that peace cannot necessarily be achieved by the desire but by the ability to deter war.

"Unfortunately, the mere desire to seek peace, if not reciprocated by others, does not necessarily succeed in building a harmonious environment in a world beset by conflicting ideas of security, sovereignty, and national interests."

India has brought about drastic changes in our security policy which are oriented towards strong, legally and morally tenable actions.

“We have proved that countries that employ terrorism as an instrument of national policy can also be deterred through options that were considered un-implementable in the past.”

Talking about the external environment, Rajnath Singh said, “India has fostered close relationships and partnerships with like-minded friends to further the common interests of countries in the region and beyond. Our strategic partnership with the U.S. is stronger than ever before. Similarly, India’s friendship has grown tremendously with Japan over the last few years as well. We share common concerns with Australia and shared values.”

Minister said, “India also has strong, traditional and deep-rooted relations with Russia. Our two countries have weathered many a challenge in the past through our close understanding and appreciation of each other’s concerns and interests. We continue to build upon our relationship with Russia and especially in the military sphere.”

India has also forged a very special partnership with reliable friends such as France and Israel. “We value their support and will continue to build upon it in the future as well.”

The Defence Minister slammed Pakistan continuing to remain adamant in the use of terrorism as state policy.

“However, we have achieved substantial success in working with progressive and like-minded countries to not only expose Pakistan’s regressive policies but also make it increasingly difficult to continue with its previous business as usual approach,” he said.

Highlighting the evolving and changing character of war a large number of initiatives have been undertaken by us in the recent past in this regard.

“At the structural level, India has a more closely interlinked and coordinated security network. We have not only created the appointment of CDS and established the Department of Military Affairs, but are also in the process of further integrating the armed forces through both theatre and functional commands. Reforms have been initiated at the headquarters level within the Army and the MoD as well.” Minister said.

<https://www.newindianexpress.com/nation/2020/nov/05/india-determined-to-protect-its-territory-says-rajnath-singh-as-lac-standoff-lingers-2219704.html>



## Indian Rafale fighter jet adds Hammer stand-off weapon to its lethal arsenal

*The Hammer weapon can be used for multi-target attack and has zero maintenance due to reduced life cycle cost. With data link capability, the weapon is aware of the hostile environment and has full flexibility to strike at the target*

*By Shishir Gupta*

New Delhi: France has agreed to equip Indian Rafale fighters with air-to-surface Hammer all-weather smart weapon apart from air-to-air MICA, METEOR missiles and air-to-ground SCALP stand-off weapon. The Hammer is a fire and forget weapon that can be launched from a very short range to a very long range of 70 kilometres without availability of GPS and has high resistance to jamming and target location errors.

According to senior officials, the Hammer contract was signed between the two governments in September 2020 and the weapons in large numbers will be delivered to the Golden Arrows Squadron of Indian Air Force station in Ambala by the end of this month. The Hindustan Times is not disclosing the contract or the total numbers.



The second batch of the Rafale fighter which arrived at Jamnagar airbase in Gujarat on Wednesday. (Courtesy: IAF)

The defence cooperation between India and France is such that normally the Hammer weapon would have been delivered to the Indian Air Force (IAF) in a year but the French air force has decided to part with limited weapons from their inventory to cater to New Delhi's urgent requirement. The Rafale fighter is on the frontline of the IAF, which is currently on high state of alert due to People's Liberation Army (PLA) aggression at four points along the Line of Actual Control (LAC). The second batch of three Rafale fighters flew from Bordeaux last night using air-to-air refuellers and joined the Ambala squadron today.

The Hammer weapon can be used for multi-target attack and has zero maintenance due to reduced life cycle cost. With data link capability, the weapon is aware of the hostile environment and has full flexibility to strike at the target. In addition to the use of dedicated warhead and an air burst capacity, the angle of impact can be set up till a full vertical dive for maximum destruction.

While MICA has air-to-air kill at a maximum range of 80 km, the METEOR missile has a beyond visual range touching near 140 km. The SCALP is an air-to-ground stand-off weapon with a 300 km range and a 450 kilogram warhead. It flies just below the speed of sound and had imaging infra-red terminal guidance.

With the arrival of Hammer weapon, the Indian Rafale has now a full armament complement with the capacity to dominate and destroy the adversary, whether it be a JF-17 fighter with Pakistan Air Force or J-20 fighter with the PLA Air Force.

<https://www.hindustantimes.com/india-news/indian-rafale-fighter-jet-adds-hammer-stand-off-weapon-to-its-lethal-arsenal/story-4AzUFBF2vphYF4y8EkjIdI.html>

## Rafale will be wreaked havoc on enemies, it will increase manifold in strength when equipped with Hammer missile

By Bhavi Mandalia

### Highlights:

- **Rafale fighter jet is going to be more powerful**
- **Rafale's strength will increase further after being armed with a Hammer missile.**
- **This is an air to ground missile kit.**
- **Hammer with data link capability is aware of weapons war-like environments**

New Delhi: The second batch of Rafale fighter aircraft has arrived in India amid the ongoing tension along the Line of Actual Control (LAC) in eastern Ladakh with China. With the addition of three more Rafale fighter aircraft to India, the strength of the Indian Air Force has increased. These powerful aircraft are already going to be more powerful. Now these fighter jets are going to be more powerful, because now they will be equipped with Hammer missile. The Hammer means the Highly Agile and Maneuverable Munitions Actuated Range (Hammer), an air-to-ground missile kit. It moves via rocket.

In fact, France has agreed to equip the Indian fighter aircraft Rafale with a hammer. Explain that Rafale is already equipped with deadly MICA, Meteor and SCALP missiles. But now Rafale's strength will increase further after being equipped with Hammer missile. According to the reports, the Hammer is a very dangerous weapon, which can be launched from a very long range of 70 km from a very short distance even without GPS.



Rafale fighter aircraft became part of Indian Air Force

France handed over 5 more Rafale fighter jets to India, Chinese J-20's to become 'Kaal'

### Agreement was reached between the government of India and France

According to reports, the Hammer contract was signed between the governments of India and France in September 2020 and a large number of weapons will be delivered by the end of this month to the Golden Arrow Squadron of the Indian Air Force Station in Ambala. Defense cooperation between India and France is such that Hammer weapons were usually to be delivered to the Indian Air Force within a year, but the French Air Force with limited arms in its inventory to meet New Delhi's immediate need Has decided to participate.

3 Rafale, 5 jets have already arrived in India after landing non-stop from France under tension from China

### How will the hammer weapon benefit?

The Hammer weapon can be used for simultaneous attacks on multiple targets and its maintenance costs are also low. With data link capability, the Hammer weapon is aware of combat-like environments and is fully flexible to hit targets. Explain that Rafael is on the frontline of Combat Air Force, which is on high alert due to the aggression of People's Liberation Army (PLA) at four points along the Line of Actual Control (LAC).

### Rafael reached India without stopping

Let me tell you that the Indian Air Force told that the second batch of Rafale planes flew non-stop from France and reached India at 8:14 pm on Wednesday night. This means that Rafael has

reached India from France without stopping. 3 Rafale fighter jets came from Istres in France to Jamnagar in Gujarat. Significantly, in France, Indian Air Force fighter pilots are already using seven Rafale fighter jets for training.

<https://pledgetimes.com/rafale-will-be-wreaked-havoc-on-enemies-it-will-increase-manifold-in-strength-when-equipped-with-hammer-missile/>

## Amid LAC standoff, Andaman and Nicobar Command conducts joint services exercise

*The exercise focussed on enhancing interoperability and synergy among the three services - Army, Navy and Air Force - to maximise combat potential, officials said*

New Delhi: The Andaman and Nicobar Command (ANC) conducted a three-day joint services exercise code named 'Bull Strike' at the remotely located Teresa Island, military officials said on Thursday.

The drill began on Tuesday and ended on Thursday and saw participation from three services components of the ANC, elements of Indian Army's Parachute Brigade, MARCOS (Marine Commando Force) and Special Forces, officials said.

The exercise focussed on enhancing interoperability and synergy among the three services - Army, Navy and Air Force - to maximise combat potential, officials said.



For representational purposes. (File | EPS)

"The major training activities comprised combat free fall and para drop from strategic lift aircraft C-130 by a company of Para Commandos from the mainland, action by MARCOS of Indian Navy and Special Heli Borne Operations (SHBO) by Indian Army Ghatak platoons," said an official.

As part of the exercise, troops of the Army, Navy and Air Force of the ANC were mobilised for amphibious landing, in close coordination with the para drop (parachute drop) of Special Forces, the officials said.

The exercise was conducted at Teresa island, which is located in the strategically important Nicobar group of islands, they stated.

Ground based manoeuvres, tactics and procedures for joint operations in the Andaman and Nicobar Islands were rehearsed, they added.

In addition, search and rescue (SAR) and medical evacuation procedures were practised by participating troops, they mentioned.

Lieutenant General Manoj Pande, Commander-in-Chief of the ANC, witnessed the exercise on the final day and addressed troops, complimenting them for achieving high standards of training and exhorting them to maintain the highest state of operational readiness at all times, according to the officials.

<https://www.newindianexpress.com/nation/2020/nov/06/amid-lac-standoff-andaman-and-nicobar-command-conducts-joint-services-exercise-2219922.html>

## Russia's Rosoboronexport: India's defence partner is 20 years old

*Despite the global pandemic of COVID-19, ROE has been fulfilling its obligations to customers, and has also been introducing new models of weapons, military equipment and civilian products in the global market*

*By Huma Siddiqui*

The only state intermediary in Russia for the exports and imports of the entire range of products, technologies and services of military and dual-use, Rosoboronexport (ROE) completed 20 years of its existence. According to a senior officer, "India is a reliable partner and a long-standing partner of Rosoboronexport and a number of major projects have been jointly implemented, including the licensed production of multirole Su-30MKI fighter jets in India, the modernization and transfer of the Vikramaditya aircraft carrier to the Indian Navy."

Despite the global pandemic of COVID-19, ROE has been fulfilling its obligations to customers, and has also been introducing new models of weapons, military equipment and civilian products in the global market. The Russian company has also expanded the practice of industrial partnership.

The new advanced weapons including the 59N6-TE radar which has the capability of detecting hypersonic targets, the Boomerang wheeled combat platform, new equipment which can help in combating epidemiological threats have also been launched in the market. As part of its expansion plans, the company has now started Security equipment segment which is good for Homeland security as well as for other law enforcement authorities.

Amidst the growing threat from small-sized unmanned aerial vehicles, the company has also offered its partners a line of special electronic warfare equipment designed to combat them.

Among the new platforms, the T-90MS main battle tank with incomparable firepower, the Sprut-SDM1 light amphibious tank with unique combat capabilities, the-38T medium-class multipurpose helicopter, Project 12701 Alexandrit-E mine countermeasures ship, the Tornado-S long-range multiple launch rocket system, Project 21980E Grachonok special purpose boat, coastal missile systems, work has been started.



**Amidst the growing threat from small-sized unmanned aerial vehicles, the company has also offered its partners a line of special electronic warfare equipment designed to combat them.**

According to Sergey Chemezov, CEO of Rostec and Chairman of the Board of Directors of Rosoboronexport, "Attention to trends, high level of competence and customer needs, have been demonstrated over the years. These suggest that the company has a good prospect for expanding its footprint and deepening cooperation with partners."

### **India and Rosoboronexport**

All the bilateral projects are implemented on the basis of a long-term program of military-technical cooperation and are in line with the Make in India program. The Russian company has been working closely with companies – HAL, OFB, Bharat Forge, Bharat Dynamics, and others.

In order to coordinate the military-technical cooperation, the Indian-Russian Intergovernmental Commission on Military-Technical Cooperation (IRIGC-MTC) was established in 2000, headed by

the Defense Ministers of Russia and India. The current program envisages the implementation of more than 200 joint projects.

**Which are the major projects?**

These include the licensed production of Su-30MKI fighter jets, T-90S/SK tanks, tank shells. The program of comprehensive after-sales service support for the Vikramaditya aircraft carrier is already operational.

The contract for the supply of S-400 Triumph air defence missile systems to India has now become one of the most critical aspects for the entire period of military-technical cooperation between the two countries.

The Su-30MKI program being adopted by the Indian Air Force became a benchmark for a highly effective heavy multi-role fighter jet. Su-30MKI has become the first in the world super manoeuvrable combat aircraft in serial production, and the first in the world fighter jet equipped with the phased-array radar, delivered for export. At the same time, the open architecture of the Su-30MKI avionics makes it possible to further expand its combat capabilities.

<https://www.financialexpress.com/defence/russias-rosoboronexport-indias-defence-partner-is-20-years-old/2121456/>

## Nature-inspired design: Mimicking moth eyes to produce transparent anti-reflective coatings

There are many human problems that scientists and engineers have solved by drawing ideas directly from biomechanisms found in other lifeforms, from Velcro to Japan's famous bullet trains, the Shinkansen. Thus, it should not come as a surprise to know that many remarkable advances in anti-reflective coating were inspired by the peculiar biostructures found in moth eyes.

As mainly nocturnal animals that wish to stay hidden from predators, moths have evolved to develop eyes that are non-reflective. Their eyes have a periodic nanometric structure that makes the eye surface graded, as opposed to polished. This causes most [incident light](#) to bend at the surface and therefore, be transmitted through the eye instead of being reflected off it. This nanoscale arrayed structure is so effective that researchers have tried to mimic it using other materials to create anti-reflective coatings with varying degrees of success.

However, in spite of the recent progress in nanoscience that allows the adoption of this idea for various practical applications, there are still barriers to overcome in terms of scalability and cost of manufacturing. To tackle these problems, scientists from Tokyo University of Science and Geomatec Co., Ltd., Japan, have been working on a novel strategy to produce moth-eye nanostructures and transparent films. In their latest study, published in *Micro and Nano Engineering*, they present a promising method to fabricate moth-eye molds and films at large scales.

Though this research team had previously succeeded in creating moth eye molds made of glassy carbon etched with an oxygen ion beam, this approach was not scalable. "Producing glassy carbon substrates requires the use of powder metallurgy technology, which is difficult to use to produce molds with a large area," explains Professor Jun Taniguchi from Tokyo University of Science, "To overcome this limitation, we tried using only a thin layer of glassy carbon deposited on top of a large regular glass substrate."

Moreover, to make this new strategy feasible, the team opted this time to use an inductively coupled plasma (ICP) system as opposed to the previously used electron-cyclotron resonance ion source. While both devices can etch glassy carbon using a concentrated beam of oxygen ions, ICP technology produces a wider ion beam irradiation range, which is more suitable for working on large-area structures.

After testing with different ICP parameters, the researchers determined that a two-step ICP etching process was best to obtain a high-quality nanostructured mold. Then, they used this mold to produce a transparent film with a moth-eye nanostructure using a UV-curable resin.



Scientists have found a way to produce large area transparent films whose nanostructures are inspired by the moth eye structure. Credit: Ian Lindsay on Pixabay

The optical properties of this film were remarkable; its reflectance toward light in the visible range was only 0.4%, 10 times lower than that of a similar film without the moth-eye nanostructure. What's more, the transmittance of light through the material was also increased, meaning that no trade-off in optical properties occurred as a result of using the film to reduce reflected light.

Mr Hiroyuki Sugawara, chief technical officer at Geomatec, highlights the many possible applications of such anti-reflective films if it were possible to produce them at the meter scale: "We could use these films to improve visibility in flat panel displays, digital signs, and the transparent acrylic plates used everywhere since the start of the COVID-19 pandemic. Moreover, anti-reflective coating could also be an efficient way to improve the performance of solar panels."

This study showcases how to expand the uses of biologically inspired structures by making their fabrication more easily scalable. These advances could also help to preserve nature so that we can keep obtaining useful ideas from other species.

**More information:** Tomoya Yano et al, Moth-eye structured mold using sputtered glassy carbon layer for large-scale applications, *Micro and Nano Engineering* (2020). DOI: [10.1016/j.mne.2020.100077](https://doi.org/10.1016/j.mne.2020.100077)  
<https://phys.org/news/2020-11-nature-inspired-mimicking-moth-eyes-transparent.html>



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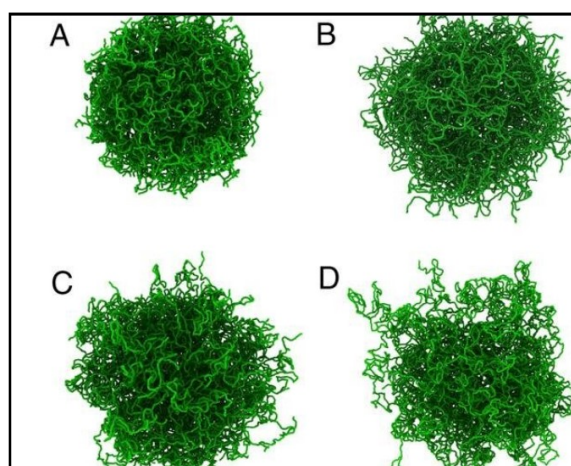
## Dense microgel suspensions reveal in-silico what happens under compression

By John Toon

Microgel suspensions made up of microscopic liquid-filled polymer particles occupy a curious physical state somewhere between liquid and solid, giving them unique properties and potential uses in self-healing structures, optically active materials, microreactors, drug-delivery systems, and templates for regenerating living structures such as bone and muscle.

Using large-scale computer simulations, researchers at the Georgia Institute of Technology have now mapped out the surprising behavior and mechanics of these complex particle-solvent systems, learning how the "soft and squishy" particles deform, swell, de-swell, and penetrate each other as they respond to compression. The findings could help guide the design of microgel-based applications with unique and useful properties.

"We wanted to understand broadly what happens to these particles if you put them together and start compressing them," said Alexander Alexeev, professor and Anderer Faculty Fellow in Georgia Tech's George W. Woodruff School of Mechanical Engineering. "Unlike rigid particles that fill the available space and then stop compressing, these particles have multiple processes that can work in parallel inside the suspension. Microgels can change shape, shrink, and penetrate one another. We found that these processes play a varying role when you increase the particle number density and compress them enough."



Simulation snapshots of swollen microgel particles. (Top) Microgels that have a uniform cross-link distribution, and (Bottom) microgels that have a Gaussian cross-link distribution. Credit: Georgia Tech

Findings of the study were reported October 19 in the journal *Proceedings of the National Academy of Sciences*. The research was supported by the National Science Foundation (NSF) and the MCIU/AEI/FEDER EU, and simulations utilized the NSF's Extreme Science and Engineering Discovery Environment.

Using mesoscale computer simulations, the researchers studied the behavior of compressed suspensions consisting of shape-shifting microgels with different architectures at a variety of packing fractions and solvent conditions. They found that under compression, the "fluffy" microgels—which resemble microscopic sponges with polymer threads extending from them—change shape and shrink, with limited interpenetration among particles.

"You can use their softness and the fact that they change shape to pack them even more," said Alberto Fernandez-Nieves, ICREA Professor in the Department of Condensed Matter Physics at the University of Barcelona and adjunct professor in Georgia Tech's School of Physics. "There are a variety of mechanisms to pack them into an available volume, and these mechanisms may play a different role depending on the situation. Until this study, we didn't quite know how the microgels could be packed together beyond random close packing."

Their ability to release solvent allows the microgels to shrink and deform, unlike hard particles in regular colloidal suspensions. In addition, the polymer threads allow them to interpenetrate and overlap to pack more particles into a given space. The microgel particles range in size from 50 nanometers up to as much as 10 microns in diameter. In their simulations, Alexeev, Fernandez-Nieves, and recent Ph.D. graduate Svetoslav Nikolov studied suspensions containing about a hundred microgel particles.

"Their compressibility is a new ingredient that is not present in other soft particles, and it can bring about the fascinating and unique aspects of these microgel systems," said Fernandez-Nieves. "This study gives us information we need to exploit this softness to achieve things we wouldn't be able to do otherwise."

The simulations provided information about the effects of variables such as solvent type and degree of compression on the mechanical properties of the microgels in the suspension.

"If you look at the mechanical properties of the suspension in different solvents, you see the curves are very different," Alexeev said. "If they are swollen, they are fluffy and can move around in the suspension. If they expel solvent, they can become almost dry, so the mechanical properties can change dramatically. What we found is surprising and not at all what people expected."

Among the key fundamental findings is that the mechanical properties of the suspension can be quantified in terms of the single microgel bulk modulus. "It is how these particles compress that determines the material properties of the whole suspension when it is sufficiently concentrated," Fernandez-Nieves said.

"You can have many different kinds of behavior, but when you scale all the behaviors by the actual compressibility of one microgel, all the behaviors come together," he added. "That means this quantity seems to be the important one to consider to understand the macroscopic properties of the suspension."

The researchers used the NSF's Extreme Science and Engineering Discovery Environment to simulate the microgel systems. While the behavior of ordinary particle-based systems might seem straightforward to study, the compressibility of the microgels coupled with the complexity of the polymer crosslinking made the simulation quite large, Alexeev noted.

"A single particle is already a quite complicated system," he said. "The computational complexity provided findings that we hope will encourage experimentalists to further explore what these unique systems can do."

**More information:** Svetoslav V. Nikolov et al. Behavior and mechanics of dense microgel suspensions, *Proceedings of the National Academy of Sciences* (2020). [DOI: 10.1073/pnas.2008076117](https://doi.org/10.1073/pnas.2008076117)

**Journal information:** [Proceedings of the National Academy of Sciences](https://phys.org/news/2020-11-dense-microgel-suspensions-reveal-in-silico.html)  
<https://phys.org/news/2020-11-dense-microgel-suspensions-reveal-in-silico.html>

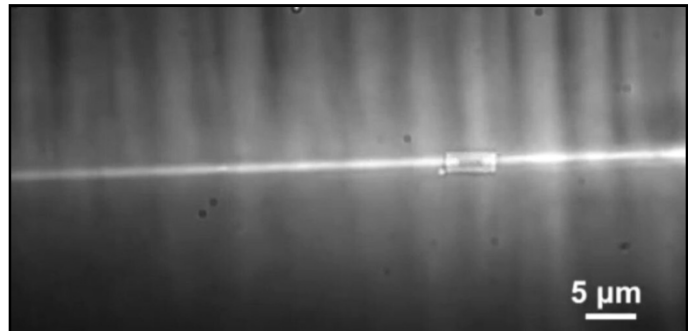


## Nanomotors controlled with laser light

Researchers from the Institute of Industrial Science, the University of Tokyo (UTokyo-IIS) have designed novel linear nanomotors that can be moved in controlled directions using light. This work opens the way for new microfluidics, including lab-on-a-chip systems with optically actuated pumps and valves.

The world of nanoscale machines looks very different to the one containing the contraptions to which we have become accustomed. For example, powering and precisely controlling a motor smaller than a single bacterium can be much more difficult than, say, driving a car.

Now, a team of scientists led by UTokyo-IIS have introduced a system of linear motors made from gold nanorods that



Credit: University of Tokyo

can move in a controlled direction when exposed to laser light. Like a sailboat that can move in any desired direction by adjusting the rigging, these nanomotors are not constrained to follow the direction of the light. Rather, they move based on their orientation even when exposed to a laser beam traveling from another angle.

The motion is powered by the lateral optical force created from the sideways scattering of light from the particles. As a result, the need to focus or shape the laser beam with lenses, which was once a difficult task, is eliminated. In addition, motor sizes are not constrained by the wavelength of light, unlike with previous devices.

"Instead of being limited to moving in the direction of laser light or the field gradient, the direction is determined by the orientation of the nanoparticles themselves," first author Yoshito Tanaka says. The key to this technology is the localized surface plasmon resonance—collective oscillations of free electrons—within periodic arrays of nanorods. These can produce scattered light in a particular direction. "Careful design of the separation between nanorods leads to constructive interference in one direction and destructive interference in the other. This allows us to produce directional scattering to propel the nanomotor," senior author Tsutomu Shimura says.

The researchers envision using this technology to create a new platform for nano-sized machinery with moving parts that follow predetermined paths while being nudged along by unfocused [light](#). This will greatly reduce the cost and complexity of these devices while also improving precision and reliability.

The work is published in *Science Advances* as "Plasmonic linear nanomotor employing lateral optical forces."

**More information:** "Plasmonic linear nanomotor using lateral optical forces" *Science Advances* (2020). [advances.sciencemag.org/lookup.../1126/sciadv.abc3726](https://advances.sciencemag.org/lookup.../1126/sciadv.abc3726)

**Journal information:** [Science Advances](https://phys.org/news/2020-11-nanomotors-laser.html)  
<https://phys.org/news/2020-11-nanomotors-laser.html>

# India-made COVID-19 vaccine could be launched as early as Feb: govt scientist

*launch in February would make COVAXIN the first India-made vaccine to be rolled out*

New Delhi: An Indian government-backed COVID-19 vaccine could be launched as early as February - months earlier than expected - as last-stage trials begin this month and studies have so far showed it is safe and effective, a senior government scientist told Reuters.

**Bharat Biotech**, a private company that is developing COVAXIN with the government-run Indian Council of Medical Research (ICMR), had earlier hoped to launch it only in the second quarter of next year.

“The vaccine has shown good efficacy,” senior ICMR scientist Rajni Kant, who is also a member of its COVID-19 task-force, said at the research body's New Delhi headquarters on Thursday.

“It is expected that by the beginning of next year, February or March, something would be available.”

Bharat Biotech could not immediately be contacted.

A launch in February would make COVAXIN the first India-made vaccine to be rolled out.

India's cases of coronavirus infections rose by 50,201 cases on Thursday to 8.36 million, second only to the United States. Deaths rose by 704, with the total now at 124,315. The daily rise in infections and deaths has slowed since a peak in mid-September.

Kant, who is the head of ICMR's research management, policy, planning and coordination cell, said it was up to the health ministry to decide if COVAXIN shots can be given to people even before the third-stage trials are over.

“It has shown safety and efficacy in the phase 1 and 2 trials and in the animal studies - so it is safe but you can't be 100% sure unless the phase 3 trials are over,” Kant said.

“There may be some risk, if you are ready to take the risk, you can take the vaccine. If necessary, the government can think of giving the vaccine in an emergency situation.”

Health Minister Harsh Vardhan said in September the government was considering granting an emergency authorisation for a COVID-19 vaccine, particularly for the elderly and people in high-risk workplaces.

Several leading vaccine candidates are already in final-stage testing. An experimental vaccine developed by Britain's AstraZeneca is among the most advanced ones, and Britain expects to roll it out in late December or early 2021.

**AstraZeneca** has signed several supply and manufacturing deals with companies and governments around the world, including with the Serum Institute of India.



A scientist prepares samples during the research and development of a vaccine against the coronavirus disease. File | Photo Credit: REUTERS

Other late-stage vaccines are developed by Moderna Inc , Pfizer Inc with partner BioNTech SE, and Johnson & Johnson.

<https://www.thehindu.com/news/national/india-made-covid-19-vaccine-could-be-launched-as-early-as-feb-govt-scientist/article33029671.ece>



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## Scientists identify synthetic mini-antibody to combat Covid-19

*In breakthrough research, scientists have identified synthetic mini-antibodies to combat Covid-19*

Washington: In breakthrough research, scientists have identified synthetic mini-antibodies to combat Covid-19.

The ability of SARS-CoV-2 to infect cells depends on interactions between the viral spike protein and the human cell surface protein ACE2. To enable the virus to hook onto the cell surface, the spike protein binds ACE2 using three finger-like protrusions, called the receptor-binding domains (RBDs). Blocking the RBDs therefore has the potential to stop the virus from entering human cells. This can be done using antibodies.

Nanobodies, small antibodies found in camels and llamas, are promising as tools against viruses due to their high stability and small size. Although obtaining them from animals is time-consuming, technological advances now allow for rapid selection of synthetic nanobodies, called sybodies. A technology platform to select sybodies from large synthetic libraries was recently developed in the lab of Markus Seeger at the University of Zurich, and made available for this study.

### **In search of the best sybody against SARS-CoV-2**

EMBL Hamburg's Christian Low group searched through the existing libraries to find sybodies that could block SARS-CoV-2 from infecting human cells. First, they used the viral spike protein's RBDs as bait to select those sybodies that bind to them. Next, they tested the selected sybodies according to their stability, effectiveness, and the precision of binding. Among the best binders, one called sybody 23 turned out to be particularly effective in blocking the RBDs.

To learn exactly how sybody 23 interacts with the viral RBDs, researchers in the group of Dmitri Svergun at EMBL Hamburg analysed the binding of sybody 23 to the RBDs by small-angle X-ray scattering. In addition, Martin Hallberg at CSSB and Karolinska Institutet used cryo-EM to determine the structure of the full SARS-CoV-2 spike bound to sybody 23. The RBDs switch between two positions: in the 'up' position the RBDs poke out, ready to bind ACE2; in the 'down' position they are furled to hide from the human immune system. The molecular structures revealed that sybody 23 binds RBDs in both 'up' and 'down' positions, and blocks the areas where ACE2 would normally bind. This ability to block RBDs regardless of their position might explain why sybody 23 is so effective.



The ability of SARS-CoV-2 to infect cells depends on interactions between the viral spike protein and the human cell surface protein ACE2. (Pixabay)

Finally, to test if sybody 23 can neutralise a virus, the group of Ben Murrell at Karolinska Institutet used a different virus, called a lentivirus, modified such that it carried SARS-CoV-2's spike protein on its surface. They observed that sybody 23 successfully disabled the modified virus in vitro. Additional tests will be necessary to confirm whether this sybody could stop SARS-CoV-2 infection in the human body.

### **Scientific collaboration during lockdown**

“The collaborative spirit has been enormous in these times, and everybody was motivated to contribute,” says Christian Low, one of the lead scientists in the study. The researchers started the project as soon as they received approval from EMBL leadership to reopen their laboratories during the Covid-19 lockdown. They managed to select the candidate sybodies and perform the analyses in just a few weeks.

“Getting the results so quickly was only possible because the methodologies we used had already been established for other research projects unrelated to SARS-CoV-2. Developing these tools would have taken significantly more time and resources,” says Low.

The results of this project hold out the promise of a potential way to treat Covid-19. In future work, the scientists will perform further analyses to confirm whether sybody 23 could be an effective Covid-19 treatment.

*(This story has been published from a wire agency feed without modifications to the text.)*

<https://www.hindustantimes.com/health/scientists-identify-synthetic-mini-antibody-to-combat-covid-19/story-ujUKWktOA7I3H0KZy9JwIO.html>

