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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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### THEWEEK

Fri, 16 Oct 2020

## Locked and loaded

*The defence industry in India is primed to deliver*

*By Pradip R Sagar*

In a webinar organised by the Federation of Indian Chambers of Commerce and Industry on August 27, Prime Minister Narendra Modi spelt out how the government wanted to make India's defence industry self-reliant. "Our resolve for Atmanirbhar Bharat is not inward-looking," he said. "It is to make India capable and to boost global peace and economy."

India has the third largest annual defence budget (\$70 billion in 2020), behind USA (\$732 billion) and China (\$261 billion). It imports 9.2 per cent of global arms, second only to Saudi Arabia. As much as 30 per cent of India's defence budget is spent on capital acquisitions—90 per cent of them are imports.

In May, Union Finance Minister Nirmala Sitharaman, who held the defence portfolio earlier, raised the automatic-route limit for FDI in the sector to 74 per cent from 49 per cent, allowing foreign players to own a controlling



Promoting local: Defence Expo 2020. India has imposed an import embargo on 101 items, including artillery guns | Arvind Jain

stake in joint ventures with Indian companies. Several other measures were announced to boost domestic production.

Under the 'Make in India' initiative, the government had been trying to increase domestic defence manufacturing and create jobs. The renewed impetus under Atmanirbhar Bharat is aimed at reducing dependence on imported military hardware. To give priority to indigenous items, necessary changes have been made in the defence procurement policy, the guiding document for military procurement.

The government's thrust is evident from the two proposed defence industrial corridors—in Tamil Nadu and Uttar Pradesh—and the launch of the Innovations for Defence Excellence, an initiative to boost technology development. A defence planning committee headed by National Security Adviser Ajit Doval, with the three service chiefs and the secretaries of defence and expenditure as members, was constituted to speed up modernisation of the armed forces.

The defence ministry has bifurcated the procurement budget into two: domestic purchases and foreign procurements. An import embargo has been laid on as many as 101 items—including artillery guns, light military transport aircraft and conventional submarines—worth almost Rs1.3



lakh crore for the Army and Rs1.4 lakh crore for the Navy. Under Atmanirbhar Bharat, the domestic industry will get contracts worth Rs4 lakh crore in seven years.

# DYNAMIC DRDO

A look at what the Defence Research and Development Organisation has accomplished in the past few weeks

## Shaurya

Nuclear capable surface-to-surface missile. An advanced version with a range of around **1,000km** was tested on Oct 3. Soon to be inducted into the Strategic Forces Command, which handles the nuclear arsenal for the three services

## SMART

Anti-submarine torpedo release system. SMART (supersonic missile assisted release of torpedo) was tested on Oct 5. Using it, a torpedo with a range of **10km** can be carried up to **1,000km** by a hypersonic missile before being launched



## BrahMos ER (extended range)

Surface-to-surface cruise missile. The ER version with a range of **400km**, up from **290km**, was tested on Sept 30. BrahMos, developed jointly by India and Russia and first tested in 2001, is capable of striking ships and targets on land. The land cruise missile can hit **Mach 2.8** (2.8 times the speed of sound)

## Rudram

New-generation anti-radiation missile (designed to detect and home in on a radio emission source, typically radar). Tested on Oct 9. It has inertial navigation (internal instruments measure acceleration and position with stored data), GPS and passive homing (enabling it to find and hit a radar installation even if it stops transmitting)

## HSTDV

With HSTDV (hypersonic technology demonstrator vehicle), India joins an elite group of countries—the US, Russia and China—who possess this technology. It has a range of uses, including in development of air defence missiles of the future, surveillance and reconnaissance, and in the development of energy efficient, low cost, reusable satellite launch vehicles

## ATG missile

Laser-guided anti-tank guided missile was test-fired from battle tank Arjun. It can destroy armoured vehicles from a distance of **3km**. ATGMs use different guidance systems like laser, cameras and even wire. DRDO scientists claim some of these are flexible enough to be used from aircraft, land vehicles and by the infantry

## Rustom II

Medium-altitude long endurance drone. The indigenous prototype achieved eight hours of flight at **16,000ft**. DRDO scientists are trying to achieve a height of **26,000ft** and endurance of **18 hours** by the end of 2020. India is trying to get Rustom II to match the specifications of Israel's Heron, which is being used by the Air Force and Navy

GRAPHICS SREEMANIKANDAN S.\RESEARCH PRADIP R. SAGAR

The Defence Research and Development Organisation has come out with a list of 108 systems and subsystems—including unmanned aerial vehicles, mobile decontamination units and marine rocket launchers—that it wants locally designed and manufactured. It has earmarked Rs100 crore to help the private sector, especially the nearly 6,000 micro, small and medium enterprises that supply products and components to defence behemoths. “This will help DRDO focus on more advanced technologies,” said DRDO chief Satheesh Reddy. “The industry will be a partner right from the beginning of all our projects.”

According to Laxman Behra, research fellow at the Institute for Defence Studies and Analyses, the government has simplified policies for private players. “In the next few years, the government will reap the benefit of these policy reforms,” he said. “Efforts are on to provide a level playing field to private players.”

With a well-defined policy and funding commitment in place, the focus is now on the acquisition process and the procedures to ensure ease of doing business. “The four waves of business process restructuring between 2018 and 2019 and the new draft defence acquisition process (DAP 2020) have focused on extensive involvement of the industry in its formulation,” said Jayant Damodar Patil, defence head, Larsen and Toubro. “[It] addresses all generic issues faced by the industry.”

Private players had built infrastructure, capability and capacity over the past few years. L&T, for instance, invested in establishing seven state-of-the-art centres for making weapon and armoured systems, warships and submarines, and missile, aerospace and military communication systems. The next logical step for the government, said Patil, is to expedite placement of orders.

“Programmes worth more than Rs4.1 lakh crore have already been granted acceptance of necessity (AON) by the defence ministry,” he said. “All that is needed is initiating issuance of RFPs (request for proposals) against the AONs, reviewing their progress periodically, and awarding [contracts] in a time-bound manner.”

Granting a level playing field for both public- and private-sector units would be crucial. The defence sector was first opened to private players in 2001, and each subsequent edition of the defence procurement procedure had added provisions to boost the domestic industry. But the complex policies and processes dampened enthusiasm.

The Atmanirbhar drive is expected to finally set things right. “Private players feel that there is still a continued bias towards public-sector undertakings,” Lt Gen (retd) Subroto Saha, member of the national security advisory board under the Prime Minister’s Office, told THE WEEK. “The prime minister’s initiative strives to bridge this gap in indigenisation and self-reliance with greater private-sector participation.”

<https://www.theweek.in/theweek/cover/2020/10/15/locked-and-loaded.html>

## **Explained: Why India's anti-radiation missile Rudram matters**

*What is an anti-radiation missile? How was Rudram developed? How significant are such missiles in aerial warfare? What next for Rudram?*

*By Sushant Kulkarni*

Pune: India's first indigenous anti-radiation missile, Rudram, developed for the Indian Air Force, was successfully flight-tested from a Sukhoi-30 MKI jet off the east coast on Friday.

### **What is an anti-radiation missile?**

Anti-radiation missiles are designed to detect, track and neutralise the adversary's radar, communication assets and other radio frequency sources, which are generally part of their air defence systems. Such a missile's navigation mechanism comprises an inertial navigation system — a computerised mechanism that uses changes in the object's own position — coupled with GPS, which is satellite-based.

For guidance, it has a "passive homing head" — a system that can detect, classify and engage targets (radio frequency sources in this case) over a wide band of frequencies as programmed. Officials said once the Rudram missile locks on the target, it is capable of striking accurately even if the radiation source switches off in between. Officials said the missile has an operational range of more than 100 km, based on the launch parameters from the fighter jet.



The Rudram missile is launched from a Sukhoi-30 MKI.

### **How was Rudram developed?**

Rudram is an air-to-surface missile, designed and developed by the Defence Research and Development Organisation (DRDO). Officials said DRDO initiated development of anti-radiation missiles of this type around eight years ago, and its integration with fighter jets has been a collaborative effort of various DRDO facilities and formations of the IAF and Hindustan Aeronautics Ltd. While the system has been tested from a Sukhoi-30 MKI, it can be adapted for launch from other fighter jets too.

Because the missiles are to be carried and launched from extremely complex and sensitive fighter jets, the development was full of challenges, such as development of radiation seeker technologies and guidance systems, besides integration with the fighter jet, said a DRDO scientist.

An official said the Sanskrit name Rudram was given in keeping with tradition, because it includes the letters ARM (the acronym for anti-radiation missile) and the word in Sanskrit describes a "remover of sorrows" (one of its meanings).

### **How significant are such missiles in aerial warfare?**

Rudram has been developed for the IAF's requirement to enhance its Suppression of Enemy Air Defence (SEAD) capability. As one of the many aspects of SEAD tactics, anti-radiation missiles are used mainly in the initial part of air conflict to strike at the air defence assets of the enemy, and also in later parts, leading to higher survivability to a country's own aircraft. Neutralising or disrupting the operations of the adversary's early warning radars, command and control systems, surveillance systems that use radio frequencies and give inputs for anti-aircraft weaponry, can be very crucial.

Scientists said modern-day warfare is more and more network-centric, which means it comprises elaborate detection, surveillance and communication systems that are integrated with the weapons systems.

## What next for Rudram?

Rudram hit the radiation target with pinpoint accuracy, DRDO said. After the test, Defence Minister Rajnath Singh tweeted to say the test is “a remarkable achievement”.

Officials said some more flights would take place before the system is ready for induction.

<https://indianexpress.com/article/explained/why-anti-radiation-missile-rudram-matters-6718894/>



Fri, 16 Oct 2020

## Atmanirbharta in defence

*Despite the minor setback in the indigenous ATAGS programme,  
India must forge ahead in the nation's interest and for the Army's sake*

*By Lt Gen JP Singh*

The Advanced Towed Artillery Gun System (ATAGS) programme began in 2012, spearheaded by the Defence Research and Development Organisation (DRDO), with two strategic partners — the Bharat Forge Limited (BFL) and Tata Power Strategic Engineering Division (SED). The Defence Acquisition Council (DAC) had ratified the procurement of 150 ATAGS in August 2018. However, the process of developing them started way back in 2013 and concluded by 2017. The howitzer gun system was developed in a record time of 30 months and has gone through extensive trials over the last four years and performed admirably with remarkable consistency.

The ATAGS is one of the most advanced and perhaps the world's first gun which is capable of delivering Bi-Modular Charge System (BMCS) zone seven propellants. With a firing range of 48 km — a record of sorts in the 155 millimetre/52 calibre family — the ATAGS is an appendage to the indigenously developed 155 millimetre/45 calibre artillery gun Dhanush.

Dhanush is a derivative of the FH-77B 155mm/39 calibre towed howitzer, previously built by the Swedish defence contractor Bofors. The Indian Army procured a total of 414 Swedish howitzers between 1987 and 1991. Dhanush howitzers have a maximum effective range of 38 km in salvo mode as compared to the 48 km of the ATAGS.

The India-made ATAGS consists of a dual power system where hydraulics is used for mobility and gun in/out action whereas electrical power is used for the Gun Laying and Ammunition Handling System (AHS). The system is configured with an all-electric drive that ensures maintenance-free and reliable and secure operations over a long period of time. The gun system has automatic setting up, laying with a high-end Inertial Navigation System (INS) and automated AHS, which loads shell, charge and primer simultaneously with a manual back-up for the laying system. The gun system's hydraulic drive provides effective manoeuvrability in different terrains — on roads, cross country, in the desert and in high altitude areas. The high power Auxiliary Power Unit (made in India) also renders effective self-propelled speed, rapid deployment and short response time.



The ATAGS has greater than 95 per cent indigenous components. The complete supply chain, from raw materials to end product, lies within the country, making it a true embodiment of a “Make in India” in defence system. The ATAGS gun system comprises 7,463 components, of which 4,977 are manufactured parts involving about 30,000 manufacturing processes and more than 2,00,000 inspection parameters.

The project is now in the Technology Readiness Level (TRL) stage 10 (as per the DRDO TRL stages), after being put through mandatory trials over the last five years. Earlier this month, it

entered into its last stages of trial — viz the Preliminary Staff Qualitative Requirements (PSQR) trial, which is done prior to its induction into the arsenal system. The gun has already been through a rigorous pre-PSQR trial with the users and DRDO teams. In these trials, the BFL- developed gun system fired a total of 130 plus rounds, mostly in zone seven, and the feedback was that the system has lived up to the parameters.

The gun fielded by Tata Aerospace and Defence Limited succeeded in firing 99 rounds. At the 100th round, which was fifth of the rapid-fire practice, the gun tube sheared off, triggering the first unfortunate incident. The cause is currently being investigated. Some experts blame it on ammunition, while the others want to zero in on the tube and the immense pressure it has been made to withstand. It must be noted that the guns, which have till now fired almost 2,000 rounds between them, can easily tolerate pressure levels up to 560 megapascals and are the only ones to fire munitions in zone seven. As part of the process, an investigation to identify and rectify the causes behind the “shear and structural strain” is a must. It would be detrimental to the cause of Atmanirbhar Bharat to delay or disrupt the processes of development of the ATAGS.

This is the first weapon platform which has been designed and developed from scratch and can boast of being truly Indian. Developed by the DRDO and two major Indian industry partners, nurturing a well-networked ecosystem of Indian vendors and sub-vendors, the ATAGS symbolises national pride. We own the design, its IP and all the data concerning the overall weapon system. Foreign assistance is costly and it will be foolhardy not to build on the successes that we have already achieved so far, notwithstanding minor setbacks. Most of the guns coming from the US, France, Germany, Israel and the Czech Republic, have encountered similar incidents at lower zones of firing, involving lower pressure, during trials. Thus, blaming higher pressure in ATAGS is a bit far-fetched. It is worth mentioning that none of these guns were fired in zone seven and neither fired as many rounds as the ATAGS.

It is a good opportunity to examine the quality and efficacy of the ammunition basket being produced in India as we are relatively new in making artillery munitions, fuses and charges (BMCS in this case). Given the extremely high pressure, every part of the munition, be it the shell, driving bands of the projectile or the fuse, which has to withstand extremely high angular velocity, every component must respond in a zero error manner. All said and done, precision and expertise come with real-time experience and trials. It is unlikely that a foreign vendor will part with core technologies or requisite data to make India atmanirbhar. In the nation’s interest and with the singular objective of giving more teeth to the Army, let us learn to take such incidents in our stride and resolve to forge ahead. India’s ATAGS must succeed.

*(The writer is former Deputy Chief of Army Staff. Views expressed are personal)*

<https://www.dailypioneer.com/2020/columnists/atmanirbharta-in-defence.html>



## Great Confidence

The robust confidence expressed by Dr. G. Sateesh G. Reddy, the dapper Chairman of the Defence Research and Development Organisation (DRDO), that his organisation can make any missile the Indian Armed Forces would ever require, is heartening. It shows what kind of expertise the DRDO has attained over time, making every Indian proud of the country's prowess in creation of appropriate weaponisation of its Armed Forces to suit the requirement on the ground. This point on the DRDO's journey over time has its own importance. For, there was time when the DRDO's strike rate was dismal and many of its promised projects remained only on the paper or lagging at some stage in its laboratories for years.

There was no doubt that some of the country's finest brains worked at the DRDO. Yet, the rate of delivery of the outfit was far from satisfactory, so much so that some persons of substance questioned the very existence of the DRDO on legitimate grounds. The DRDO has progressed tremendously forward from that stage about 25 years ago. It has made some rapid strides in all areas of defence research and design, and its products are in great use by the Armed Forces. Men of the eminence of Dr. A.P.J. Abdul Kalam and many others made signal contribution to this growth -- which became useful in other organisations such as Indian Space Research Organisation (ISRO) and the Bhabha Atomic Research Commission -- that is Atomic Energy Commission (whose foundations were laid by men of eminence like Dr. Vikram Sarabhai and Dr. Homi Bhabha).

Today, Dr. G. Sateesh and his teams stand on that foundation and are in a position to make legitimate and correct claims to excellence. This is a matter of immense and intense pride for all Indian people. Dr. Sateesh has talked about being able to make any missile for the Armed Forces. That shows the depth and height of India's very successful missile programme -- particularly fuelled by the 'Missile Man of India', Dr. A.P.J. Abdul Kalam. India's missiles have won global acclaim over the past couple of decades, making the world's military powers respect the Indian capabilities. This programme is closely linked to the space and nuclear programmes as well, adding special teeth to India's security ideology. Dr. Sateesh's assertions, thus, embody in them the whole story of how India has created a new and great relevance for itself in the international security scenario.

<https://www.thehitavada.com/Encyc/2020/10/16/GREAT-CONFIDENCE.html>



Fri, 16 Oct 2020

## Abdul Kalam remembered on 89th birth anniversary

*By B Madgu Gopal*

Visakhapatnam: The birth anniversary of former President A.P.J. Abdul Kalam was observed by the Bharatiya Janata Party here on Thursday.

BJP Parliamentary District president M. Raveendra recalled the contributions of Dr. Kalam to the Nation and his simplicity despite holding high positions.

Dr. Kalam was born on October 15, 1931 in a middle-class family. He obtained a degree in aeronautical engineering from IIT-Madras in 1958 and aspired to become a fighter pilot in the Indian Air Force. However, he lost the opportunity by a whisker as he finished ninth in the recruitment round while there were only eight posts, Mr. Raveendra said.

Dr. Kalam then joined the Defence Research and Development Organisation (DRDO) and later shifted to the Indian Space Research Organisation (ISRO) in 1969, and became Project Director of the Satellite Launch Vehicle III (SLV-3) project, which was carried out with the first indigenously-designed rocket.

Later, Dr. Kalam became the 11th President of India during NDA rule. His name was proposed by the NDA government and the Congress Party had also extended support, and he became President in 2002.

On completion of his tenure as President, Dr. Kalam took to his favourite pastime of teaching students across the country. He breathed his last while teaching students of IIM-Shillong on July 27, 2015.

BJP leaders S.R.K.K.S. Jagapathi Raja Bahadur, Albert, Jacob, Chokkakula Rambabu and K.V.S.N. Prasad were among those who attended the function.

<https://www.thehindu.com/news/national/andhra-pradesh/abdul-kalam-remembered-on-89th-birth-anniversary/article32865984.ece>

## Defence News

### Defence Strategic: National/International

## THEWEEK

Fri, 16 Oct 2020

# Our requirements provide huge opportunity for domestic industry

*Interview/ Air Chief Marshal Rakesh Kumar Singh Bhadauria, Chief of the air staff*

*By Pradip R Sagar*

Air Chief Marshal Rakesh Kumar Singh Bhadauria led the team that negotiated the purchase of 36 Rafale jets from France, but he is a strong supporter of the Make in India programme. He played a major role in the development of the indigenously-made light combat aircraft Tejas. In an exclusive interview, Bhadauria explained why being self-reliant is the only long-term solution to ensure India's security. Excerpts:

**Q/ How is the Air Force preparing to become self-reliant through the Atmanirbhar Bharat mission?**

**A/** The vision of Atmanirbhar Bharat finds innate resonance with the planning process in the Indian Air Force. The IAF has had indigenously designed aircraft such as HT-2 and HF-24, and versions of Kiran and the [Tejas] MK1. Among indigenously manufactured aircraft are the Gnat, MiG-21, MiG-27, Jaguar, Avro (HS-748), Chetak, Cheetah, Dornier 228, Hawk and Su-30. [Also, the domestic industry has] upgraded MiG-21, MiG-27, MiG-29, Mirage, Jaguar, Dornier 228, An-32 and Mi-17.



**Q/ How self-reliant is the IAF in air-defence systems?**

A/ All our current inductions in the ecosystem of ground-operated radars are either indigenously designed or made by Bharat Electronics Ltd. Among airborne radars, we have already inducted the AEW&C (airborne early warning and control system). We have also inducted indigenous missile systems and locally manufactured early-warning suites for our fighter fleet. Certain critical operation support systems such as the integrated air command and control system (IACCS), the air force network (AFNet) and integrated materials management online system (IMMOLS) are completely home-grown.

**Q/ Which are the future air assets—like fighter jets, transport planes, helicopters and trainer jets—that can be made indigenously?**

A/ The indigenous projects that we wholeheartedly support include the advanced light helicopter, Tejas MK1A and its future upgrades, light combat helicopters, and the HTT-40 trainer jet. In medium- to long-term, we have placed our trust in the fifth-generation advanced medium combat aircraft project. The Avro replacement project, which will be under Make in India, has the potential for orders from the civil sector as well. Overall, our requirements provide a huge opportunity for the domestic aviation industry to evolve rapidly.

**Q/ What is the scope of the Atmanirbhar Bharat mission in the IAF?**

A/ [The Air Force wants] the domestic industry to develop niche technologies specific to military aviation. This is indeed a golden period of opportunity for all stakeholders in the Indian aviation industry. We must remember that in the long run, a strong, indigenous and self-reliant defence ecosystem is the only counter to the technology, weapons and platforms that our adversaries have or will have.

**Q/ Is being self-reliant the only solution to future wars?**

A/ India's wars—today or in the future—will have to be fought by us alone. *Atmanirbharta* is the only long-term solution.

<https://www.theweek.in/theweek/cover/2020/10/15/our-requirements-provide-huge-opportunity-for-domestic-industry.html>

# THE ECONOMIC TIMES

Fri, 16 Oct 2020

## Indian Air Force team in France to make preparations to induct more Rafale jets

**Synopsis**

*The IAF's Rafale project management team has an office in Paris headed by a Group Captain-rank officer. The team is tasked with overseeing the production timelines as well as coordinating training of the crew. A team of experts headed by assistant chief of air staff (projects) reached France earlier this week to coordinate logistical issues as well as training of pilots and technicians.*

New Delhi: As it prepares to induct a second batch of Rafale jets, the Indian Air Force has sent a team of officials to France to oversee the logistical issues and review the training of a hand-picked group of pilots at the Saint-Dizier air base there, officials said on Thursday.

The second batch of four Rafale jets is expected to arrive in India in the next four weeks.

The first batch of five Rafale jets arrived in India on July 29, nearly four years after India signed an inter-governmental agreement with France to procure 36 of these aircraft at a cost of Rs 59,000 crore.

Several teams from the IAF have visited France since January to oversee the progress of the Rafale project including integration of India-specific enhancements and weapons systems, the officials said.

The IAF's Rafale project management team has an office in Paris headed by a Group Captain-rank officer. The team is tasked with overseeing the production timelines as well as coordinating training of the crew.

A team of experts headed by assistant chief of air staff (projects) reached France earlier this week to coordinate logistical issues as well as training of pilots and technicians, said the officials.

The first batch of Rafale jets was finally inducted into the IAF on September 10.

Chief of Air Staff Air Chief Marshal RKS Bhadauria on October 5 said the induction of all 36 Rafale jets will be completed by 2023.

Ten Rafale jets have been delivered to India so far and five of them stayed back in France for imparting training to IAF pilots.

Known for their air-superiority and precision strikes, the Rafale jets are India's first major acquisition of fighter planes in 23 year after the Sukhoi jets were imported from Russia.

The newly inducted fleet has been carrying out sorties in eastern Ladakh where Indian and Chinese troops are engaged in a bitter border row for over five months.

A group of IAF pilots is currently undergoing training on Rafale jets at the Saint-Dizier air base in eastern France.

<https://economictimes.indiatimes.com/news/defence/indian-air-force-team-in-france-to-make-preparations-to-induct-more-rafale-jets/articleshow/78680707.cms>



A Rafale fighter jet taxis on the tarmac during its induction ceremony at an air force station in Ambala, India, September 10, 2020

**INDIA  
TODAY**

*Fri, 16 Oct 2020*

## **Pak continues to push terrorists, arms across LoC, Army effectively thwarting attempts: Gen Naravane**

*Indian Army chief Gen MM Naravane on Thursday said that India has thwarted Pakistan's multiple attempts to push terrorists and arms across the Line of Control*  
*By Manjeet Singh Negi*

Indian Army Chief Gen Manoj Mukund Naravane on Thursday said the Pakistan Army was trying to push as many terrorists and arms as possible before the onset of winters. But the Indian Army's counter-terrorist grid has thwarted such bids effectively, he said.

Speaking to Aajtak and India Today TV, Gen Naravane said, "Pakistan is not letting up on its nefarious design of pushing as many terrorists as they can before the onset of winters. However, our counter-terrorist and counter-infiltration grid is dynamic and very effective as is evident from the number of terrorists that have been neutralised by the security forces and the infiltration attempts that have been foiled on the Line of Control."

From September 24 to October 15, a total of 17 terrorists have been eliminated by security forces which include three foreign terrorists.

On October 14, a suspected BAT (Border Action Team) action bid was foiled in the Tangdhar sector by alert troops when three-four armed intruders were observed to be closing onto a forward post. Prompt action by alert troops averted the infiltration bid after which search and surveillance of the area were coordinated.

While the global Financial Action Task Force (FATF) is meeting later this month to deliberate on Pakistan's compliance with international anti-terrorist financing norms, Pakistan continues to support terrorism by abetting the smuggling of weapons across the Line of Control.

On October 10, alert troops deployed in the Keran Sector of Kupwara foiled a Pakistani attempt to push in arms across the LoC after they noticed 2-3 men transporting four AK 74 Rifles, Eight Magazines and 240 AK Rifle ammunition in a tube tied to a rope across Kishenganga river.

<https://www.indiatoday.in/india/story/pak-continues-to-push-terrorists-arms-across-loc-army-effectively-thwarting-such-attempts-gen-naravane-1731887-2020-10-15>



Fri, 16 Oct 2020

## Zojila tunnel construction work begins, Nitin Gadkari launches blasting process

*The Zojila tunnel, Asia's longest bi-directional one, will connect Srinagar, Dras, Kargil and Leh via a tunnel through the famous Zojila Pass all around the year*

Union Minister Nitin Gadkari on Thursday launched the construction work on Zojila tunnel and exuded confidence that the strategic project which will provide all-year connectivity between Srinagar valley and Leh will be completed ahead of schedule.

"It is a moment of pride for India. I am confident that it will be completed in four years and the Prime Minister will inaugurate it before the code of conduct for the next Lok Sabha elections," the Road Transport, Highways and MSMEs Minister said.

The project has a completion schedule of six years.

Gadkari was addressing an event after the virtual launch of construction work of the 14.15-km Zojila tunnel project through ceremonial first blast.

The project holds strategic significance as Zojila Pass is situated at an altitude of 11,578 feet on the Srinagar-Kargil-Leh National Highway and remains closed during winters due to heavy snowfall.

Once completed, the tunnel, projected as Asia's longest, would reduce the travel time from 3 hours to 15 minutes with avalanche-free travel on the Srinagar-Leh section of NH1.

He said the re-modelling of the project has resulted in savings to the tune of over ₹4,000 crore to the public exchequer without any compromise on safety, security and quality.

The Minister emphasized that with honest efforts, "we can take our country forward at lower costs."

"The watershed moment in the road history of the UTs of Jammu & Kashmir & Ladakh is finally here... One of the most difficult stretches to drive and build, the geo-sensitive Zojila stretch is strategically important to the defence of our country.



Photo of blasting process for Zojila tunnel construction. (Hindustan Times)

"Zojila tunnel will not only provide all-weather connectivity between Srinagar, Drass, Kargil and Leh but it will also further strengthen the economic and social-cultural integration of both the Union Territories," Gadkari said.

This tunnel when completed will be a landmark achievement in the history of modern India, the Minister said.

"It will also be of great importance to the Defence of the country, in view of the fact that massive military activities along our borders in Ladakh, Gilgit and Baltistan regions are taking place," Ministry of Road Transport and Highways (MoRTH) said.

The travel tourism sector will get a maximum boost and generate employment for the locals, the Minister said and added: "We are ensuring robust safety measures in case of any emergency for the travellers crossing the Zojila tunnel."

He assured formation of committees under LG Leh and LG J&K with respective Chief Secretaries and officers of Ministry of Road Transport and Highways, National Highways and Infrastructure Development Corporation Limited (NHIDCL) to oversee tunnel work and to sort out local issues.

Gadkari informed that seven tunnel roads are under construction in the Jammu and Kashmir region. He said, construction of the 8,450-metre-long twin-tube tunnel between Qazigund and Banihal will be completed by the coming March.

The work on 2,968-metre-long 6-single tunnels road between Ramban and Banihal is due for completion in December 2021.

Further, the 450-metre-long tunnel between Khilani and Kishtwar will be ready by June 2022.

The Minister further informed that DPRs (detailed project reports) have been completed for the 4.5-km-long Chenani-Anantnag tunnel, the 10.2-km-long tunnel at Sinthan Pass at a cost of ₹4,600 crore, the ₹350-crore Khakhlani Bypass tunnel, and the 10-km-long tunnel between Chhatru and Anantnag at a cost of ₹5,400 crore and tenders for these will be out shortly.

Gadkari also referred to the construction of Delhi-Katra Green Expressway at a cost of ₹21,000 crore, which will reduce the distance between the two important places to only 650 kms.

He informed that land acquisition is underway for the same, and the work will begin on this stretch by the coming December. He said it is being developed as a modern highway in line with London design of transportation with weather information available to drivers.

The Minister said Udhampur to Ramban highway will be completed by December.

Union Minister Jitendra Singh said the central government has made several schemes for the development of the region.

The Zojila tunnel project was re-awarded this year to Megha Engineering & Infrastructure Ltd (MEIL) which had emerged as the lowest bidder quoting ₹4,509.5 crore. The other two bidders in the race were Larsen & Toubro and Icon International JV.

NHIDCL on January 15, 2019 terminated the contract awarded to troubled IL&FS group company -- IL&FS Transportation -- after it abandoned the project citing financial problems.

In February this year, Gadkari reviewed this project in order to reduce the cost.

"The construction cost of Zojila tunnel was earlier worked out at ₹6,575.85 crore... the total integrated cost of the project including Zojila tunnel and approaches up to Z- Morh tunnel works out to ₹10,643 crores," MoRTH said.

Compared to the present cost of the integrated project, based on the tender received at ₹4,509.5 crore, the total capital cost of the project would be ₹6,808.63 crore, it added.

*This story has been published from a wire agency feed without modifications to the text. Only the headline has been changed.*

<https://auto.hindustantimes.com/auto/news/zojila-tunnel-construction-work-begins-nitin-gadkari-launches-blasting-process-41602755136329.html>

## Zoji La tunnel to give more teeth to Indian army in Ladakh, says Kargil DC

*The tunnel will ensure round the year connectivity to Ladakh as it will bypass Zoji La (pass) which remains snowbound for six months*

*By Ravi Krishnan Khajuria*

Jammu: The 14.15 km long Zoji La (pass) tunnel which will connect Sonmarg to Drass will not only ease physical connectivity of the strategic Ladakh region with rest of India throughout the year but will also help add more teeth to the Indian Army, a top official in Kargil said Thursday.

Work began on the Drass side of the tunnel on Thursday with Union minister for road transport and highways Nitin Gadkari initiating the first blasting of the tunnel.

The tunnel assumes significance in the light of India's standoff with China along the Line of Actual Control (LAC) in eastern Ladakh.

"It was a long pending demand of the people of Ladakh. It will be a strategic tunnel that will connect Ladakh with the rest of India 24x7," Kargil district commissioner Baseer-ul-Haq Choudhary said.

"Obviously, it is going to be a major achievement for us. The tunnel will not only provide physical connectivity to the region but will also establish an emotional connect with the rest of India," he added.

The district commissioner said with this tunnel employment opportunities will open up for the people of Ladakh and supply of essential commodities will also be maintained round the year.

"Ladakh being a tourist destination, this tunnel will give immense impetus to tourism, especially winter tourism like ice hockey, skiing and other activities," he said.

Choudhary also said that from the defence point of view, the tunnel will add more teeth to the Indian security forces in the region and in turn strengthen national security.

"It will be of great importance to the defence forces of the country. This project shall bring to fruition 70 years of overwhelming public demand of Ladakh region," he said.

After infrastructure development and finance company IL&FS went bust, the project that was allotted to it in May 2018 was stopped in July 2018, and the contract was terminated in January 2019 by the National Highways & Infrastructure Development Corporation Limited (NHIDCL). The project was re-awarded to Megha Engineering & Infrastructure LTD (MEIL).

In February, Gadkari reviewed the whole project in detail and the project was approved afresh on May 23.

The construction period is now six years.

The total integrated cost of the project including Zoji La tunnel and approaches up to Z-Morh tunnel works out to Rs 10,643 crores.

The tunnel is being constructed at an altitude of about 3,000 metres under Zoji La pass which connects Srinagar to Leh through Drass and Kargil but remains open for only six months in a year. Heavy snow forces the closure of the road for six months.

<https://www.hindustantimes.com/india-news/zoji-la-tunnel-to-give-more-teeth-to-indian-army-in-ladakh-says-kargil-dc/story-GO1WevqupGbqIG4h5Q1nI.html>



Work began on the Zoji La tunnel near Drass on Thursday with Union Minister Nitin Gadkari initiating the first blast for the project.(HT PHOTO)

## India to deliver kilo class submarine INS Sindhuvir to Myanmar Navy

*It will be the first submarine of the Myanmar Navy which has been ramping up cooperation with the Indian Navy in the last few years*

New Delhi: India on Thursday said it will deliver a kilo class submarine to Myanmar's Navy, a move that comes in the backdrop of China's increasing efforts to expand its military influence in the region.

It will be the first submarine of the Myanmar Navy which has been ramping up cooperation with the Indian Navy in the last few years.

"Cooperation in the maritime domain is a part of our diverse and enhanced engagement with Myanmar. In this context, India will be delivering a kilo class submarine INS Sindhuvir to the Myanmar Navy," Spokesperson in the Ministry of External Affairs Anurag Srivastava said at a media briefing.

The announcement came days after Chief of Army Staff General MM Naravane and Foreign Secretary Harsh Vardhan Shringla travelled to Myanmar on a two-day visit during which they held talks with the top military and political brass of the country including State Counsellor Aung San Suu Kyi.

"We understand that this will be the first submarine of the Myanmar Navy. This is in accordance with our vision of SAGAR Security and Growth for All in the Region, and also in line with our commitment to build capacities and self reliance in all our neighbouring countries," Srivastava said.

Myanmar is one of India's strategic neighbours and shares a 1,640-kilometer-long border with a number of northeastern states including militancy-hit Nagaland and Manipur.

In the last few years, both sides have been ramping up maritime security cooperation.

Kilo class refers to diesel-electric attack submarines that were designed and built in the erstwhile Soviet Union.

The Indian Navy regularly interacts with the Myanmar Navy through staff talks, joint working group meeting on maritime cooperation and other operational interactions which include port visits, coordinated patrols and bilateral exercises.

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

[https://www.business-standard.com/article/current-affairs/india-to-deliver-kilo-class-submarine-ins-sindhuvir-to-myanmar-navy-120101501400\\_1.html](https://www.business-standard.com/article/current-affairs/india-to-deliver-kilo-class-submarine-ins-sindhuvir-to-myanmar-navy-120101501400_1.html)

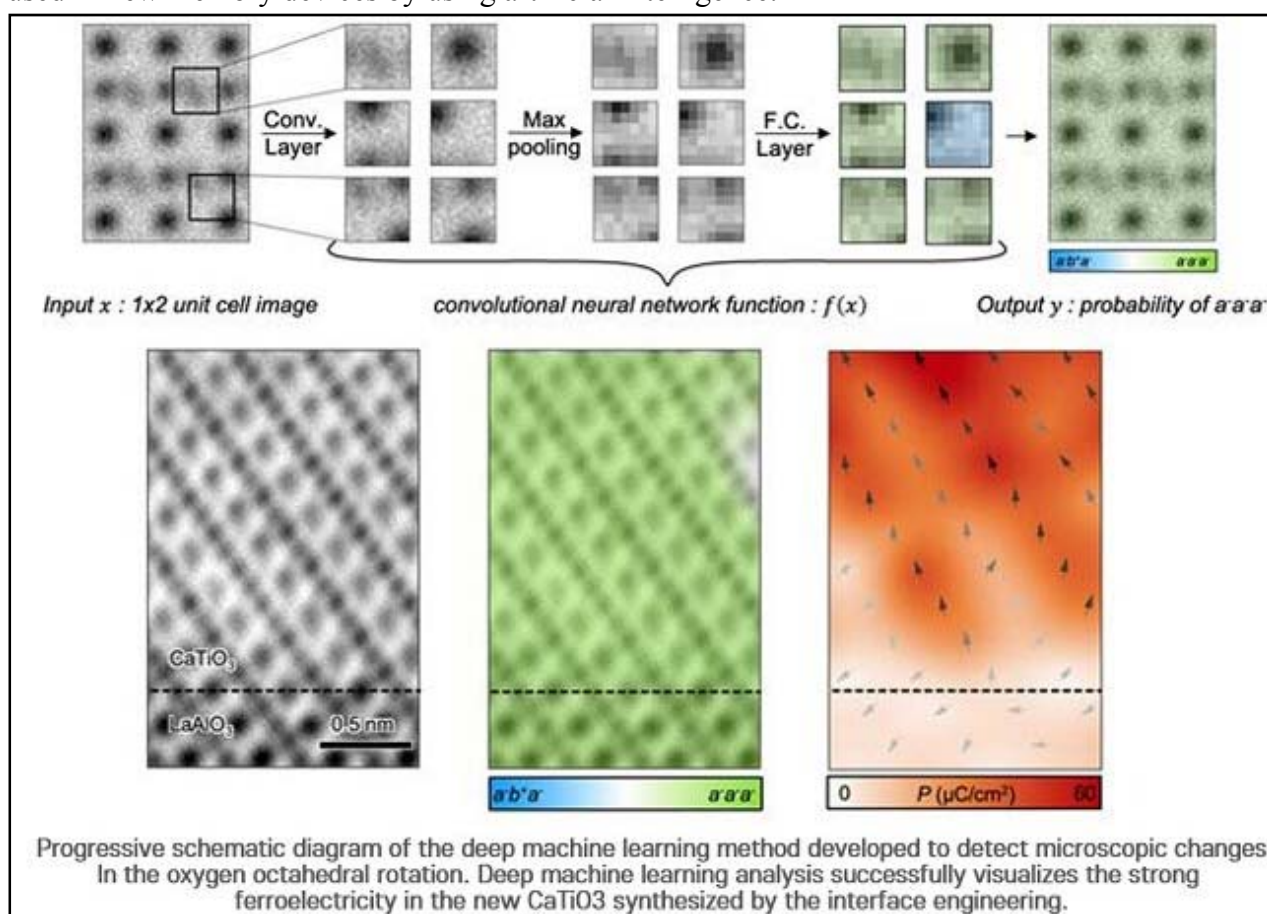


Myanmar is one of India's strategic neighbours and shares a 1,640-kilometer-long border with a number of northeastern states including militancy-hit Nagaland and Manipur.



## Making new materials using AI

There is an old saying, "If rubber is the material that opened the way to the ground, aluminum is the one that opened the way to the sky." New materials were always discovered at each turning point that changed human history. Materials used in memory devices are also drastically evolving with the emergence of new materials such as doped silicon materials, resistance changing materials, and materials that spontaneously magnetize and polarize. How are these new materials made? A research team from POSTECH has revealed the mechanism behind making materials used in new memory devices by using artificial intelligence.



Credit: Pohang University of Science & Technology (POSTECH)

The research team led by Professor Si-Young Choi of Department of Materials Science and Engineering and the team led by Professor Daesu Lee of the Department of Physics at POSTECH have together succeeded in synthesizing a novel substance that produces electricity by causing polarization (a phenomenon in which the position of negative and positive charges is separated from the negative and positive charges within the crystal) at room temperature and confirmed its variation in the crystal structure by applying deep neural network analysis. This paper was published in a recent issue of *Nature Communications*.

The atomic structures of perovskite oxides are often distorted and their properties are determined by the oxygen octahedral rotation (OOR) accordingly. In fact, there are only a few

stable OOR patterns present at equilibrium and this inevitably limits the properties and functions of perovskite oxides.

The joint research team focused on a perovskite oxide called  $\text{CaTiO}_3$  which remains nonpolar (or paraelectric) even at the absolute temperature of 0K. Based on the ab-initio calculations, however, the team found that a unique OOR pattern that does not naturally exist would be able to facilitate the ferroelectricity, a powerful polarization at room temperature.

In this light, the research team succeeded in synthesizing a novel material (heteroepitaxial  $\text{CaTiO}_3$ ) that possesses the ferroelectricity by applying interface engineering that controls the atomic structures at the interface and accordingly its physical property.

In addition, deep neural network analysis was applied to examine the fine OOR and the variation of a few decades of picometer in the atomic structures, and various atomic structures were simulated and data were utilized for AI analysis to identify artificially controlled OOR patterns.

"We have confirmed that we can create new physical phenomena that do not naturally occur by obtaining the unique OOR pattern through controlling the variation in its atomic structure," remarked Professor Daesu Lee. "It is especially significant to see that the results of the convergent research of physics and new materials engineering enable calculations for material design, synthesis of novel materials, and analysis to understand new phenomena."

Professor Choi explained, "By applying the deep machine learning to materials research, we have successfully identified atomic-scale variations on tens of picometers that are difficult to identify with the human eye." He added, "It could be an advanced approach for materials analysis that can help to understand the mechanism for creating new materials with unique physical phenomena."

**More information:** Jeong Rae Kim et al, Stabilizing hidden room-temperature ferroelectricity via a metastable atomic distortion pattern, *Nature Communications* (2020). DOI: [10.1038/s41467-020-18741-w](https://doi.org/10.1038/s41467-020-18741-w)

**Journal information:** [Nature Communications](https://phys.org/news/2020-10-materials-ai.html)  
<https://phys.org/news/2020-10-materials-ai.html>



*Fri, 16 Oct 2020*

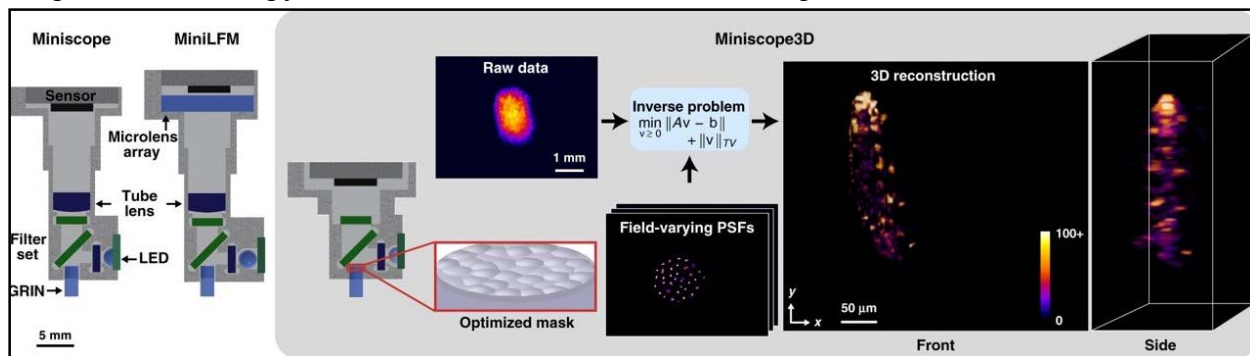
## **Miniscope3D—A single-shot miniature three-dimensional fluorescence microscope**

*By Thamarasee Jeewandara*

A miniature fluorescence microscope that weighs less while offering high resolution compared to existing devices will have a range of applications in systems biology. Existing miniature fluorescence microscopes are a standard technique in life sciences, but they only offer two-dimensional (2-D) information. In a new report now on *Nature Light: Science & Applications*, Kyrollos Yanny, Nick Antipa and a team of scientists in the Joint Graduate Program in Bioengineering, Electrical Engineering and Computer Sciences at the University of California, Berkeley and the Universite libre de Bruxelles Belgium, developed a single-shot 3-D fluorescence microscope. They engineered the new device known as the Miniscope3D by replacing the tube lens of a conventional 2-D miniscope with an optimized multifocal phase mask at the objective's aperture stop. Using the device, Yanny and Antipa et al. optically recorded neural activity in free-moving animals and in long-term in situ imaging applications in incubators and within lab-on-a-chip devices.

## Miniature fluorescence imaging and technical innovations

Miniature fluorescence microscopes are important in systems biology for optical recordings of neural activity in free-moving animals, long-term in situ imaging in incubators and medical devices. Such microscopes are also known as "miniscopes" and are made of 3-D printed parts, although offering 2-D fluorescence imaging alone. Single-shot methods can enable faster capture speeds and a temporal resolution limited by the camera frame rate. For example, a previously developed miniature light-field microscope (MiniLFM) can process neural activity with an optimized algorithm. In this work, Yanny et al. developed a 3-D miniscope to achieve higher resolution with lighter weight compared to existing techniques. The team tested the microscopic capabilities by imaging fluorescent resolution targets as well as freely swimming biological samples and mouse brain tissue. They validated the reconstructed outcomes in comparison with two-photon microscopy to understand limits of the new technique.



**Miniscope3D system overview.** Compared with previous Miniscope and MiniLFM designs, our Miniscope3D is lighter weight and more compact. We remove the Miniscope's tube lens and place a 55  $\mu\text{m}$  thick optimized phase mask at the aperture stop (Fourier plane) of the GRIN objective lens. A sparse set (64 per depth) of calibration point spread functions (PSFs) is captured by scanning a 2.5  $\mu\text{m}$  green fluorescent bead throughout the volume. We use this data set to pre-compute an efficient forward model that accurately captures field-varying aberrations. The forward model is then used to iteratively solve an inverse problem to reconstruct 3D volumes from single-shot 2D measurements. The 3D reconstruction here is of a freely swimming fluorescently tagged tardigrade. Credit: Light: Science & Applications, doi: 10.1038/s41377-020-00403-7

To achieve high-quality imaging in a small, low-weight device, Yanny et al. placed the phase mask (where light passing through the mask will undergo a phase-shift proportional to the thickness of the material) in Fourier space to reduce computational burden and improve compactness. They added 3-D capabilities to the 2-D miniscope at the cost of a small loss in lateral resolution and lower signal-to-noise ratio. The algorithm united the optical theory with compressed sensing to fabricate the optimized phase masks. The technique facilitated a new miniature 3-D [microscope](#) architecture with higher resolution, open-source designs, higher-quality fabrication and an efficient calibration scheme or reconstruction algorithm.

### Characterizing the computational microscope and investigating the mouse brain

The team tested the performance of the computational microscope using samples of increasing complexity to capture 3-D dynamic recordings. They measured the lateral resolution at different depths by imaging a fluorescent resolution target. They then validated the accuracy of their results using two-photon microscopy. For example, the Miniscope3D could accurately recover all reconstructed images of the 3-D fluorescent bead sample post-processing. They showed the potential of the method using neuro-biological samples where green fluorescent protein tagged regions expressed sparse populations of neurons throughout the sample. The reconstructed images obtained from different parts of the hippocampus showed dendrites running across the surface alongside individual cell bodies. When Yanny et al. next investigated dynamic samples of free-swimming, green-dyed tardigrades (also known as water bears), the reconstructed images showed the efficiency of Miniscope3D imaging to track freely moving biological organisms at high resolution in space-time.

### Applications and accessibility of the device

Most applications of Miniscope3D will be similar to 3-D microscopy and MiniLFM (miniature light-field microscopy), which is considered the gold standard for single-shot miniature 3-D

fluorescence imaging. Compared to MiniLFM, however, the new Miniscope3D method offered multiple improvements including multifocal lenses, best—case lateral resolution and a 10-fold increase in the useable measurement volume. The improved performance arrived in a hardware package smaller than the MiniLFM with lighter weight to freely observe moving organisms. The method further enabled experimental reconstruction with or without scattering for mouse brain tissue at single neuron resolution. The team will optimize existing limits of the device including scattering, for further applications.

By building upon a popular open-source miniscope platform, Yanny et al. provided accessibility for the Miniscope3D design. In this way, Kyrollos Yanny, Nick Antipa and colleagues provided a 3-D prototype as an opportunity to upgrade the 2-D miniscopes currently in use across 450 laboratories. The experimental results were in good agreement with the theoretical design and analysis to serve as a useful framework for customized single-shot 3-D systems.

**More information:** Kyrollos Yanny et al. Miniscope3D: optimized single-shot miniature 3-D fluorescence microscopy, *Light: Science & Applications* (2020). DOI: [10.1038/s41377-020-00403-7](https://doi.org/10.1038/s41377-020-00403-7)

Kunal K Ghosh et al. Miniaturized integration of a fluorescence microscope, *Nature Methods* (2011). DOI: [10.1038/nmeth.1694](https://doi.org/10.1038/nmeth.1694)

Jesse K. Adams et al. Single-frame 3-D fluorescence microscopy with ultraminiature lensless FlatScope, *Science Advances* (2017). DOI: [10.1126/sciadv.1701548](https://doi.org/10.1126/sciadv.1701548)

**Journal information:** [Light: Science & Applications](#), [Nature Methods](#), [Science Advances](#)  
<https://phys.org/news/2020-10-miniscope3da-single-shot-miniature-three-dimensional-fluorescence.html>



Fri, 16 Oct 2020

## ATLAS Experiment releases new search for long-lived particles

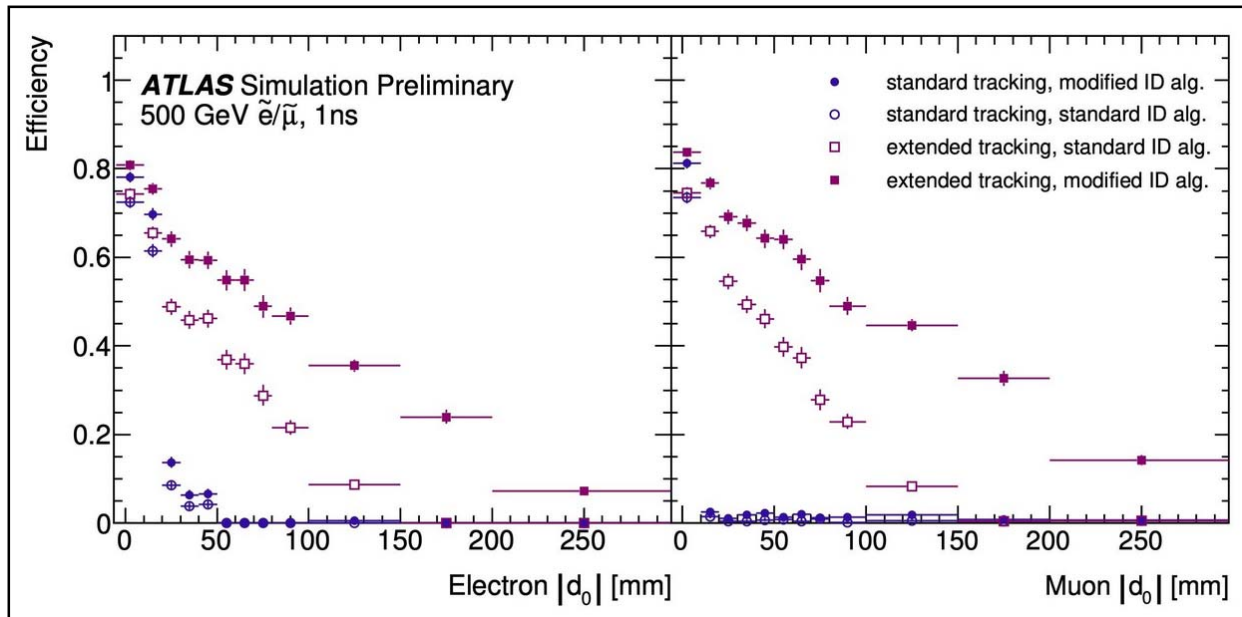
Despite its decades of predictive success, there are important phenomena left unexplained by the Standard Model of particle physics. Additional theories must exist that can fully describe the universe, even though definitive signatures of particles beyond the Standard Model have yet to turn up.

Researchers at the ATLAS experiment at CERN are broadening their extensive search program to look for more unusual signatures of unknown physics, such as long-lived particles. These new particles would have lifetimes of 0.01 to 10 ns; for comparison, the Higgs boson has a lifetime of  $10^{-13}$  ns. A theory that naturally motivates long-lived particles is supersymmetry (SUSY). SUSY predicts that there are "superpartner" particles corresponding to the particles of the Standard Model with different spin properties.

A new search from the ATLAS Collaboration looks for the superpartners of the electron, muon and tau lepton, called "sleptons" ("selectron", "smuon", and "stau", respectively). The search considers scenarios where sleptons would be produced in pairs and couple weakly to their decay products and so become long-lived. In this model, each long-lived slepton would travel some distance (depending on their average lifetime) through the detector before decaying to a Standard Model lepton and a light undetectable particle. Physicists would thus observe two leptons that seem to come from different locations than where the proton–proton collision occurred.

This unique signature presented a challenge for physicists. Although many theories predict particles that could travel in the ATLAS detector for some time before decaying, typical data reconstruction and analysis is oriented towards new particles that would decay instantaneously, the way heavy Standard Model particles do. ATLAS physicists thus had to develop new methods of identifying particles in order to increase the likelihood of reconstructing these "displaced" leptons.

Only displaced electrons and muons were studied in this analysis, but the results could be applied to taus as well, since taus decay promptly into an electron or a muon in around one third of cases.



The efficiency of reconstructing a lepton from the decay of a long-lived particle, measured in simulated events, shown as a function of the distance between the lepton track and the collision point ( $d_0$ ). The solid blue circles show the efficiency using standard ATLAS reconstruction techniques. The solid purple squares indicate the efficiency using additional tracking for displaced particles and special identification criteria developed for this search. Credit: ATLAS Collaboration/CERN

Because the particles created by the decay of a long-lived particle would appear away from the collision, unusual background sources can arise: photons mis-identified as electrons, muons that are mis-measured, and poorly measured cosmic-ray muons. Cosmic-ray muons come from high-energy particles colliding with our atmosphere and can traverse the ATLAS detector. Since they do not necessarily pass through the detector near the collision point, they can appear as if originating from a long-lived particle decay. ATLAS physicists have developed techniques not only for reducing these sources' contributions but also for estimating how much each contributes to the search.

The analysis did not find any collision events with displaced leptons that passed the selection requirements, a result that is consistent with the low expected background abundance. Using these results, physicists set limits on the slepton mass and lifetime. For the slepton lifetime that this search is most sensitive to (around 0.1 nanoseconds) ATLAS was able to exclude selectrons and smuons up to a mass of around 700 GeV, and staus up to around 350 GeV. The previous best limits on these long-lived particles were around 90 GeV and came from the experiments on the Large Electron–Positron Collider (LEP), CERN's predecessor to the LHC. This new result is the first to make a statement on this model using LHC data.

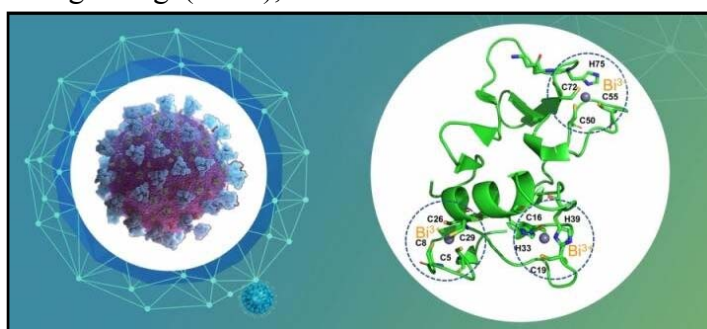
**More information:** Search for displaced leptons in 13 TeV proton-proton collisions with the ATLAS detector (ATLAS-CONF-2020-051): [cds.cern.ch/record/2740685](https://cds.cern.ch/record/2740685)  
<https://phys.org/news/2020-10-atlas-long-lived-particles.html>

## Novel antiviral strategy for treatment of COVID-19

A research team led by Professor Hongzhe SUN, Norman & Cecilia Yip Professor in Bioinorganic Chemistry, Department of Chemistry, Faculty of Science, and Professor Kwok Yung YUEN, Henry Fok Professor in Infectious Diseases, Department of Microbiology, Li Ka Shing Faculty of Medicine of the University of Hong Kong (HKU), has discovered a novel antiviral strategy for treatment of COVID-19.

They discovered that a class of metallodrugs currently used in the treatment of other infectious diseases is showing efficacy to potently suppress SARS-CoV-2 replication and relieve viral-associated symptoms in an animal model.

The findings provide a new and readily available therapeutic option with high clinical potential for infection with SARS-CoV-2. This ground-breaking work has been published online in a top-class scientific journal *Nature Microbiology*. A related patent has been filed in the US.



Proposed structure of Bi-bound zinc-binding domain of SARS-CoV-2 helicase. Through kicking out the crucial zinc(II) ions in the zinc-binding domain of SARS-CoV-2 helicase, RBC demonstrated its ability to potently suppress the replication of SARS-CoV-2. Credit: The University of Hong Kong

SARS-CoV-2 is an emerging coronavirus that has caused over 30 million laboratory-confirmed cases and more than 1 million deaths globally of COVID-19 since December 2019. As the process of developing an effective vaccine is still ongoing, another approach for prevention and treatment of the disease is to identify anti-COVID-19 agents from existing virus-specific antiviral drugs to repurpose their uses to target the new virus. Remdesivir, a broad-spectrum antiviral drug, has been reported to show efficacy towards SARS-CoV-2. However, global shortage of the drug, its relatively high price and lack of significant clinical benefits in severe cases, are factors that have limited its wider applications. Clinical trials on a series of antiviral agents are still ongoing which have yet to demonstrate therapeutic efficacies. Therefore, greater efforts are needed to extend the evaluation to cover a wider spectrum of clinically approved drugs, which hopefully could open the way to alternative treatment strategies against the disease through some readily available channels.

Generally, metal compounds are used as anti-microbial agents; their antiviral activities have rarely been explored. After screening a series of metallodrugs and related compounds, the research team identified ranitidine bismuth citrate (RBC), a commonly used anti-ulcer drug which contains the metal Bismuth for treatment of *Helicobacter pylori*-associated infection, as a potent anti-SARS-CoV-2 agent, both in vitro and in vivo.

RBC targets the vital non-structural protein 13 (Nsp13), a viral helicase essential for SARS-CoV-2 to replicate, by displacing the crucial zinc(II) ions in the zinc-binding with Bismuth-ions, to potently suppress the activity of the helicase.

RBC has been demonstrated to greatly reduce viral loads by over 1,000-folds in SARS-CoV-2-infected cells. In particular, in a golden Syrian hamster model, RBC suppresses SARS-CoV-2 replications to reduce viral loads by ~100 folds in both the upper and lower respiratory tracts, and

mitigates virus-associated pneumonia. RBC remarkably diminishes the level of prognostic markers and other major pro-inflammatory cytokines and chemokines in severe COVID-19 cases of infected hamsters, compared to the Remdesivir-treated group and control group.

RBC exhibits a low cytotoxicity with a high selectivity index at 975 (the larger the number the safer the drug), as compared to Remdesivir which has a low selectivity index at 129. The finding indicates a wide window between the drug's cytotoxicity and antiviral activity, which allows a great flexibility in adjusting its dosages for treatment.

The team investigated the mechanisms of RBC on SARS-CoV-2 and revealed for the first time the vital Nsp13 helicase as a druggable target by RBC. It irreversibly kicks out the crucial zinc(II) ions in the zinc-binding domain to change it to bismuth-bound via a distinct metal displacement route. RBC and its Bi(III) compounds dysfunctionalised the Nsp13 helicase and potently inhibited both the ATPase (IC<sub>50</sub>=0.69 μM) and DNA-unwinding (IC<sub>50</sub>=0.70 μM) activities of this enzyme.

The research findings highlight viral helicases as a druggable target, and the high clinical potential of bismuth (III) drugs and other metallodrugs for treatment of SARS-CoV-2 infections. Hopefully, following this important breakthrough, more antiviral agents from readily available clinically approved drugs could be identified for potential treatment of COVID-19 infections. They can be in the form of combination regimens (cocktails) with drugs that exhibit anti-SARS-CoV-2 activities including RBC, dexamethasone and interferon-β1b.

**More information:** Shuofeng Yuan et al. Metallodrug ranitidine bismuth citrate suppresses SARS-CoV-2 replication and relieves virus-associated pneumonia in Syrian hamsters, *Nature Microbiology* (2020). DOI: [10.1038/s41564-020-00802-x](https://doi.org/10.1038/s41564-020-00802-x)

**Journal information:** [Nature Microbiology](https://www.nature.com/news/2020-10-antiviral-strategy-treatment-covid-19)  
<https://phys.org/news/2020-10-antiviral-strategy-treatment-covid-.html>

