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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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### **Raksha Mantri Shri Rajnath Singh hands over DRDO developed products to Armed Forces**

*Shri Rajnath Singh expressed confidence that DRDO would  
be successful in developing futuristic warfare technologies*

#### **Key Highlights**

- **Five DRDO developed products handed over to the Armed forces and other security agencies**
- **Six Transfer of Technology (ToT) agreements executed with seven public and private sector companies**

Raksha Mantri Shri Rajnath Singh handedover five Defence Research and Development Organisation (DRDO) developed products to the Armed forces and other security agencies at an event held at DRDO Bhawan, New Delhi on December 14, 2021, as part of Azadi Ka Amrit Mahotsav celebrations and iconic week of Ministry of Defence. He also handed over six Transfer of Technology (ToT) agreements to seven public and private sector companies. Earlier DRDO organised a Seminar on “Preparing For The Future” where Vice Chiefs of the Armed Forces and DRDO Scientists shared their views.

Speaking on the occasion, the Raksha Mantri said, such seminars help in meeting of the minds and evolving a common strategy to face enemy threats.

Shri Rajnath Singh said, “When we talk about integration and jointness, it is not limited to initiatives taken by government alone. Its success has to be achieved by meeting of minds of our defence forces. It is an effort to jointly enhance our capabilities to face the challenges posed by our adversaries.” “The integration we talk about, is not limited to our the forces but also it means synergy among every concerned organisation in the country,” he added.

He added that there has been a big change over the last few years in the approach of DRDO whereby it was not only working on technologies to mitigate current threats but also on first-of-its-kind technologies to face the future challenges.

On the objective of making India a strong platform of defence manufacturing base and net defence exporter, Raksha Mantri said DRDO has played a significant role in this endeavour. “Its path passes through collaboration among DRDO, the Armed Forces, Private industry, start-ups and academia. The ToT with private players which took place today indicate that we are ready to make a strong defence industrial base in the country that will cater not only the domestic defence requirements but also will fulfill needs of friendly countries by defence item exports.”

Paying tribute to late Chief of Defence Staff (CDS), General Bipin Rawat and others who lost their lives in an air crash recently, the Raksha Mantri said that the process of integration and modernisation of Tri-Services that was initiated with creation of post of CDS and Department of

Military Affairs will move on seamlessly and will be priority of the government to achieve the target as soon as possible.

Emphasizing the role of technology in warfare, Shri Rajnath Singh said our aim should be to make India a leader in the defence technology and identified development of Hypersonic cruise missile as one such advanced technology for which all should work together.

Citing the scientific prowess of DRDO in developing Mission Shakthi, Raksha Mantri said DRDO is working on smart materials, Artificial Intelligence, Machine Learning based systems, Swarm drones, Asymmetric warfare etc.

Shri Rajnath Singh said the Government is working in a concerted manner to realize the objective of Make in India and Make for the World by bringing in several policy reforms such as increasing FDI in Defence sector through automatic route to 74%, Corporatisation of OFB, creation of defence corridors in Uttar Pradesh and Tamil Nadu, formulation of Defence Production and Export Promotion Policy 2020, bringing out positive lists of defence items for domestic manufacturing etc. He added that these policies aim to make our Armed Forces strong by strengthening domestic defence industry.

Products handed over to the Armed Forces & Ministry of Home Affairs are Anti-Drone system, Modular Bridge, Smart Anti Airfield Weapon, Chaff Variants and the Light Weight Fire Fighting Suit. The counter drone systems, developed by DRDO for detection, deterrence and destruction of incoming drones was handed over to the CISC by the Raksha Mantri. He also handed over the Modular Bridge to the Chief of Army Staff General M M Naravane. Modular bridge developed by R&DE (Engineers) is a single span, mechanically launched assault bridge of military load class MLC-70, and can be launched in different spans.

The Raksha Mantri handed over Smart Anti Airfield Weapon (SAAW), an air launched, long-range, stand-off, air-to-surface Smart Bomb, to the Chief of the Air Staff Air Chief Marshal V R Chaudhari. The variants of Advanced Chaff were handed over to the Chief of the Naval Staff Admiral R Hari Kumar. Structural fire-fighting suit developed by DRDO's Centre for Fire, Explosive and Environment Safety (CFEES), Delhi was handed over to Shri V S K Kaumudi, Special Secretary, MHA.

The LAToT documents of seven DRDO developed systems were handed over during the event for the systems/technologies namely Coastal Surveillance Radar, Automatic Chemical Agent Detection and Alarm (ACADA) & Chemical Agent Monitor (CAM), Unit Maintenance Vehicle, Unit Repair Vehicle, Fused Silica based Ceramic Core technology and the Fire Suppressing Gel.

Secretary, DDR&D and Chairman, DRDO Dr G Satheesh Reddy; Vice Chiefs of Army, Navy and Air Staff, other senior civil and military officials of Ministry of Defence and Home Affairs were also present on the occasion.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1781416>



## रक्षामंत्री श्री राजनाथ सिंह ने डीआरडीओ द्वारा विकसित उत्पाद सशस्त्र बलों को सौंपे

श्री राजनाथ सिंह ने डीआरडीओ द्वारा भविष्य की युद्ध संबंधी प्रौद्योगिकी  
सफलतापूर्वक विकसित किए जाने को लेकर भरोसा जताया

मुख्य विशेषताएं:

- डीआरडीओ द्वारा विकसित पांच उत्पाद सशस्त्र बलों और अन्य सुरक्षा एजेंसियों को सौंपे गए
- सात सार्वजनिक और निजी क्षेत्र की कंपनियों के साथ छह प्रौद्योगिकी हस्तांतरण (टीओटी) समझौते किए गए

रक्षामंत्री श्री राजनाथ सिंह ने रक्षा अनुसंधान और विकास संगठन (डीआरडीओ) द्वारा विकसित उत्पाद 14 दिसंबर, 2021 को डीआरडीओ भवन, नई दिल्ली में आजादी का अमृत महोत्सव समारोह और रक्षा मंत्रालय द्वारा मनाए जा रहे विशेष सप्ताह के तहत आयोजित एक कार्यक्रम में सशस्त्र बलों और अन्य सुरक्षा एजेंसियों को सौंपे। उन्होंने सात सार्वजनिक और निजी क्षेत्र की कंपनियों को छह प्रौद्योगिकी हस्तांतरण (टीओटी) समझौते भी सौंपे। इससे पहले डीआरडीओ ने 'भविष्य की तैयारी' विषय पर एक संगोष्ठी का आयोजन किया जिसमें सशस्त्र बलों के उप प्रमुखों और डीआरडीओ के वैज्ञानिकों ने अपने विचार साझा किए।

इस अवसर पर रक्षामंत्री ने कहा, इस तरह के सेमिनार से शीर्ष नेतृत्व का समागम और दुश्मन के खतरों का सामना करने के लिए एक आम रणनीति विकसित करने में मदद मिलती है।

श्री राजनाथ सिंह ने कहा, "जब हम एकीकरण और संयुक्तता की बात करते हैं, तो यह सिर्फ सरकार द्वारा की गई पहलों तक सीमित नहीं है। इसकी सफलता हमारे रक्षा बलों के शीर्ष नेतृत्व के समागम से हासिल करनी है। यह हमारे विरोधियों द्वारा पेश की गई चुनौतियों का सामना करने के लिए संयुक्त रूप से हमारी क्षमताओं को बढ़ाने का एक प्रयास है।"

उन्होंने कहा, "हम जिस एकीकरण की बात करते हैं, वह हमारे बलों तक ही सीमित नहीं है, बल्कि इसका मतलब देश के हर संबंधित संगठन के बीच तालमेल भी है।"

उन्होंने कहा कि पिछले कुछ वर्षों में डीआरडीओ के दृष्टिकोण में एक बड़ा बदलाव आया है जिससे यह न सिर्फ मौजूदा खतरों की गंभीरता को कम करने वाली प्रौद्योगिकी पर काम कर रहा है बल्कि भविष्य की चुनौतियों का सामना करने के लिए अपनी तरह की पहली प्रौद्योगिकी विकसित करने में भी जुटा है।

भारत को रक्षा विनिर्माण आधार और शुद्ध रक्षा निर्यातक का एक मजबूत प्लेटफॉर्म बनाने के मकसद को लेकर रक्षा मंत्री ने कहा कि डीआरडीओ ने इस प्रयास में महत्वपूर्ण भूमिका निभाई है। उन्होंने कहा, "इसका मार्ग डीआरडीओ, सशस्त्र बलों, निजी उद्योग, स्टार्ट-अप और शिक्षाविदों के बीच सहयोग से होकर गुजरता है। निजी कंपनियों के साथ आज हुआ टीओटी यह दर्शाता है कि हम देश में एक मजबूत रक्षा औद्योगिक आधार बनाने के लिए तैयार हैं जो न सिर्फ देश की रक्षा संबंधी आवश्यकताओं की पूर्ति करेगा बल्कि रक्षा उपकरणों के निर्यात से मित्र देशों की जरूरतों को भी पूरा करेगा।

दिवंगत चीफ ऑफ डिफेंस स्टाफ (सीडीएस), जनरल बिपिन रावत और हाल ही में एक हवाई दुर्घटना में जान गंवाने वाले अन्य लोगों को श्रद्धांजलि देते हुए, रक्षामंत्री ने कहा कि सीडीएस पद के सृजन के साथ-साथ तीनों सेनाओं के एकीकरण और आधुनिकीकरण की प्रक्रिया शुरू की गई। सैन्य मामलों का विभाग निर्बाध रूप से इस दिशा में आगे कार्य करता रहेगा बढ़ेंगे और जल्द से जल्द लक्ष्य को हासिल करना सरकार की प्राथमिकता होगी।

युद्ध में प्रौद्योगिकी की भूमिका पर जोर देते हुए, श्री राजनाथ सिंह ने कहा कि हमारा उद्देश्य भारत को रक्षा प्रौद्योगिकी में अग्रणी बनाना और हाइपरसोनिक क्रूज मिसाइल के विकास को एक ऐसी उन्नत तकनीक के रूप में विकसित करना होना चाहिए, जिसके लिए सभी को मिलकर काम करना चाहिए।

मिशन शक्ति को विकसित करने में डीआरडीओ के वैज्ञानिक कौशल का हवाला देते हुए रक्षामंत्री ने कहा कि डीआरडीओ स्मार्ट सामग्री, आर्टिफिशियल इंटेलिजेंस, मशीन लर्निंग आधारित सिस्टम, स्वार्म ड्रॉन्स और एसिमेट्रिक वारफेयर आदि पर काम कर रहा है।

श्री राजनाथ सिंह ने कहा कि ऑटोमेटिक रूट से रक्षा क्षेत्र में एफडीआई बढ़ाकर 74 फीसदी करने, ओएफबी का कॉरपोरेटाइजेशन, उत्तर प्रदेश और तमिलनाडु में रक्षा गलियारों का निर्माण, रक्षा उत्पादन और निर्यात संवर्धन नीति 2020 बनाने, घरेलू विनिर्माण आदि के लिए रक्षा वस्तुओं की सकारात्मक सूची लाने आदि जैसी अनेक नीतिगत सुधारों के माध्यम से सरकार 'मेक इन इंडिया और मेक फॉर द वर्ल्ड' के उद्देश्य को साकार करने के लिए संगठित तरीके से काम कर रही है।

उन्होंने कहा कि इन नीतियों का उद्देश्य घरेलू रक्षा उद्योग को मजबूत करके हमारे सशस्त्र बलों को मजबूत बनाना है।

सशस्त्र बलों और गृह मंत्रालय को सौंपे गए उत्पादों में एंटी-ड्रोन सिस्टम, मॉड्यूलर ब्रिज, स्मार्ट एंटी एयरफील्ड वेपन, चैफ वेरिएंट और लाइट वेट फायर फाइटिंग सूट शामिल हैं। आने वाले ड्रॉनों का पता लगाने, उन्हें रोकने और नष्ट करने के लिए डीआरडीओ द्वारा विकसित काउंटर ड्रोन सिस्टम रक्षामंत्री द्वारा सीआईएससी को सौंपा गया।

उन्होंने सेनाध्यक्ष जनरल एम एम नरवने को मॉड्यूलर ब्रिज भी सौंपा। आरएंडडीई (इंजीनियर्स) द्वारा विकसित मॉड्यूलर ब्रिज मिलिट्री लोड क्लास एमएलसी-70 का सिंगल स्पैन, मेकेनिकली लॉन्च किया गया असॉल्ट ब्रिज है, और इसे अलग-अलग स्पैन में लॉन्च किया जा सकता है।

रक्षामंत्री ने वायु सेना प्रमुख एयर चीफ मार्शल वी आर चैधरी को स्मार्ट एंटी एयरफील्ड वेपन (एसएडब्ल्यू), एक एयर लॉन्च, लॉन्ग-रेंज, स्टैंड-ऑफ, एयर-टू-सरफेस स्मार्ट बम सौंपा। एडवांस्ड चैफ के वेरिएंट नौसेना प्रमुख एडमिरल आर हरि कुमार को सौंपे गए। डीआरडीओ के सेंटर फॉर फायर, एक्सप्लोसिव एंड एनवायरनमेंट सेफ्टी (सीएफईईएस), दिल्ली द्वारा विकसित स्ट्रक्चरल फायर फाइटिंग सूट गृह मंत्रालय के विशेष सचिव श्री वी एस के कौमुदी को सौंपा गया।

इस कार्यक्रम के दौरान तटीय सर्विलांस रडार, ऑटोमेटिक केमिकल एजेंट डिटेक्शन एंड अलार्म (एसीएडीए) और केमिकल एजेंट मॉनिटर (सीएएम), यूनिट रखरखाव वाहन, यूनिट मरम्मत वाहन, फ्यूज्ड सिलिका आधारित सिरेमिक कोर प्रौद्योगिकी और अग्नि शमन जेल नामक सिस्टम/प्रौद्योगिकी के लिए डीआरडीओ द्वारा विकसित सात प्रणालियों के एलएटीओटी दस्तावेज सौंपे गए।

इस अवसर पर सचिव, डीडीआरएंडडी और अध्यक्ष, डीआरडीओ डॉ जी सतीश रेड्डी, थलसेना, नौसेना और वायुसेना के उप प्रमुख, रक्षा और गृह मंत्रालय के अन्य वरिष्ठ नागरिक और सैन्य अधिकारी भी मौजूद थे।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1781568>

## Need to quickly think about development of hypersonic cruise missiles: Rajnath

*This is to maintain our minimum credible deterrence, he says*

*By Dinakar Peri*

New Delhi: Ballistic missile defences were getting “robust” day by day and to maintain a minimum credible deterrence, India should quickly think about developing hypersonic cruise missiles, Defence Minister Rajnath Singh said on Tuesday. He pointed to the fast-changing battlefield landscape with the emergence of new technologies.

“Our effort should be to make India the leader in defence technology. Those technologies which we have already developed are already ours, but along with that we should also acquire those technologies which today are only with a handful of countries,” he stated at an event of the Defence Research and Development Organisation (DRDO).

“For example, ballistic missile defence are getting robust day by day. So, in order to maintain our minimum credible deterrence, we should quickly think about developing hypersonic cruise missiles,” he noted.

Hypersonic weapons are manoeuvrable weapons that can fly at speeds of at least Mach 5, five times the speed of sound. Several countries, including India, are currently developing them.

In 1998, India conducted nuclear tests under Phokran-II and in 2003, declared its nuclear doctrine based on credible minimum deterrence and a No-First-Use (NFU) policy. The concept of maintaining a minimum credible deterrence and a nuclear triad for delivery of nuclear weapons based on aircraft, missiles and nuclear submarines flow from that.

At the event, Mr. Singh handed over five technologies developed by the DRDO to the three Services and Home Ministry as part of ‘Azadi Ka Amrit Mahotsav’. He also handed over six Transfer of Technology (ToT) agreements for the technologies developed by the DRDO to seven public and private sector companies.

Emphasising on emerging technologies, he stressed that developments such as cyber, space, IT, robotics, Artificial Intelligence and big data analysis were adding new facets on the battlefield. Some of the products being developed by the DRDO were not just futuristic but also the first of the kind, he pointed out.

### Technologies handed over

The technologies handed over by Mr. Singh include an anti-drone system for the three Services, a modular bridge for the Army, smart anti-airfield weapon and Chaff variants for the Air Force and a lightweight firefighting suit to the Home Ministry.

The ToT documents handed over comprise coastal surveillance radar, automatic chemical agent detection and alarm and chemical agent monitor, unit maintenance vehicle, unit repair vehicle, fused silica based ceramic core technology and fire suppressing gel.

<https://www.thehindu.com/news/national/need-to-quickly-think-about-development-of-hypersonic-cruise-missiles-rajnath/article37954715.ece>



Union Defence Minister Rajnath Singh hands over DRDO developed products to Armed Forces and other security agencies at an event in New Delhi on December 14, 2021. | Photo Credit: Special Arrangement

## Rajnath Singh asks DRDO to fast develop hypersonic weapons

By Rajat Pandit

New Delhi: With China, Russia and the US actively building aerodynamically manoeuvrable hypersonic weapons that fly over five times the speed of sound (Mach 5), defence minister Rajnath Singh has directed DRDO to move fast towards developing such arsenal to 'maintain' India's minimum credible deterrence against adversaries.

Towards this end, India is planning to conduct another test of its hypersonic technology demonstrator vehicle (HSTDV), powered by a scramjet engine, by early next year, said sources.

The HSTDV, which was successfully tested for the first time in September last year, will serve as a crucial building block in the development of long-range hypersonic weapons, which will take at least another four to five years to become a reality. A hypersonic weapon can either be a 'glide vehicle' launched from a rocket or a scramjet-powered 'cruise missile'.

Speaking at a DRDO event on Tuesday, the defence minister said ballistic missile defence systems are getting more and more robust with the passage of time. "In order to maintain a minimum credible deterrence, we have to immediately think about hypersonic cruise missile development. It will be a revolutionary step in our defence sector and we all have to put our efforts into it," he said.

Singh formally handed over an indigenous anti-drone system, smart anti-airfield weapon (SAAW), modular bridge and advanced chaff variants to the armed forces at the event.

But his remarks on hypersonic weapons were significant, though he did not elaborate. They came in the backdrop of China's test of a nuclear-capable missile carrying a hypersonic glide vehicle and warhead on July 27 this year, which stunned military experts around the world. China has stolen the march over the US, which has not yet developed hypersonic weapons with nuclear warheads.

Russian President Vladimir Putin, on his part, claims his country is the global leader in developing hypersonic missiles. Deliveries of the latest Zircon hypersonic cruise missiles to the Russian Navy will begin in 2022, he recently said.

India, of course, is nowhere close to developing hypersonic weapons that can defeat an enemy's missile defence shields with the combination of high speed and manoeuvrability.

Last year's test involved the 'cruise vehicle' or HSTDV being carried by the 'launch vehicle' powered by the solid rocket motor of an Agni-I ballistic missile to a 30-km altitude.

The cruise vehicle then separated and auto-ignited its scramjet engine to fly on its own for 23 seconds at Mach 6 speed. The HSTDV tests in the coming years will require longer duration hypersonic flights to eventually pave the way for development of hypersonic weapons.

The Indian Armed Forces already have the conventional ramjet-powered BrahMos supersonic cruise missiles, which fly at Mach 2.8 speed, developed jointly with Russia. Their strike range is being enhanced from the original 290-km to well over 400-km now. But while ramjet engines operate well at supersonic speeds around Mach 3, their efficiency drops at hypersonic speeds.

<https://timesofindia.indiatimes.com/india/rajnath-singh-asks-drdo-to-fast-develop-hypersonic-weapons/articleshow/88285554.cms>



Defence minister Rajnath Singh (PTI photo)



## New locally developed military hardware for armed forces

*In a move aimed at self-reliance in India's defence manufacturing sector, defence minister Rajnath Singh on Tuesday handed over to the armed forces locally developed military hardware.*  
*By Rahul Singh*

New Delhi: In a move aimed at self-reliance in India's defence manufacturing sector, defence minister Rajnath Singh on Tuesday handed over to the armed forces locally developed military hardware including a smart air-launched weapon, anti-drone systems, and an advanced radar countermeasure system, officials familiar with the development said.

The weapons and systems were developed by the Defence Research and Development Organisation.

Singh also handed over transfer of technology (ToT) agreements covering six systems, including the coastal surveillance radar, to seven public and private sector companies to bolster their defence manufacturing capabilities at an event organised as part of the countrywide celebrations to mark the 75th year of India's Independence.

This comes at a time when a time when the government is encouraging self-reliance is the defence sector through a slew of policy decisions.

The notable systems handed over to the armed forces include the smart anti-airfield weapon (SAAW), which can target enemy airfield assets such as radars, bunkers, taxiways and runways; and counter-drone systems to swiftly detect, intercept, and destroy small drones that pose a security threat.

SAAW has a range of 100km.

The anti-drone system will give the military both "soft kill" and "hard kill" options to tackle the new and fast-emerging aerial threat, the officials said. The first refers to jamming the hostile drone, while the second involves a laser-based kill system. The drone threat was highlighted by the June 27 attack targeting the Jammu air force station, the first-ever offensive use of drones to hit an Indian military facility.

The steps taken by the government to boost indigenisation include increasing foreign direct investment (FDI) from 49% to 74%, notifying two lists of 209 weapons and systems that cannot be imported and creating a separate budget for buying locally made military hardware.

Singh identified the development of a hypersonic cruise missile as a key focus area.

India took the first steps last year towards developing a new class of ultra-modern weapons that can travel six times faster than the speed of sound (Mach 6) and penetrate any missile defence, with DRDO carrying out a successful flight test of the hypersonic technology demonstrator vehicle (HSTDV) for the first time.

Only the US, Russia and China have developed technologies to field fast-maneuvring hypersonic missiles that fly at lower altitudes and are extremely hard to track and intercept. Mach 6 translates into a speed of 7,408kmph.

India could develop hypersonic cruise missiles powered by air-breathing scramjet engines in about four years, the officials said. Such engines operate efficiently at hypersonic speeds and allow supersonic combustion.

<https://www.hindustantimes.com/india-news/armed-forces-get-new-locally-developed-military-hardware-101639507988421.html>



Defence minister Rajnath Singh at the seminar on 'Preparing for Future' at DRDO Bhawan, in New Delhi, on Tuesday. (ANI)

## Defence Minister Rajnath Singh hands over DRDO-developed products to Armed Forces

*Defence Minister Rajnath Singh handed over five products developed by DRDO to the Armed Forces and other security agencies at an event at DRDO Bhawan in New Delhi on Tuesday.*

*By Manjeet Negi*

Defence Minister of India Rajnath Singh handed over five products developed by the Defence Research and Development Organisation (DRDO) to the Armed Forces and other security agencies at an event at DRDO Bhawan in New Delhi on Tuesday. He also handed over six Transfer of Technology (ToT) agreements to seven public and private sector companies. The event was part of the government's Azadi Ka Amrit Mahotsav celebrations.

### Products handed over

Rajnath Singh handed over the Smart Anti Airfield Weapon (SAAW), an air-launched, long-range, stand-off, air-to-surface smart bomb, to the Chief of the Air Staff Air Chief Marshal V R Chaudhari. The variants of advanced chaff were handed over to the Chief of the Naval Staff Admiral R Hari Kumar.

A structural fire-fighting suit developed by DRDO's Centre for Fire, Explosive and Environment Safety (CFEES) in Delhi was handed over to V S K Kaumudi, Special Secretary in the Ministry of Home Affairs.

Additionally, the Transfer of Technology documents of seven DRDO-developed systems were handed over. The seven systems include coastal surveillance radar, automatic chemical agent detection and alarm (ACADA) and chemical agent monitor (CAM), unit maintenance vehicle, unit repair vehicle, fused silica-based ceramic core technology and fire-suppressing gel.

### 'Ready to make strong defence industrial base'

At a seminar titled 'Preparing For The Future' organised by DRDO on Tuesday, Rajnath Singh said, "There has been a big change over the last few years in the approach of DRDO. It is not only working on technologies to mitigate current threats but also on first-of-its-kind technologies to face future challenges."

He added that India can become a strong defence manufacturing base and exporter through collaboration between DRDO, the Armed Forces, private industry, start-ups and academia.

"The ToT with private players which took place today indicate that we are ready to make a strong defence industrial base in the country that will cater not only to domestic defence requirements but will also fulfill needs of friendly countries via defence item exports," Rajnath Singh said.

### Tribute to CDS Bipin Rawat

Paying tribute to late Chief of Defence Staff (CDS) General Bipin Rawat and others who lost their lives in the recent chopper crash, Rajnath Singh said that the process of integration and modernisation of tri-services that was initiated with the creation of the post of CDS will continue to be prioritised by the government.

<https://www.indiatoday.in/india/story/defence-minister-rajnath-singh-drdo-products-armed-forces-1887865-2021-12-15>



Defence Minister Rajnath Singh handed over DRDO-developed products to the Armed Forces on Tuesday. (Photo: PTI)

## Integration of forces to face challenges from adversaries: Rajnath Singh

*Singh also handed over five DRDO products to the armed forces and other security agencies*

New Delhi: Integration of the armed forces is an effort to jointly enhance India's capabilities to face the challenges posed by the adversaries, Defence Minister Rajnath Singh said on Tuesday.

He also handed over five Defence Research and Development Organisation (DRDO) products to the armed forces and other security agencies and overlooked the execution of six transfer of technology (ToT) agreements with seven public and private sector companies on Tuesday, as part of the 'Azadi Ka Amrit Mahotsav' celebrations of the Ministry of Defence.



Defence Minister Rajnath Singh

Speaking on the occasion, Rajnath Singh said, "When we talk about integration and jointness, it is not limited to the initiatives taken by the government alone. Its success has to be achieved by meeting the minds of our defence forces. It is an effort to jointly enhance our capabilities to face the challenges posed by our adversaries."

"The integration we talk about is not limited to our forces, but it also means synergy among every concerned organisation in the country," he added.

The Defence Minister said that there has been a big change over the last few years in the approach of DRDO whereby it is not only working on technologies to mitigate the current threats, but also on first-of-its-kind technologies to face the future challenges.

On the objective of making India a strong platform for defence manufacturing base and net defence exporter, Rajnath Singh said DRDO has played a significant role in this endeavour.

"Its path passes through collaboration among DRDO, the armed forces, private industry, startups and academia. The ToT with private players which took place today indicate that we are ready to make a strong defence industrial base in the country that will cater not only to the domestic defence requirements, but will also fulfil the needs of friendly countries by defence item exports."

Paying tribute to late Chief of Defence Staff (CDS), General Bipin Rawat, and others who lost their lives in the recent chopper crash in Tamil Nadu, Rajnath Singh said that the process of integration and modernisation of tri-services that was initiated with the creation of the post of CDS and the Department of Military Affairs will move on seamlessly and will be priority of the government to achieve the target as soon as possible.

Emphasising the role of technology in warfare, Singh said India's aim should be to make the country a leader in defence technology, and identified the development of Hypersonic cruise missile as one such advanced technology for which all should work together.

Citing the scientific prowess of DRDO in developing Mission Shakthi, Defence Minister said DRDO is working on smart materials, Artificial Intelligence, Machine Learning based systems, Swarm drones, Asymmetric warfare and others.

Singh said the government is working in a concerted manner to realise the objective of 'Make in India and Make for the World' by bringing in several policy reforms such as increasing FDI in defence sector through automatic route to 74 per cent, corporatisation of OFB, creation of defence corridors in Uttar Pradesh and Tamil Nadu, formulation of Defence Production and Export Promotion Policy 2020, and bringing out positive lists of defence items for domestic manufacturing, among others.

He added that these policies aim to make the armed forces strong by strengthening the domestic defence industry.

Products handed over to the armed forces and the Ministry of Home Affairs are anti-drone system, modular bridge, smart anti-airfield weapon, chaff variants and the light weight fire fighting suit.

The counter drone systems, developed by DRDO for detection, deterrence and destruction of incoming drones were handed over to the CISC by Singh.

He also handed over a modular bridge to the Chief of Army Staff, General M.M. Naravane.

Modular bridge developed by R&DE (engineers) is a single span, mechanically launched assault bridge of military load class MLC-70, and can be launched in different spans.

Singh also handed over Smart Anti-Airfield Weapon (SAAW), an air launched, long-range, stand-off, air-to-surface Smart Bomb, to the Chief of the Air Force, Air Chief Marshal V.R. Chaudhari.

The variants of advanced chaff were handed over to the Chief of the Naval Staff, Admiral R Hari Kumar. Structural fire-fighting suit developed by DRDO's Centre for Fire, Explosive and Environment Safety (CFEES), Delhi, was handed over to V.S.K. Kaumudi, Special Secretary, MHA.

The LAToT documents of seven DRDO developed systems were handed over during the event for the systems/technologies, namely coastal surveillance radar, automatic chemical agent detection and alarm (ACADA) and chemical agent monitor (CAM), unit maintenance vehicle, unit repair vehicle, fused silica based ceramic core technology and fire suppressing gel.

[https://www.business-standard.com/article/current-affairs/integration-of-forces-to-face-challenges-from-adversaries-rajnath-singh-121121401334\\_1.html](https://www.business-standard.com/article/current-affairs/integration-of-forces-to-face-challenges-from-adversaries-rajnath-singh-121121401334_1.html)

**R. REPUBLICWORLD.COM**

Wed, 15 Dec 2021

## Counter-Drone system developed by DRDO in India to detect and eliminate aerial threats

*The DRDO has developed a new counter drone system. The new system has been handed over to the armed forces by Union Defence Minister Rajnath Singh.*

*By Vishnu V V*

In another boost to India's Defence system, Defence Research and Development Organisation (DRDO) have now developed a counter-drone system for detection, deterrence and destruction of incoming drones. The newly developed counter-drone system will enable mitigation of the impact of drones posing a threat to national security. The new system has been handed over to the armed forces by Union Defence Minister Rajnath Singh.

The DRDO has developed a new counter-drone system for the enhancement of areal security. The drone system has been on trial at several locations for the past few months. Today, the defence minister has finally introduced the anti-drone system and handed it over to the chiefs for deployment at various locations. The drone system made by the DRDO as part of the government's Make in India initiative is modern and efficient in terms of its capabilities and range.

The newly developed drone also comes as a power statement as it replaces the drone system the government had acquired from other countries. The anti-drone system is part of India's focus on



Image: REPUBLICWORLD

the indigenisation of defence products. The DRDO recently tested several other systems and defence products which were also introduced by the defence ministry.

### **India tests long-range Supersonic Missile Assisted Torpedo**

India on Monday successfully test-fired a long-range Supersonic Missile Assisted Torpedo (SMART) off the coast of Balasore in Odisha. As per the statement of the Defence Research and Development Organisation DRDO, the SMART system will help India enhance its anti-submarine warfare capability. The successful test-firing of the mission was monitored by tracking stations (radars, electro-optical systems) along the coast and the telemetry stations including down range ships.

"The system has been designed to enhance Anti-submarine warfare capability far beyond the conventional range of the torpedo," the DRDO said.

Earlier on December 8, the DRDO had informed of the successful testing of an air version of BrahMos supersonic cruise missile from the Integrated Test Range in Chandipur off the Odisha coast. The missile was test-fired from supersonic fighter aircraft Sukhoi 30 MK-I. Describing the launch as 'a major milestone' in the BrahMos development, the DRDO said that it was now ready for production in the country.

<https://www.republicworld.com/india-news/general-news/counter-drone-system-developed-by-drdo-in-india-to-detect-and-eliminate-aerial-threats.html>

**TIMESNOWNEWS.COM**

Wed, 15 Dec 2021

## **DRDO develops special fire entry suit that can be worn inside burning buildings**

*Dr Prosun Roy, who headed the design team says rescue personnel in these special suits can be inside a 'fire zone' for 150 seconds.*

*By Srinjoy Chowdhury*

New Delhi: Burn injuries are a worry. And after the horrific helicopter crash this month killing 13 people, including General Bipin Rawat, even more so.

The Defence Research and Development Organisation or DRDO have just readied suits that are more fire-resistant. A special Fire Entry suit can allow someone to go inside a burning building, or for that matter, an aircraft or helicopter. Rescue personnel in these special suits can be inside a 'fire zone' for 150 seconds, a lot of time when every second is of enormous value.

A lightweight structural firefighting suit can allow rescue personnel to enter a burning building to bring out people. The DRDO versions have exceeded the European EN-469 standard and equalled the American 4971 standard.

They are cheaper, indigenous and at 25 kgs are lighter than many suits. As Dr Prosun Roy, who headed the design team says, it can be used by the petrochemical industries as well. If a leaky valve has to be dealt with in a burning building, these suits, which can be manufactured without much difficulty, are ideal for the job.

<https://www.timesnownews.com/india/article/drdo-develops-special-fire-entry-suit-that-can-be-worn-inside-burning-buildings/840449>



Times Now's Srinjoy Chowdhury in conversation with Dr Prosun Roy | Photo Credit: Times Now

## All you should know about the Smart Anti-Airfield Weapon handed over to IAF by Defence Minister Rajnath Singh

### *Snapshot*

- *Today, Defence Minister Rajnath Singh handed over the indigenously developed Smart Anti-Airfield Weapon and a counter-drone system developed by the DRDO to the Indian Air Force.*
- *While the development of the weapon began sometime around 2012-13, the first test was carried out in 2016.*

Earlier today (14 December), Defence Minister Rajnath Singh handed over the indigenously developed Smart Anti-Airfield Weapon (SAAW), an air-launched smart glide bomb, to the Indian Air Force (IAF).

Developed by the Defence Research and Development Organisation (DRDO), SAAW weighs 125 kilograms and can engage ground-based assets at enemy airfields, including radars, bunkers, taxi tracks and runways etc. up to a range of 100 kilometers. It gives the IAF stand-off capabilities against such enemy assets.



DRDO's SAAW (Livefist)

SAAW is a high precision-guided bomb and is lighter than other weapons systems of the same class.

While the development of the weapon began sometime around 2012-13, the first test was carried out in 2016. It has been successfully test-fired from a Jaguar aircraft of the IADF in the past. It had been tested from a Hawk-I advanced trainer of the Hindustan Aeronautics Limited (HAL).

In September 2020, the Defence Acquisition Council headed by Defence Minister Singh had approved the purchase of this weapon for the IAF and the Indian Navy at an approximate cost of Rs 920 crore.

The weapon is being integrated on the IAF's Jaguar and Su-30 MKI fighters and the Indian Navy's MiG-29K jets.

SAAW has already been tested with indigenous electro-optical sensor technology that significantly improves its accuracy. The electro-optical configuration of the system is equipped with an imaging infra-red seeker that exponentially enhances terminal accuracy.

In 2017, the then chief of the DRDO, Dr S Christopher, said that the weapon has higher precision and is much cheaper than missiles.

"So far the bombs we have don't have precision, so they go by wind condition, weather condition... When you are fighting the enemy, you can't keep trying hundred times, once you have fired he will know where you are," he said, adding, "As the weather and wind conditions change, it is always possible for the bomb to go elsewhere. In this bomb, the guidance system will correct its course and go and land at the same place."

"This is a sort of guided bomb and it will be much much cheaper than a missile or rocket, the reason being that it is not having a propulsion, it is making use of the aircraft's propulsion. It can go and land in a place we want," *TheWeek* quoted Dr Christopher as saying.

Apart from SAAW, the Defence Minister also handed over to the IAF a counter-drone system developed by the DRDO. The system is designed to detect, deter, and destroy enemy drones. The radar part of the counter-drone system has a range of 4 to 6 kilometres.

The development comes after the Air Force Station in Jammu, located around 14 km from the border with Pakistan, was targeted in the wee hours of 27 June by terrorists using drones.

<https://swarajyamag.com/news-brief/all-you-should-know-about-the-smart-anti-airfield-weapon-handed-over-to-iaf-by-defence-minister-rajnath-singh>



Wed, 15 Dec 2021

## DRDO's Supersonic Missile Assisted Release of Torpedo (SMART): All you need to know

*Defence Research and Development Organization, DRDO has recently test-fired the Supersonic Missile Assisted Release of Torpedo or SMART. Take a look at the details of this system below.*

*By Tulika Tandon*

India has recently test-fired a long-range Supersonic missile assisted torpedo or popularly called SMART from the Balasore coast in Odisha. The weapon has been developed by the Defence Research and Development Organization (DRDO) for the Indian Navy.

As per DRDO, "The system has been designed to enhance anti-submarine warfare capability far beyond the conventional range of the torpedo." The test was conducted on Wheeler island on December 13, 2021. Check all about the system and its details below.

The Defence Minister also congratulated the team of DRDO for the development of this system, SMART.

### **About: Supersonic Missile Assisted Torpedo (SMART)**

1. This is a next-generation missile-based standoff torpedo delivery system.
2. The system of this missile has been designed for the enhancement of anti-submarine warfare capability. It would work beyond the conventional range of the torpedo.
3. It is also a canister based missile system consisting of advanced two-stage solid propulsion, electromechanical actuators and precision inertial navigation.
4. The missiles launch was done from a ground mobile launcher and it is capable of covering a range of distances.

### **DRDO's Tests This Month:**

On December 11, 2021, India successfully flight-tested indigenously developed helicopter-launched stand-off anti-tank (SANT) missile in Rajasthan's Pokhran firing ranges.

The defence ministry's statement mentioned, "flight-testing, carried out by DRDO and the Indian Air Force (IAF), was successful in meeting all the mission objectives of the missile. The weapon, developed for the IAF, can neutralise targets in a range up to 10 km."

Also prior to these tests, a series of successful tests were conducted on the Extended Range Pinaka rocket system (Pinaka-ER) was carried out over three days.

<https://www.jagranjosh.com/general-knowledge/drdo-supersonic-missile-assisted-release-of-torpedo-smart-all-you-need-to-know-1639463078-1>



SMART- Supersonic Missile Assisted Release of Torpedo

## Overwhelming response to DFRL, DEBEL expo

*Spin-off product from technology developed for Tejas aircraft was on display*

Mysuru: Students and general visitors in hundreds flocked to the Exhibition of Technology and Products conducted to mark Azadi Ka Amrit Mahotsav or celebration of the 75th anniversary of Independence, on Tuesday.

The concluding day witnessed a beeline to the exhibition organized in front of the Kote Anjaneyaswami temple opposite the Balarama gate of the palace and the organisers said that the response was beyond all expectations.

On Monday the organisers intended to close the exhibition at 5 p.m. but the rush was such that the expo had to be kept open till 7 p.m. The response on Tuesday exceeded Monday's crowd and it was largely youngsters, college and school-going students, said the organisers.

Both the DFRL and the Defence Bioengineering and Electro Medical Laboratory (DEBEL), Bengaluru, which participated and showcased many of its products are Defence Research and Development Organisation (DRDO) laboratories.

As the focus of DFRL's research is on food and meant to cater to defence personnel deployed under varied conditions, it showcased a slew of products developed and patented by it. The DFRL has of late been focusing on degradable materials, rapid testing kit, and diversification of convenient rations suiting the requirements of armed forces in different terrains.

Newer products such as degradable cutleries, photo degradable polymeric materials for secondary packaging, rapid test kit to check the quality of milk and frozen meat, light-weight energy-rich convenient products like energy bars as well as mobile laboratory for microbiological testing were on display.

The mobile laboratory had come in handy in the early days of the first wave of the COVID-19 and it was deployed at the K.R. Hospital for collecting and testing the samples for the virus.

The DEBL has been carrying out R and D in the field of bioengineering and electro medical technology related to defence. Some of the technologies developed by it include protective equipment, individual underwater breathing apparatus, submarine escape system, and advanced micro-climatic conditions suit for battle tanks and submarines.

The advanced micro-climatic conditions suit helps in mitigation of extreme temperatures and heat stress faced by the soldiers operating battle tanks and submarines when the ambient temperature can go beyond 50 degrees C. The suit comprises a liquid cooled garment connected to an active chiller unit and helps beat heat stress, according to the scientists who explained the salient features of some of the products on display.

One of the significant technologies developed by DEBEL and which was on demonstration was the Medical Oxygen Plant (MOP) system. It was developed as a spin-off product from the onboard oxygen plant system developed for India's Light Combat Aircraft (LCA) Tejas. It took less than two years to translate the concept from design to development and came in handy for hospitals during COVID-19.

<https://www.thehindu.com/news/national/karnataka/overwhelming-response-to-dfrl-debel-expo/article37953526.ece>



The mobile lab for microbiological testing parked at the venue of the exhibition conducted by DFRL and DEBEL in Mysuru. | Photo Credit: M.A. SRIRAM



## Firm bags MoD order for mountain foot bridge

*By Sandip Dighe*

Pune: City-based equipment manufacturer Worldwide Oilfield Machine has signed an Rs32 crore deal with the Ministry of Defence to manufacture and supply 30 lightweight Mountain Foot Bridge developed by premier DRDO lab Research and Development Establishment (Engineers) here. The R&DE (Enggrs) has given the licence to the firm to manufacture the bridges as part of a tech transfer deal.

The bridge is to be inducted by the Indian Army and will be useful in high-altitude regions. It is made of high-strength aluminium alloys and capable of withstanding conditions prevailing in high-altitude regions like Siachen.

Ajay Shinde, manager (projects and strategic products) of the firm, said, “The bridge will be made from Indian materials. As per the agreement, we will deliver the first bridge to the Directorate General of Quality Assurance (DGQA) on August 17, 2022. A total contract worth Rs32 crore has been signed with the ministry to complete the manufacturing of all 30 bridges.”

He said, the bridge can also be used effectively in natural disasters like floods to safely rescue people from flood-affected areas. The bridge can be launched manually in 90 minutes with a crew of 15. It can carry in components with a maximum weight of each is 18 kg. “The trials of the bridge had carried out at Siachen glacier and in Arunachal Pradesh extensively. After achieving the desired results, the Army accepted the bridges. Now, we are in the process of developing its advanced version that can be suitable for vehicle carrying in the high altitude region,” said a senior official from the DRDO on condition of anonymity.

The maximum length of the MFB is 34.5 meters with a walkway width of 0.8 meters.

“The bridge can allow accumulation of fresh snow up to half a meter. This capability will enable the troops’ movement smoothly in tough regions, where covering even a meter’s distance is a big challenge,” added the official.

<https://timesofindia.indiatimes.com/city/pune/firm-bags-mod-order-for-mountain-foot-bridge/articleshow/88286033.cms>

# DRDO on Twitter

 **Rajnath Singh** ✓  
@rajnathsingh

Speaking at the Seminar on 'Preparing for Future'.



Rajnath Singh  
Speaking at the Seminar on 'Preparing for Future'.

12:52 PM · Dec 14, 2021

 **A. Bharat Bhushan Babu** ✓ @SpokespersonMoD · 6h

Raksha Mantri Shri @rajnathsingh handedover @DRDO\_India developed products to the Armed forces and other security agencies.

@DefenceMinIndia  
@AjaybhattBJP4UK @drajaykumar\_ias  
@adgpi  
@indiannavy @IAF\_MCC @mygovindia @AmritMahotsav @PBNS\_India  
@airnewsalerts @DDNewslive





**PRO, Hyderabad, Ministry of Defence** @dprohyd · 10h

Raksha Mantri Shri Rajnath Singh expressed confidence that DRDO would be successful in developing futuristic warfare technologies.

@SpokespersonMoD

@DRDO\_India



**DRDO** @DRDO\_India · 6h

#AmritMahotsav #IconicWeek Raksha Mantri handed over 05 DRDO developed products to Armed forces & other security forces in a seminar on "Preparing For The Future". He handed over 06 ToT agreements to industry.

@adgpi @DefenceMinIndia @IAF\_MCC @indiannavy

[pib.gov.in/PressReleasePa...](http://pib.gov.in/PressReleasePa...)





DRDO @DRDO\_India · 16h

DRDO Seminar on "Preparing for the Future" is being held as part of Iconic Week celebrations #AmritMahotsav. Honble Raksha Mantri Shri Rajnath Singh is the Chief Guest. Service Chiefs & other senior officials present at the event. #AcceleratingSelfReliance #TechLeader



DRDO @DRDO\_India · 16h

Iconic Week for India@75 #DRDO initiated a wide spectrum of activities to strengthen our #ArmedForces by handing over best in class systems & technologies. Supporting Indian industry, fostering young minds, DRDO providing thrust to indigenous developments. #AmritMahotsav





Wed, 15 Dec 2021

# India may become the first buyer of S-500 anti-aircraft missile system: Russian deputy PM Borisov

## *Story highlights*

*The comments from the Russian deputy prime minister comes even as the delivery of its long-range S-400 ground-to-air missile defence system to India has begun*

New Delhi: Russian Deputy Prime Minister Yury Borisov has indicated that India may be the first foreign buyer of its most advanced S-500 'Prometei' anti-aircraft missile system.

When asked whether India would be the first country to purchase the Russian-made S-500, Borisov told RBC TV Channel on Monday, "Beyond a doubt, once we deliver this system to our troops, India will be the first on the list, if it expresses its desire to buy these advanced armaments."

The S-500 'Prometei' anti-aircraft missile system is the most advanced Russian mobile service to air system and was put into service earlier this year. In 2019, Turkish President Recep Tayyip Erdogan expressed interest in buying the S-500 units.

The comments from the Russian deputy prime minister comes even as the delivery of its long-range S-400 ground-to-air missile defence system to India has begun.

The \$5.5 billion deal for five S-400 systems had become a thorn in the growing US-India partnership, with the latter running the risk of facing the Countering America's Adversaries Through Sanctions Act (CAATSA) sanctions.

The CAATSA was passed in the US in 2017, on the back of the supposed involvement of Russia in the 2016 US presidential elections.

Under the CAATSA's section 231, sanctions would be imposed on entities that "operate for or on behalf of" Russian defence or intelligence sectors.

The US has already imposed CAATSA on Turkey, a NATO ally, for the purchase of a batch of S-400 missile defence systems from Russia, however, it has yet to take a call on India

Even though the US said it will try to negotiate with India to spurn the deal, New Delhi has been rejecting the jurisdiction of a third country's domestic law.

Earlier on December 6, during the 21st India-Russia summit, Russian Foreign minister Sergei Lavrov claimed that the US had been planning to undermine the deal and make India "obey the American orders".

Defence forms the main pillar of the partnership between Russia and India. Brahmos missile, licensed production of SU 30 aircraft, T30 Tanks are some of the examples of this cooperation. The next big focus is the joint production of AK series assault rifles in India.

<https://www.wionews.com/world/india-may-become-the-first-buyer-of-s-500-anti-aircraft-missile-system-russian-deputy-pm-borisov-436769>

## **Explainer: How is Russia's S-500 missile defence system superior to S-400?**

### *Story highlights*

***Russia has already begun the delivery of S-400 Triumph surface-to-air missile systems to India. The S-500 surface-to-air missile defence system can target hypersonic cruise missiles including UAVs.***

New Delhi: After acquiring the S-400 missile defence system from Russia, India may now buy the S-500 Prometey surface-to-air missile defence system.

Russia's Deputy Prime Minister Yury Borisov told Russia's TASS news agency that "India will be the first on the list if it expresses its desire to buy these advanced armaments."

Russia has already begun the delivery of S-400 Triumph surface-to-air missile systems to India. So how is S-500 different from S-400?

### **What is the S-500 missile system?**

It is Russia's most advanced new generation surface-to-air missile system capable of intercepting intercontinental ballistic missiles (ICBM).

It can also target hypersonic cruise missiles and can intercept ballistic missiles within a range of 600kms. It can be deployed easily and has an airborne engagement range of 400-500km.

It can also target spacecraft including unmanned aerial vehicles (UAVs). Reports claim Russian defence officials have been training Army officials since 2017 to operate the sophisticated system. Reports claim the Russian Army will be equipped with the new system by 2024.

### **S-500 vs S-400 missile defence**

The Russian Army is reportedly set to replace the S-400 missile defence system with the S-500 in 2024. The S-500 air defence system was tested successfully in July this year against a ballistic target at Kapustin Yar in Russia.

The S-400 has been in service since April 2007. It has an operational range of 400 kms. However, the S-500 is a much more sophisticated version that can target ballistic missiles from 600 kms away compared to just 60km by the S-400. Also, the fact that the S-500 can target hypersonic missiles gives it an edge over the S-400.

The S-500 can also reportedly target B-2, F-22 and F-35 stealth aircraft.

### **CAATSA row:**

In October 2018, India had signed a \$5 billion deal with Russia to buy five units of the S-400 air defence missile systems despite warning from the former Trump administration that going ahead with the contract may invite US sanctions.

Two US Senators, India caucus co-chairs Mark Warner and John Cornyn had earlier sent a letter to US President Biden urging him to waive CAATSA sanctions against India.

Under the Countering America's Adversaries Through Sanctions Act (CAATSA), the US can take punitive action against countries purchasing defence hardware from Russia.

### **US sanctions on Turkey**

The former Trump administration had hit Erdogan's Turkey with sanctions after it agreed to buy Russian S-400 air defence system.



**File photo: A Russian serviceman walks past S-400 missile air defence systems in Tverskaya Street before a rehearsal for the Victory Day parade, which marks the anniversary of the victory over Nazi Germany in World War Two, in central Moscow, Russia April 29, 2019. Photograph:( Reuters )**

The US government had blocked the sale of next-generation US F-35 planes after Erdogan's deal with Putin's Russia. The sale led to a bitter row between the US and Turkey as Erdogan demanded compensation as Turkey had made a \$1.4 billion advance payment.

President Erdogan has been pushing the Biden administration to deliver the older version of the F-16 fighter planes instead, however, there has been no confirmation from US officials.

<https://www.wionews.com/world/explainer-how-is-russias-s-500-missile-defence-system-superior-to-s-400-436847>



Wed, 15 Dec 2021

## Chilean envoy calls on Army Chief Gen Naravane

Ambassador of Chile to India, Juan Rolando Angulo Monsalve, on Tuesday called on Army Chief General MM Naravane and discussed bilateral issues.

"Juan Rolando Angulo Monsalve, Ambassador of Chile to India, called on General MM Naravane #COAS and discussed issues of mutual interest," Indian Army tweeted.

Earlier in September this year, the 7th Foreign Office Consultations (FOC) was held between India and Chile in Santiago.



Chilean envoy meets Army chief Gen Naravane

During the FOC, both sides comprehensively reviewed the entire gamut of their bilateral relations which included trade and investments, defence, agriculture, health and pharmaceuticals, energy, space, cooperation in Antarctica, disaster management, cultural and consular issues.

Both sides acknowledged that trade is an important pillar of India-Chile relations and expressed satisfaction at the ongoing negotiations for the further expansion of the Preferential Trade Agreement which was signed in 2006 and expanded in 2017.

The two sides also exchanged views on regional and international issues on common interest including cooperation in the United Nations and agreed to work closely with each other in the multilateral arena.

<https://www.catchnews.com/world/chilean-envoy-calls-on-army-chief-gen-naravane-227488.html>



Wed, 15 Dec 2021

## Generating topology from loss in hybrid light-matter particles

Losing particles can lead to positive, robust effects.

An international collaboration has demonstrated a novel topology arising from losses in hybrid light-matter particles, introducing a new avenue to induce the highly-prized effects inherent to conventional topological materials, which can potentially revolutionize electronics.

Led by Singapore's Nanyang Technological University (NTU) and the Australian National University (ANU), the study represents the first experimental observation of a non-Hermitian topological invariant in a semiconductor in the strong light-matter coupling regime supporting formation of exciton-polaritons.

### **Losing is not always losing**

Losses, such as friction or electrical resistance, are ubiquitous in nature, but are seen as detrimental to devices.

In electronics, for example, resistance leads to heating and limits computing efficiency.

In photonic systems, photons easily escape confinement, limiting transmission efficiency.

"However, this negative view about loss has significantly changed recently, thanks to advances in non-Hermitian physics, which have shown that losses can lead to striking effects not possible in a 'perfect' lossless world," says Prof Elena Ostrovskaya from the Australian National University.

Non-Hermitian physics directly incorporates losses and/or gain into quantum mechanics.

Taking advantage of analogy between quantum mechanics and classical wave physics, recent advances in photonics demonstrated that judicious control of losses can lead to counter-intuitive effects, such as lasers that turn on despite increasing loss, robust switching between lasing modes, and irreversible propagation of light.

Studies of non-Hermitian effects in quantum condensed matter systems, such as electronic materials, are less common.

### **Gaining topology from loss**

Losses can induce nontrivial topology, turning a conventional material into a topological one.

Topological electronic materials are classified using topological invariants (e.g., the Chern number), a number that quantifies how the electron wavefunctions effectively wind or rotate in momentum space.

Materials with the same topological invariant have the same topology.

If two materials with contrasting topology are merged, robust effects, such as dissipationless one-way transport, occurs at their interface.

Electrical conduction along such dissipationless pathways, without the scattering that causes dissipation of energy and heat in conventional materials, allowing electrical current to flow with almost zero wasted dissipation of energy.

In this study, the team mixed excitons (electronic excitations) in lead-halide perovskite semiconductor with photons to create exciton-polaritons.

"Typically, one needs exotic materials or sophisticated material engineering to induce topological behavior. However, in this work, we discovered that the mere presence of loss in an



exciton-polariton system based on lead-halide perovskite causes it to exhibit a nontrivial topology," says Dr. Eli Estrecho (ANU), one of the lead authors of the paper

The team carefully measured the energy and linewidths at different momenta and polarisations of polaritons in the system.

The energy and linewidths correspond to the real and imaginary parts of the complex energy of the lossy system in the language of non-Hermitian physics. And the two polarization states give rise to two distinct energy bands in momentum space.

From this analysis, the team found the points where both real and imaginary parts of the two complex energy bands coincide. These are called exceptional points, and in this system they occur in pairs.

This would not have been possible if the linewidths were neglected, as was typically done in previous works.

Furthermore, the team found that the complex energies rotate with a defined handedness and phase around the exceptional points. In fact, the phase winds exactly by as predicted by theory—this quantity is the new topological invariant that arises only in non-Hermitian systems.

"This is the first direct measurement of a non-Hermitian topological invariant associated with an exceptional point in momentum space of a condensed matter system," says Dr. Rui Su (Nanyang Technological University), one of the lead authors from study.

Furthermore, the team found that the winding of the wavefunctions and the energy bands are distinct from each other, confirming that they indeed observe a novel topology.

This work introduces a new avenue in designing topological materials, complementing conventional topology. Instead of avoiding loss, losses can be re-engineered or introduced intentionally to induce topological effects in an inherently non-topological system.

This could be instrumental in exploiting robust effects due to topology towards realizing a topological transistor in a lossy system.

Furthermore, because exciton-polaritons in perovskites can exhibit collective quantum behavior—a Bose-Einstein condensate, this work paves the way for studying non-Hermitian topological effects on the quantum behavior of condensates and superfluids.

#### **Expanded focus from parameter to momentum space**

The ANU group has previously used polaritons to observe non-Hermitian degeneracies called exceptional points and have shown chiral flow of polaritons due to these points.

However, these points were observed in parameter space.

This time around, the exceptional points are demonstrated in momentum space, which can directly affect the propagation of the particles, including polariton superfluids.

"Creating these exceptional points in momentum space paves the way towards studies of combined effects of topology and non-Hermitian physics in exciton-polariton systems," says Dr. Eli Estrecho.

"Direct Measurement of Non-Hermitian Topological Invariant in a Hybrid Light-Matter System" was published in *Science Advances* in November 2021.

**More information:** Rui Su et al, Direct measurement of a non-Hermitian topological invariant in a hybrid light-matter system, *Science Advances* (2021). DOI: [10.1126/sciadv.abj8905](https://doi.org/10.1126/sciadv.abj8905)

**Journal information:** [Science Advances](https://www.science.org)

<https://phys.org/news/2021-12-topology-loss-hybrid-light-matter-particles.html>

# Marathon experiment reveals quirks of quarks

By Crispin Savage

University of Adelaide experts, who are part of the international community of researchers investigating the fundamental physical properties of atoms, may have come across a new paradigm for the way atomic nuclei are built.

"We have been working on the theoretical analysis of an amazing experiment, Marathon, which took 20 years from conception to publication," said Professor Anthony Thomas, Elder Professor of Physics, the University of Adelaide.

"The original aim was to accurately measure the distribution of quarks, especially the down quark, as a function of momentum."

A quark is a type of elementary particle and a fundamental constituent of matter. All commonly observable matter is composed of up quarks, down quarks and electrons.

"Understanding how quarks work in relation to a proton's momentum is a fundamental property which defied measurement ever since quarks were discovered 50 years ago," said Professor Thomas.

"It tests our understanding of quantum chromodynamics (QCD), the fundamental theory of the strong force."

All the known forces of nature can be traced to four fundamental forces: gravitational, electromagnetic, strong, and weak. They govern how objects or particles interact and how certain particles decay.

The Marathon experiment collected valuable information about quarks and the nature of matter during its 20-year lifespan which contributed to insights from other work carried out by physicists around the world at the time.

The Marathon experiment has, however, yielded a piece of unique evidence—an extremely important new insight into how nuclei are built

"A fundamental, unanswered question for nuclear physics is whether nuclei are built of protons and neutrons or whether they are built of quasi-particles with the quantum numbers of neutrons and protons, but with an internal quark structure that has been changed by the huge forces inside atomic nuclei," said Professor Thomas.

Evidence for such changes was provided by an experiment at CERN, the European Organization for Nuclear Research, in the 1980s, with the effect known as the EMC effect (after the European Muon Collaboration).

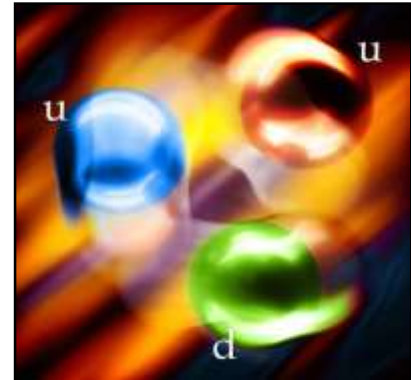
Work done by Professor Thomas at the University of Adelaide a decade ago, in collaboration with a colleague in Japan hinted at the existence of a new way in which quarks behaved.

"Our work suggested that in a nucleus with unequal numbers of neutrons and protons the change in the momentum distributions of up and down quarks would be different, a phenomenon known as an isovector EMC effect," said Professor Thomas.

"Our analysis of the Marathon data that we started 20 years ago has provided the first experimental hint for the existence of this isovector EMC effect.

"It will certainly inspire a great deal of further experimental effort, which ultimately will tell us whether we really do have a new paradigm for the way atomic nuclei are built."

Professor Thomas's paper was published in the journal *Physical Review Letters*.



Two up quarks and one down quark spinning freely in a particle accelerators stream. Credit: Brianzero/Wikimedia Commons, CC BY-SA 3.0

**More information:** C. Cocuzza et al, Isovector EMC Effect from Global QCD Analysis with MARATHON Data, *Physical Review Letters* (2021). DOI: [10.1103/PhysRevLett.127.242001](https://doi.org/10.1103/PhysRevLett.127.242001)

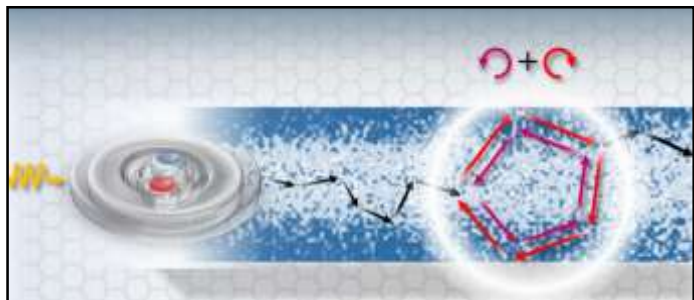
**Journal information:** *Physical Review Letters*  
<https://phys.org/news/2021-12-marathon-reveals-quirks-quarks.html>



Wed, 15 Dec 2021

## 'Crazy' light emitters: Physicists see an unusual quantum phenomenon

A highly unusual movement of light emitting particles in atomically-thin semiconductors was experimentally confirmed by scientists from the Würzburg–Dresden Cluster of Excellence ct.qmat–Complexity and Topology in Quantum Matter. Electronic quasiparticles, known as excitons, seemed to move in opposite directions at the same time. Professor Alexey Chernikov–newly appointed physicist at the Technische Universität Dresden–and his team were able to reveal the consequences of this quantum phenomenon by monitoring light emission from mobile excitons using ultrafast microscopy at extremely low temperatures. These findings move the topic of quantum transport of excitonic many-body states into the focus of modern research. The results of this work have been published in the *Physical Review Letters* journal.



The figure shows a schematic illustration of an exciton excited by a light pulse and moving along an atomically-thin layer. The exciton scatters and randomly changes its direction. In addition, a quantum mechanical interference effect can occur with the exciton propagating through a close loop in both directions at the same time. Credit: Alexey Chernikov

### Light emitters in atomically-thin matter

Quantum materials studied by Alexey Chernikov and his team are only a few atoms thin. Due to extremely strong interactions in these systems, electrons come together to form new states known as excitons. Excitons behave like independent particles and are able to absorb and emit light with high efficiency. In atomically-thin layers they are stable from lowest temperatures such as minus 268 degree Celsius up to room temperature.

Regarding the current research project that focuses on the movement of excitons in ultra-thin matter, the physicist Chernikov explains: "Excitons can be understood as a kind of moving light sources. Like other quantum mechanical objects, they combine both wave and particle properties, propagating through atomically-thin crystals. It means that they can store and transport both energy and information, but also convert them again to light. That makes them particularly interesting for us."

### On the trail of "crazy" quasiparticles

Rapid movement of excitons in atomically-thin semiconductors was visualized using highly sensitive optical microscopy: "First we applied a short laser pulse to the material that generated the excitons. Then we used an ultrafast detector to observe when and where the light was reemitted. When we repeated these experiments at very low temperatures, however, the movement of quasiparticles appeared rather astonishing," says Chernikov.

### Moving in two directions at the same time

So far, two general types of exciton movement were broadly known to the scientific community: either the excitons "jump" from one molecule to another (process known as *hopping*)–or they move

rather "classically" like billiard balls that change their direction after random scattering events. "In the ultra-thin semiconductors, however, the excitons behaved in a way that we have never seen before. In the end, the only possible explanation was that the excitons would occasionally move through closed loops in opposite directions at the same time. Such behavior was in fact known from individual electrons. However, to observe this experimentally for luminescent excitons—that was quite unusual," notes Chernikov.

After all control experiments confirmed the result, the scientists looked for the cause of their unusual observation. A recently published theoretical work by the Russian researcher Mikhail M. Glazov from the Ioffe Institute in Saint Petersburg provided the key insight: Glazov describes how excitons in atomically-thin semiconductors can indeed move through closed, ring-like paths and enter superimposed states. This means that the excitons seem to essentially move both clockwise and counterclockwise at the same time. This effect is a purely quantum mechanical phenomenon, which does not occur for classical particles. Together with the team of Ermin Malic from the Philipps University of Marburg, who provided additional insights into the exciton dynamics, the scientists were finally able to track down this unusual behavior.

### **Outlook**

In a collaboration with international colleagues Alexey Chernikov's team has shown a way to experimentally monitor quantum mechanical effects in the movement of interacting many-particle complexes. Research into the quantum transport of excitonic quasiparticles, however, is still at the very beginning. In the future, materials such as the ultra-thin layers examined by Chernikov could also serve as a basis for new types of laser sources, light sensors, solar cells or even building blocks for quantum computers.

**More information:** Koloman Wagner et al, Nonclassical Exciton Diffusion in Monolayer WSe<sub>2</sub>, *Physical Review Letters* (2021). [DOI: 10.1103/PhysRevLett.127.076801](https://doi.org/10.1103/PhysRevLett.127.076801)

**Journal information:** [Physical Review Letters](https://phys.org/news/2021-12-crazy-emitters-physicists-unusual-quantum.html)  
<https://phys.org/news/2021-12-crazy-emitters-physicists-unusual-quantum.html>

# DownToEarth

Wed, 15 Dec 2021

## Vitamin D3 can protect against fatal COVID-19 infection: Study

*Testing and supplementation of vitamin D3 remains insufficient, says report*

*By Taran Deol*

The new omicron variant of the novel coronavirus (SARS-CoV-2) has brought the question of vaccination efficacy back in focus, pushing health experts to acknowledge the need to look beyond vaccine immunity.

Patients with sufficiently high D3 serum levels preceding the novel coronavirus disease (COVID-19) were highly unlikely to suffer a fatal outcome, showed a recent study published in *PubMed*, a search engine that scans medical databases.

The study was based on two sets of meta-analysed data: One on the long-term vitamin D3 levels from 19 countries and another on 1,601 hospitalised patients — 784 of whose vitamin D3 levels were measured within a day after admission and 817 whose vitamin D levels were known beforehand.

Both confirmed an inverse correlation between vitamin D levels and COVID-19 death rate.

The importance of vaccines is repeatedly underlined through the research, which recommended “combining vaccination with routine strengthening of the immune system of the whole population by vitamin D3 supplementation to consistently guarantee blood levels above 50 nanograms per millilitre”.

From a social and political point of view, it will lower the need for further contact restrictions and lockdowns. From an economical point of view, it will save billions of dollars worldwide, as vitamin D3 is inexpensive, and together with vaccines, provides a good opportunity to get the spread of SARS-CoV-2 under control.

Widespread vitamin D deficiency was recorded before the COVID-19 pandemic began. The study attributed this shortfall to modern lifestyle that is “far from optimal with respect to nutrition, physical fitness, and recreation”.

There is enough evidence available that outlines the link between vitamin D3 and its role in regulating our immune system, according to the paper written by three German scientists.

Moreover, vitamin D3’s effectiveness in curing several diseases, especially acute respiratory distress syndrome that is also a COVID-19 after-effect, is well-known.

It has also been recorded that vitamin D3 effectively suppresses “the progression of inflammation by reducing the generation of inflammatory cytokines”. Cytokine release syndrome, also known as “cytokine storm”, causes multiple organ damage — a key cause of death in late stage COVID-19 cases.

Yet, testing and supplementation of vitamin D3 remains insufficient, the report highlighted.

After rickets — a condition that softens bones — in the 19th century, “SARS-CoV-2 pandemic is becoming the second breakthrough in the history of vitamin D3 association with disease”, the scientists wrote.

<https://www.downtoearth.org.in/news/health/vitamin-d3-can-protect-against-fatal-covid-19-infection-study-80683>

