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DRDO Technology News

THE ECONOMIC TIMES

DRDO report finds serious battery defects in EVs that caught fire

The Defence Research & Development Organisation (DRDO) that was tasked with investigating into EV fire incidents by the Union Road Transport and Highways Ministry, has found serious defects in the batteries, including designs of the battery packs and modules. According to sources in the know of the matter, these defects occur because the electric two-wheeler manufacturers like Okinawa Autotech, Pure EV, Jitendra Electric Vehicles, Ola Electric and Boom Motors may have used "lower-grade materials to cut costs". The Centre for Fire, Explosive and Environment Safety (CFEES) at the DRDO has submitted its fact-finding report to the Ministry, as first reported byAccording to the sources, the ministry has now summoned representatives of these EV manufacturers, asking them to submit an explanation on the DRDO report findings.Earlier this month, the Central Consumer Protection Authority (CCPA), which comes under the Union Consumer Affairs Ministry, sent notices to Pure EV and Boom Motors after their e-scooters exploded in April. The consumer watchdog is also examining more cases of e-scooter fires and will serve similar notices to other EV makers too.

Pure EV and Boom Motors along with Ola Electric, Jitendra EV, and Okinawa Autotech, recalled faulty batches after the EV fire incidents were reported. The preliminary findings from the government-constituted probe committee on EV fires have already identified issues with battery cells or design in nearly all of the electric two-wheeler fire incidents in the country. The committee was constituted in the wake of EV fires and battery blasts in e-scooters. The experts found defects in battery cells as well as battery design in nearly all EV fires. The government is now working on new quality-centric guidelines for EVs that will be unveiled soon.

https://economictimes.indiatimes.com/industry/renewables/drdo-report-finds-serious-battery-defects-in-evs-that-caught-fire/articleshow/91743717.cms

Defence Strategic: National/International

THE ECONOMIC TIMES

Mon, 23 May 2022

MHA to brief house panel about Assam Rifles role and work

The Union home ministry will provide details on the role and functioning of the Assam Rifles (AR) before a parliamentary panel on May 25, post the 75% reduction in areas under the Armed Forces Special Powers Act (AFSPA) in the North East, where they were deployed. This will be the first meeting after Congress leader and Rajya Sabha member Abhishek Manu Singhvi was appointed chairman of the standing committee, following the retirement of INC leader Anand Sharma. As part of the anti-insurgency grid, AR also enjoys protection under the controversial AFSPA and has come under criticism for alleged misuse of power. The outcry following the botched up operation in Nagaland last year forced the Union government in April to reduce the AFSPA from several parts of the North East, including 23 districts in Assam and partially from seven districts in Nagaland, six districts in Manipur, and one district in Assam. Assam Rifles is among the six central armed police forces (CAPFs) under the administrative control of the union home ministry and has a sanctioned strength of 66,412 personnel split into 46 battalions. However, its operational control rests with the Indian Army which reports to the Ministry of Defence (MoD). The AR has been deployed in the North-Eastern states in a counter-insurgency role and also guards the India-Myanmar border, which is spread along a length of 1,631 km.

http://m.economictimes.com/news/defence/mha-to-brief-house-panel-about-assam-rifles-role-and-work/amp_articleshow/91751154.cms

INDIA TODAY

Mon, 23 May 2022

Indian military commands form 'Tetra Group' to tackle China

With the Chinese Army continuously upgrading its military infrastructure along the border with India, four operational commands of the Indian Defence forces have come together to tackle any possible Chinese misadventure in the eastern sector from Arunachal Pradesh to Andaman and

Nicobar Islands. The grouping of these four commands is called the 'Tetra' group. The grouping includes the Shillong-based Eastern Air Command, Kolkata-based Eastern Army Command, the Navy's Eastern Command based out of Vishakhapatnam, and the country's only operational tri-services, Andaman and Nicobar Command, based in Port Blair, top government sources told India Today. The move initiated by the Indian Air Force is also being seen as a strong step towards the creation of integrated theatre commands as planned by the Narendra Modi government. The Tetra group met last week in Shillong and the top commanders discussed ways to iron out differences in the integration of forces at the ground level, the sources said.

The four commands are responsible for carrying out operations during wartime and empowered enough to take critical decisions to tackle security threats. The Eastern forces have been building up slowly and steadily to tackle the Chinese threat in the northeast and eastern front of the country, which starts from Arunachal Pradesh to the Indian Ocean Region down south. The group would continue to hold meetings at all levels to enhance integration and jointness and carry out ground implementation of decisions, they said. India and China have been engaged in a standoff in Ladakh and troops are deployed opposite each other all along the LAC. The talks are on to resolve the issue at both political and military level, but forces are preparing for tackling all types of possible misadventures.

https://www.indiatoday.in/defence/story/indian-military-commands-tetra-group-tackle-china-arunachal-pradesh-andaman-and-nicobar-islands-shillong-ladakh-1953150-2022-05-23

INDIAN DEFENCE NEWS
Global Defence, Aerospace & Security

Tue, 24 May 2022

India vows to work with Philippines to strengthen armed forces

The Indian government vowed Monday to work with the Philippines in strengthening the latter's armed forces' capabilities. India Ambassador to the Philippines Shambhu S. Kumaran paid a courtesy call on presumptive president Ferdinand "Bongbong" Marcos Jr. in Mandaluyong City. Among those tackled during the visit, Kumaran said, was the commitment to continue the "excellent bilateral relations" between the two countries. "We requested his continued support for the development of excellent bilateral relations between India and the Philippines," Kumaran said in a press briefing. "We've been having excellent progress over the past few years and we look forward to continuing the progress and dynamism under the new administration," he added. Kumaran said the Indian government likewise vows to help the Philippines in strengthening the latter's military capabilities.

In January this year, the Philippine government has awarded a $374-million (P19 billion) contract to India to equip the Philippine Navy with the world's fastest supersonic cruise missiles. "India would like to work with the Philippines towards capacity-building and capability development of the Philippines' armed forces and we do believe that under the modernization program of the Armed Forces of the Philippines, there are potential areas where Indian companies can be competitive," Kumaran said. "We will work closely with the Philippine armed forces and the [Department of National Defence] to take forward this partnership in the new

administration," he added. Similar to the Philippines, India has its own territorial dispute with China.

Kumaran said China was not mentioned during the meeting between him and Marcos Jr. Our discussion today was on the bilateral relationship. We had a very wide ranging discussion as I said on a lot of priorities of the president focusing on development in the Philippines," Kumaran said. "I briefed him about the successes of digital governance in India, and of course health, agriculture, so the focus of the discussion was on the bilateral relationship and we did not have any discussions about other aspects," he added.

http://www.indiandefensenews.in/2022/05/india-vows-to-work-with-philippines-to.html?m=1

IDN INDIAN DEFENCE NEWS
Global Defence, Aerospace & Security

Tue, 24 May 2022

IAF successfully test-fires SPYDER - A highly mobile, low level & quick reaction ground to air missile system

Indian Air Force has successfully test-fired SPYDER Air Defence System on 19th May, 2022. It is a Surface to Air missile. SPYDER can strike multiple targets at the same time which makes it a potent component of India's air defence network. SPYDER is a modern, low level, quick reaction missile system that is being used by Indian Air Force. The system is capable of securing valuable assets and mobile forces located in the combat area against a wide range of threats, enabling a quick response and handling a wide spectrum of threats and multiple targets simultaneously. The defence of valuable assets and mobile forces in the combat area requires a quick response with effective simultaneous handling of a wide spectrum of multiple targets.

The SPYDER systems defend large areas against a wide spectrum of threats. System components and interceptors can be flexibly combined, affording different configurations with various ranges and capabilities. All the SPYDER systems have multiple target engagement capability for dealing with saturation attacks. The SPYDER systems incorporate the most advanced air-to-air-missiles with proven performance: the PYTHON-5 dual waveband IIR missile, the I-DERBY active radar BVR, and the I-DERBY ER long-range missile. The missiles can also be used for air-to-air missions.

http://www.indiandefensenews.in/2022/05/iaf-successfully-test-fires-spyder.html?m=1

DefenseNews

Tue, 24 May 2022

US Army terminates strategic long-range cannon science and technology effort

The U.S. Army has decided to cancel the science and technology research effort for a potential program to develop a strategic long-range cannon, the service confirmed. Long-Range Precision

Fires is a top priority for the Army when it comes to developing a modernized force capable of facing off against near-peer adversaries like China. The Strategic Long-Range Cannon, or SLRC, could provide a way to achieve artillery ranges of 1,000 nautical miles. Congress directed the Army to stop funding the long-range cannon in its fiscal 2022 appropriations act, and "based on that direction, the Secretary of the Army decided to terminate the [SLRC] project this year," Ellen Lovett, Army spokesperson said in a May 20 statement to Defense News.

The decision also "eliminates potential redundancy, and ensures we effectively use tax dollars to achieve modernization objectives," she wrote. "Pursuing the effort could cost billions of dollars even if the science and technology effort succeeded because the Army would have to enter into a development program, procure the system, and create entirely new units to operate it."

The Army still has four other long-range fires programs set to reach operational Army units in 2023: Extended Range Cannon Artillery (ERCA), the Long-Range Hypersonic Weapon (LRHW), the Mid-Range anti-ship Missile (MRC) and the Precision Strike Missile (PrSM).

"Any unused funds originally allocated to LRC will be reapplied against other S&T projects in accordance with the direction of the Assistant Secretary of the Army for Acquisitions, Logistics and Technology," Lovett stated. During a House Armed Services Tactical Air and Land Forces subcommittee hearing last week, Army acquisition chief Doug Bush told lawmakers the decision to cancel the S&T effort for the SLRC was to avoid "redundancy" and "potential cost implications." While full cost estimates are not normally made for programs in the S&T phase, Bush said "we did feel we had sufficient information based on similar programs that are in development and to understand the rough scope of such an effort, and the secretary believes that was enough information to support her decision."

Some work on the SLRC S&T effort was ongoing, but the Army had mostly taken a pause as it waited for a National Academy of Sciences report on the cannon's technical feasibility, Brig. Gen. John Rafferty, who oversees the service's long-range precision fires development, told Defense News in March 2021. The independent study, congressionally mandated in FY20, was expected to be released last year, but has yet to be made public. Beginning in September 2020, the committee at the National Academy of Sciences held five meetings, the last of which took place in January 2021, according to its website. According to FY21 budget justification documents, the Army had planned to spend roughly $70 million in FY22 on advanced development on the program, but subsequent documents from FY22 and FY23 showed no plan to continue funding the effort beyond FY21. The Army spent $62 million in FY21 to assess various aspects of the technology needed for the long-range cannon.

https://www.defensenews.com/land/2022/05/23/us-army-terminates-strategic-long-range-cannon-science-and-technology-effort/

Mon, 23 May 2022

US F-18 fighters in India to demonstrate operational capability

Two Boeing F/A-18E Super Hornet fighter aircraft have arrived in India to showcase their operational capability at a naval facility in Goa as the Indian Navy plans to acquire a fleet of

combat jets for its indigenous aircraft carrier (IAC) Vikrant, people familiar with the development said. The demonstration by the aircraft will start this week at the shore-based test facility (SBTF) at INS Hansa, the naval air station in Goa, they said.The flight trials are expected to last over a week, they said, adding the two jets arrived in India on May 20. In January, the Indian Navy carried out flight trials of the Rafale maritime fighter aircraft.The Indian Navy plans to procure a batch of fighter jets for IAC Vikrant that is likely to be commissioned in August.

Over four years back, the Indian Navy had initiated the process to acquire 57 multi-role combat aircraft for its aircraft carrier. Four planes were in contention for the deal which included Rafale (Dassault, France), F-18 Super Hornet (Boeing, US), MIG-29K (Russia) and Gripen (Saab, Sweden). At present, the Indian Navy operates Russian-origin MiG-29K fighters from its sole aircraft carrier INS Vikramaditya. he Request For Information issued by the Navy for procurement of the deck-based fighter jets sought to know at what level of Transfer of Technology (ToT) the companies are willing to share with India.

https://economictimes.indiatimes.com/news/defence/us-f-18-fighters-in-india-to-demonstrate-operational-capability/articleshow/91748822.cms

From missiles to helicopters: US says 20 countries offer new arms for Ukraine

Some 20 countries offered new security assistance packages for Ukraine to battle invading Russian forces in a meeting of allies on Monday, US Secretary of Defense Lloyd Austin announced. In their second gathering, nearly four dozen countries and organizations forming the Ukraine Defense Contact Group met online to discuss helping Ukraine, and 20 nations pledged arms, ammunition and other supplies to support Kyiv. The group was briefed by Ukraine Defense Minister Oleksiy Reznikov on the current situation of the three-month-old war, in which the two sides are fighting along a long front line over territory Russia has seized in Ukraine's east and south. "Today, together with Minister Reznikov and his team, we've gained a sharper and shared sense of Ukraine's priority requirements and the situation on the battlefield," Austin said.

"Many countries are donating critically needed artillery ammunition, coastal defence systems and tanks and other armoured vehicles," he said. Others, he added, are offering training for Ukraine's military. He said that Denmark committed to send a Harpoon anti-ship missile system, and the Czech Republic was offering attack helicopters, tanks and rocket systems. Harpoons are cruise missiles that can skim the surface of the sea to target ships as far as 187 miles (300 kilometers) offshore, depending on the type. Usually Harpoons are mounted aboard ships or aircraft, but Denmark is the only country that acquired land-based systems for coastal protection.

The Danish battery would add a layer of protection to Ukraine's Black Sea port of Odessa, which is believed to be under threat of Russian invasion from the sea. They could also potentially reach the port of Sevastopol, where some of the Russian Black Sea fleet is based.

- Long-range rockets -

Austin would not provide details of what is included in a new $40 billion US assistance package for Ukraine, amid speculation that it could include high-precision, long-distance rockets that could be used to hit Russian territory. Ukraine has asked the United States for mobile batteries of long-range rockets, the M270 MLRS and the M142 Himars. They can launch multiple rockets at the same time with a range of up to 187 miles, eight times or more the distance of artillery in the field. That could give Ukrainian forces the ability to reach, with great precision, targets far behind Russian lines. It could also allow them to hit targets well inside Russia, though it is unclear if that is their intent. Since the first meeting of the weapons donor group at a US base in Germany four weeks ago, Austin said, "the momentum of donations and deliveries has been outstanding." He said Ukraine's needs have not changed much since the previous meeting and the war continues to be driven by artillery, supported by tanks, drones and other equipment. "The fight is really shaped by artillery in this phase, and we've seen serious exchanges of artillery fires over the last several weeks," Austin said. "Everyone here understands the stakes of this war and they stretch far beyond Europe," he added. "Russia's aggression is an affront to the rules-based international order." The Ukraine Defense Contact Group is due to meet next in person on June 15 during the NATO ministerial meeting in Brussels, Austin said.

Science & Technology News

Noodle-like robots navigate mazes without human or computer guidance

Researchers from North Carolina State University (NCSU) and the University of Pennsylvania (Penn) have developed soft robots that are capable of navigating complex environments, such as mazes, without input from humans or computer software. "These soft robots demonstrate a concept called 'physical intelligence,' meaning that structural design and smart materials are what allow the soft robot to navigate various situations, as opposed to computational intelligence," says Jie Yin, corresponding author of a paper on the work and an associate professor of mechanical and aerospace engineering at NC State.

The soft robots are made of liquid crystal elastomers in the shape of a twisted ribbon, resembling the pasta rotini, except translucent. When you place the ribbon on a surface that is at least 55 degrees Celsius (131 degrees Fahrenheit), which is hotter than the ambient air, the portion of the ribbon touching the surface contracts, while the portion of the ribbon exposed to the air does not. This induces a rolling motion in the ribbon. And the warmer the surface, the faster it rolls. A collaborative research team from NCSU and Penn has recently developed an autonomous and

intelligent twisted soft robot that can self-escape from simple maze-like obstacle courses without any external control and human interventions.

The soft robot is made of heat-responsive liquid crystal elastomers with its soft body resembling a translucent rotini. When encountering obstacles, it utilizes the embodied physical intelligence of self-snapping and self-turning for autonomous obstacle negotiation and avoidance. They also show that the robot can self-roll on hot loose sand dunes without getting stuck and slipping, as well as cross hot rocks. It can also harvest thermal energy from environments for self-powered rolling on a car roof and BBQ grills."This has been done before with smooth-sided rods, but that shape has a drawback – when it encounters an object, it simply spins in place," says Yin. "The soft robot we've made in a twisted ribbon shape is capable of negotiating these obstacles with no human or computer intervention whatsoever."

The ribbon robot does this in two ways. First, if one end of the ribbon encounters an object, the ribbon rotates slightly to get around the obstacle. Second, if the central part of the robot encounters an object, it "snaps." The snap is a rapid release of stored deformation energy that causes the ribbon to jump slightly and reorient itself before landing. The ribbon may need to snap more than once before finding an orientation that allows it to negotiate the obstacle, but ultimately it always finds a clear path forward.

"In this sense, it's much like the robotic vacuums that many people use in their homes," Yin says. "Except the soft robot we've created draws energy from its environment and operates without any computer programming." "The two actions, rotating and snapping, that allow the robot to negotiate obstacles operate on a gradient," says Yao Zhao, first author of the paper and a postdoctoral researcher at NC State. "The most powerful snap occurs if an object touches the center of the ribbon. But the ribbon will still snap if an object touches the ribbon away from the center, it's just less powerful. And the further you are from the center, the less pronounced the snap, until you reach the last fifth of the ribbon's length, which does not produce a snap at all."

The researchers conducted multiple experiments demonstrating that the ribbon-like soft robot is capable of navigating a variety of maze-like environments. The researchers also demonstrated that the soft robots would work well in desert environments, showing they were capable of climbing and descending slopes of loose sand. "This is interesting, and fun to look at, but more importantly it provides new insights into how we can design soft robots that are capable of harvesting heat energy from natural environments and autonomously negotiating complex, unstructured settings such as roads and harsh deserts," Yin says.

https://scitechdaily.com/noodle-like-robots-navigate-mazes-without-human-or-computer-guidance/amp/

Charting a safe course for an autonomous robot through a highly uncertain environment

A new technique has been developed to safely guide an autonomous robot without knowledge of its environmental conditions or the size, shape, or location of obstacles it might encounter. An autonomous spacecraft exploring the far reaches of the cosmos descends through the atmosphere

of a remote underline exoplanet. The robotic vehicle, and the researchers who programmed it, don't know much about this environment. With so much uncertainty, how can the spacecraft plot a safe trajectory that will keep it from being squashed by some randomly moving obstacle or blown off course by sudden, gale-force winds?

MIT researchers have developed a new technique that could help this spacecraft land safely. Their approach can enable an autonomous vehicle to plot a provably safe trajectory in highly uncertain situations where there are multiple uncertainties regarding both environmental conditions and objects the vehicle could collide with. The technique could even help a vehicle find a safe course around obstacles that move in random ways and change their shape over time. It plots a safe trajectory to a targeted region even when the vehicle's starting point is not precisely known and when it is unclear exactly how the vehicle will move due to environmental disturbances like wind, ocean currents, or rough terrain.

This is the first technique to address the problem of trajectory planning with many simultaneous uncertainties and complex safety constraints, says co-lead author Weiqiao Han, a graduate student in the Department of Electrical Engineering and Computer Science and the Computer Science and Artificial Intelligence Laboratory (CSAIL). "Future robotic space missions need risk-aware autonomy to explore remote and extreme worlds for which only highly uncertain prior knowledge exists. In order to achieve this, trajectory-planning algorithms need to reason about uncertainties and deal with complex uncertain models and safety constraints," adds co-lead author Ashkan Jasour, a former CSAIL research scientist who now works on robotics systems at the NASA Jet Propulsion Laboratory (JPL). Joining Han and Jasour on the paper is senior author Brian Williams, professor of aeronautics and astronautics and a member of CSAIL. The research will be presented at the IEEE International Conference on Robotics and Automation and has been nominated for the outstanding paper award.

Avoiding assumptions

Because this trajectory planning problem is so complex, other methods for finding a safe path forward make assumptions about the vehicle, obstacles, and environment. These methods are too simplistic to apply in most real-world settings, and therefore they cannot guarantee their trajectories are safe in the presence of complex uncertain safety constraints, Jasour says. "This uncertainty might come from the randomness of nature or even from the inaccuracy in the perception system of the autonomous vehicle," Han adds. Instead of guessing the exact environmental conditions and locations of obstacles, the algorithm they developed reasons about the probability of observing different environmental conditions and obstacles at different locations. It would make these computations using a map or images of the environment from the robot's perception system.

Using this approach, their algorithms formulate trajectory planning as a probabilistic optimization problem. This is a mathematical programming framework that allows the robot to achieve planning objectives, such as maximizing velocity or minimizing fuel consumption, while considering safety constraints, such as avoiding obstacles. The probabilistic algorithms they developed reason about risk, which is the probability of not achieving those safety constraints and planning objectives, Jasour says. But because the problem involves different uncertain models and constraints, from the location and shape of each obstacle to the starting location and behavior of the robot, this probabilistic optimization is too complex to solve with standard methods. The researchers used higher-order statistics of probability distributions of the uncertainties to convert that probabilistic optimization into a more straightforward, simpler

deterministic optimization problem that can be solved efficiently with existing off-the-shelf solvers.

"Our challenge was how to reduce the size of the optimization and consider more practical constraints to make it work. Going from good theory to good application took a lot of effort," Jasour says. The optimization solver generates a risk-bounded trajectory, which means that if the robot follows the path, the probability it will collide with any obstacle is not greater than a certain threshold, like 1 percent. From this, they obtain a sequence of control inputs that can steer the vehicle safely to its target region.

Charting courses

They evaluated the technique using several simulated navigation scenarios. In one, they modeled an underwater vehicle charting a course from some uncertain position, around a number of strangely shaped obstacles, to a goal region. It was able to safely reach the goal at least 99 percent of the time. They also used it to map a safe trajectory for an aerial vehicle that avoided several 3D flying objects that have uncertain sizes and positions and could move over time, while in the presence of strong winds that affected its motion. Using their system, the aircraft reached its goal region with high probability. Depending on the complexity of the environment, the algorithms took between a few seconds and a few minutes to develop a safe trajectory.

The researchers are now working on more efficient processes that would reduce the runtime significantly, which could allow them to get closer to real-time planning scenarios, Jasour says.

Han is also developing feedback controllers to apply to the system, which would help the vehicle stick closer to its planned trajectory even if it deviates at times from the optimal course. He is also working on a hardware implementation that would enable the researchers to demonstrate their technique in a real robot.

https://scitechdaily.com/charting-a-safe-course-for-an-autonomous-robot-through-a-highly-uncertain-environment/amp/

Sun, 22 May 2022

Innovative 3D-Printing technology creates glass microstructures with rays of light

The manufacturing technique enables faster production, greater optical quality, and design flexibility. Researchers at the University of California, Berkeley have developed a new way to 3D-print glass microstructures that is faster and produces objects with higher optical quality, design flexibility, and strength, according to a new study published in the journal Science. Working with scientists from the Albert Ludwig University of Freiburg in Germany, the researchers extended the capabilities of a 3D-printing process they developed three years ago — computed axial lithography (CAL) — to print much finer features and to print in glass. They dubbed this new system "micro-CAL."

Glass is often the preferred material for creating complicated microscopic objects, including lenses in compact, high-quality cameras used in smartphones and endoscopes, as well as microfluidic devices used to analyze or process minute amounts of liquid. However, present

manufacturing methods can be slow, expensive, and limited in their ability to meet the industry's increasing demands. The CAL process is fundamentally different from today's industrial 3D-printing manufacturing processes, which build up objects from thin layers of material. This technique can be time-intensive and result in rough surface texture. CAL, however, 3D-prints the entire object simultaneously. Researchers use a laser to project patterns of light into a rotating volume of light-sensitive material, building up a 3D light dose that then solidifies in the desired shape. The layer-less nature of the CAL process enables smooth surfaces and complex geometries.

This study pushes the boundaries of CAL to demonstrate its ability to print microscale features in glass structures. "When we first published this method in 2019, CAL could print objects into polymers with features down to about a third of a millimeter in size," said Hayden Taylor, principal investigator and professor of mechanical engineering at UC Berkeley. "Now, with micro-CAL, we can print objects in polymers with features down to about 20 millionths of a meter, or about a quarter of a human hair's breadth. And for the first time, we have shown how this method can print not only into polymers but also into glass, with features down to about 50 millionths of a meter."

To print the glass, Taylor and his research team collaborated with scientists from the Albert Ludwig University of Freiburg, who have developed a special resin material containing nanoparticles of glass surrounded by a light-sensitive binder liquid. Digital light projections from the printer solidify the binder, then the researchers heat the printed object to remove the binder and fuse the particles together into a solid object of pure glass. "The key enabler here is that the binder has a refractive index that is virtually identical to that of the glass, so that light passes through the material with virtually no scattering," said Taylor. "The CAL printing process and this Glassomer [GmbH]-developed material are a perfect match for each other."

The research team, which included lead author Joseph Toombs, a Ph.D. student in Taylor's lab, also ran tests and discovered that the CAL-printed glass objects had more consistent strength than those made using a conventional layer-based printing process. "Glass objects tend to break more easily when they contain more flaws or cracks, or have a rough surface," said Taylor. "CAL's ability to make objects with smoother surfaces than other, layer-based 3D-printing processes is therefore a big potential advantage." The CAL 3D-printing method offers manufacturers of microscopic glass objects a new and more efficient way to meet customers' demanding requirements for geometry, size and optical and mechanical properties. Specifically, this includes manufacturers of microscopic optical components, which are a key part of compact cameras, virtual reality headsets, advanced microscopes and other scientific instruments. "Being able to make these components faster and with more geometric freedom could potentially lead to new device functions or lower-cost products," said Taylor.

https://scitechdaily.com/innovative-3d-printing-technology-creates-glass-microstructures-with-rays-of-light/amp/