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Sat, 28 May 2022

India Developing World's Lightest Bulletproof Vest, to be Tested in 2 Months: Drdo Chief to WION

India's Defence Research Development Organization (DRDO), the country's premier Military Research and Development agency is working on developing the World's lightest bulletproof vest and it would be tested in about two months' time, Dr G. Satheesh Reddy, Chairman DRDO told WION. He said that this bulletproof vest was being developed as a 'DIA'(DRDO Industry Academia) effort, in one of the ten DIA centres in the country. He was speaking at the concluding event of India's first-ever privately-run Defence Expo, held in Chennai. Referring to the ongoing changes in India's Defence industry, he said that the industry had reached a level where they were building to meet the specifications as put forth by the customers or users. He pointed out that missiles, bombs, radars, ammunition and guns are being manufactured in a big way by the private industry, as opposed to the earlier times, when solely state-run organizations used to perform this task.

Hailing the ongoing development of the 155 mm x 52 Cal Advanced Towed Artillery Gun System (TAGS), Dr Reddy said that this Indian gun was going to be the world's longest-range artillery weapon of its kind. This weapon is being developed for the Indian Army, by DRDO in partnership with private firms Bharat Forge and Tata Power SED. "As part of Government support for the private defence sector, nearly 300 private industries have used DRDO facilities for testing. There are also special funding schemes provided by the Departments of Defence Production and R&D to boost private sector capabilities" he elaborated. The DRDO chief also mentioned that there are nearly 2000 Tier 1 & 2 defence industries in India, while the Tier 3 industries are over 10,000 in number.

Titled "Defence & technology Expo Empowering MSME" the event was organized by Swatantra Foundation, a think tank based in the Southern Indian city. "Our focus for this event is to connect MSMEs with large Defence manufacturers through B2B meetings to create business opportunities," said S. Ramasubramanian, Founder & President of Swatantra Foundation. The event brought together Indian Micro Small and Medium Industries(MSMEs) and large defence manufacturers to create business opportunities, where the former can supply components for the latter.

<https://www.wionews.com/india-news/india-developing-worlds-lightest-bulletproof-vest-to-be-tested-in-2-months-drdo-chief-to-wion-482974>

THE TIMES OF INDIA

Mon, 30 May 2022

Ordnance Factory in Chennai to Make Lighter Bulletproof Vests

The Ordnance Clothing Factory (OCF) in Chennai is working to reduce the weight of bulletproof vests along with DRDO labs. The approved low weight is now 8.9kg as per the specifications released nationally and plans are on to develop a fabric and also to use different metal shields to cut down the weight by 500g. V Mathivannan, officer on temporary charge, Ordnance Clothing Factory, Chennai, said, "We are also working to reduce weight of bulletproof jackets and would like to enter the market and export them." Using silicon carbide plates will ensure that the weight will be as per the specification of 8.9kg. "The idea is to reduce it further. If boron carbide, which is costly, but will help in reducing the weight by around 500g. But we are still working to reduce the weight further by another 500g.

" OCF is also developing vests for small arms. The Defence Research and Development Organisation (DRDO) is also working to produce the world's lightest bullet proof fabric in collaboration with academia. Light-weight fabric is the preserve of a couple of international companies and DRDO wants to create a fabric that is indigenous and lighter than the materials available in the market. DRDO chairman Satheesh Reddy said during the valedictory of Defence & Technology Expo Empowering MSME at Chennai Trade Centre on Saturday that the bulletproof fabric would be one of the many innovations in R&D in defence being done with the help of academia and industry at DRDO's centres of excellence.

"DRDO has 10 centres of excellence in R&D which have been renamed into DIA-CoE (DRDO, Academia and Industry-Centre of Excellence). With these syncretic efforts, the world's lightest bulletproof fabric is set to come out from the centres." These centres will work with academia and the industry to develop critical technology for enabling futuristic requirements of armed forces. The light-weight bulletproof jackets are being developed at DMSRDE lab of DRDO in Kanpur and Ordnance Clothing Factory in Chennai.

<https://timesofindia.indiatimes.com/city/chennai/ordnance-factory-to-make-lighter-bulletproof-vests/articleshow/91879225.cms>

THE TIMES OF INDIA

Sat, 28 May 2022

DRDO to Produce World's Lightest Bullet Proof Fabric

The Defence Research and Development Organisation (DRDO) will soon produce the world's lightest bullet proof fabric in collaboration with academia. DRDO chairman Satheesh Reddy said during the valedictory of Defence & Technology Expo Empowering MSME at Chennai Trade Centre on Saturday that the bullet proof fabric would be one of the many innovations in

R&D in defence being done with the help of academia and industry at DRDO's centres of excellence. "DRDO has 10 centres of excellence in R&D which have been renamed into DIA-CoE (DRDO, Academia and IndustryCentre of Excellence). With these syncretic efforts, the world's lightest bullet proof fabric is set to come out from the centres." These centres will work with academia and the industry to develop critical technology for enabling futuristic requirements of armed forces.

He said the defence corridor announced by the government in Tamil Nadu and UP would give a fillip to indigenisation of defence components. "DRDO will extend all support to the corridor by giving technology support, facilities and help in R&D. The government has been encouraging private industries to develop components, systems and subsystems for defence equipment." Stating that the scenarios had changed, Reddy said that the industry had migrated from "build to print" to "build to specifications" in the recent years. Going with this, the government opened new sectors to private. Missiles, guns, bombs radars are now being produced by private companies. Understanding this trend, DRDO had moved from Technology Transfer Documents (TTD) to Development cum Production Partner (DcPP) to make the industries a concurrent partner from the beginning of the process, he said.

"Industry will join the project from the time it is sanctioned. Earlier, it was done in a phased manner and industry used to be brought in at a much later stage. There will be a DRDO trial, industry trial, user trial which took time. Knowledge is now shared from the time of prototype development. This reduces the time for undergoing a number of trials. Presently, 75 companies are working with DRDO, many of them are private companies." He said that the aim of the country was to move from importer of defence equipment to that of an exporter.

Reddy also said around 300 industries used the DRDO facilities for testing and other work. DRDO had also opened the patents to companies, he added. Around 250 companies, mostly MSMEs, took part in the expo. The three-day Defence and Technology Expo - Empowering MSMEs was organized by Swatantra Foundation along with TIDCO and Lagu Udyog Bharati. The event saw over a dozen contracts being awarded. The valedictory function on Saturday was presided over by former chief election commissioner T S Krishna Murthy. The chief guest for the event was DRDO Chairman Satheesh Reddy.

<https://timesofindia.indiatimes.com/business/india-business/drdo-to-produce-worlds-lightest-bullet-proof-fabric/articleshow/91858672.cms>



Mon, 30 May 2022

Power Games: MoD Summons Defaulters, but Stalemate Continues

The Defence Offset Management Wing of the Ministry of Defence last week summoned all the Original Equipment Manufacturers (OEMs) who have not honoured their offset commitments. The OEMs were asked to explain why they have not implemented their offset contracts and by when they would discharge their duty. Four sessions lasting about an hour each were held with the defaulters. Among them are the world's largest defence companies. These companies had sold their wares to the government of India and had agreed to invest in India, 30% of the payment received from the government. They had signed separate offset contracts along with the contracts for the sale of their equipment. Sources said about three dozen companies were called by the MoD to seek explanation. The MoD, however, did not insist on any deadline for fulfilling the offset commitment. Neither did the OEMs offer any time schedule for the same, sources said. As a result, the stalemate between MoD and the OEMs continues, putting a question mark over the success of the government's offset policy.

The Congress party has decided to organise Rashtra Raksha Yajna (special prayer for peace, harmony and unity in the country) in temples all around the poll-bound Himachal Pradesh. The first yajna was held at Union minister Anurag Thakur's Lok Sabha constituency Hamirpur on Saturday. The big ones will be organised at Shakti peeths with prominent leaders in attendance, and small ones at temples in villages and mohallas of the state attended by local leaders of the party. The stated purpose of the yajna is to save the country from the divisive and negative politics of the BJP. It is, however, being held under the banner of Sarv Kalyankaari Sanstha which is headed by state Congress working president Rajinder Rana, who performed the havan at the Hamirpur Yajna. The function was attended by a large number of priests and locals, and chants for peace dominated the proceedings. Congress leaders said the yajna would have a calming effect on the people during a time when the BJP was whipping up religious hysteria with the aim of dividing the society on communal lines and reaping electoral dividend with the help of this polarisation. Terming the attack on communal harmony as an attack on the very foundation of India, Congress leaders said the party has decided to follow the ancient practice of organising yajna to ward off the evil facing the country.

Chief minister Manohar Lal Khattar's government is all set to buy an eight-seater Airbus H145 twin-engine helicopter to ferry the state chief minister. The chopper, which remains under the control of the state government, is allowed to be used by the Governor and other persons

authorised by the state government. Sources said that the Haryana government's tender for the procurement of the helicopter was drafted in such a way that only the Airbus chopper qualified for the bidding. Much to the surprise of industry watchers, the state government seems to have accepted the single tender, instead of redrafting it to allow a fair competition to get better value for the public money being spent. The new helicopter selected by the government would cost the state exchequer around Rs 100 crore. According to sources, an order for this chopper is likely to be placed in a week's time from now. With the acquisition of this chopper, the Khattar government would have two flying machines. It had bought a Beechcraft jet plane for about Rs 45 crore in its previous term.

<https://www.newindianexpress.com/nation/2022/may/30/power-gamesmod-summons-defaulters-but-stalemate-continues-2459601.html>



Mon, 30 May 2022

India to Buy 26 Fighters for INS Vikrant on G-2-G Basis

The carrier-based fighter acquisition by the Indian Navy will be part of a larger arrangement with the country selected as India is looking to manufacture fighter aircraft engines under the “Atmanirbhar Bharat” plan. With the indigenous twin-engine deck-based fighter a decade away, the Narendra Modi government will be buying 26 carrier-based fighters for soon to be commissioned INS Vikrant on a government-to-government basis on the recommendation of the Indian Navy.

While the flight test trials of options French Rafale-Marine have already been conducted at the Indian Navy's shore-based test facility in Goa this January, the trials of US F-18 super hornet are expected to be completed by June 15. Out of the 26 aircraft, the Indian Navy wants 8 twin seater trainers, which can also be used in combat conditions. Both the fighters are virtually of same vintage and both the manufacturers have maintenance, repairs, and overhaul facilities in India. Both the aircraft have undergone intensive trials at the test facility in Goa but have not landed on India's sole aircraft carrier, INS Vikramaditya, as it is under major maintenance in Karwar and expected to start sailing later in June. India's indigenous aircraft carrier INS Vikrant is undergoing sea trials and is expected to be commissioned by Prime Minister Narendra Modi on August 15, 2022.

According to South Block officials, India is not looking to lease fighters for INS Vikrant but will go for outright G-to-G purchase of the deck-based fighters from either French Dassault or US Boeing, based on the evaluation of Indian Navy's aviation wing. Both the companies have dealt with the Indian Air Force with Dassault selling Rafale fighters and Boeing selling P8I anti-submarine warfare platform, Chinook helicopters and C-17 heavy lift aircraft. The two aircraft have proven track records with F-18 being tested in Afghan and Iraq wars by the US Navy.

The carrier-based fighter deal is expected to be linked with a larger strategic arrangement with the country involved as New Delhi is looking for aircraft engine manufacturing under the “Atmanirbhar Bharat” initiative with the participation of Indian private sector companies. While French Safran is keen to manufacture 100 kilo newton engines with Indian entities without any

pre-conditions, Defence Ministry is also exploring the same with the US as the GE-404 engine is used in the indigenous Tejas fighter and GE-414 being considered for the twin engine advanced multi-role combat aircraft (AMCA) project of the DRDO.

<https://www.hindustantimes.com/india-news/india-to-buy-26-fighters-for-ins-vikrant-on-g-2-g-basis-101653881468920.html>



Sun, 29 May 2022

Those Whopping 40,000 Crore: Relevance of S-400 Missile Defence System

No cost analysis is apparently relevant when it comes to national defence. Most of the advanced countries are spending a substantial amount on their defence forces with the USA spending the maximum, an estimate puts it close to 800 billion dollars. Given the active challenges on its long borders with China and Pakistan, India is not spending commensurately adequate funds on modernisation of its armed forces especially given the size of its Armed Forces. Reduction of size of armed forces beyond a point may not be practical given the type of borders we have, even if the armed forces are modernised. Ongoing Russia-Ukraine conflict has adequately demonstrated that the battles cannot be won alone by superior armed forces and there are multiple other factors which contribute to the outcome of the war and therefore a nation with 'winner' mindset has to factor in all such aspects in the right sizing of its armed forces including modernisation. It was aptly highlighted by the previous COAS during his speech at Rashtriya Raksha University (RRU) that a peaceful and stable environment is needed for a country to prosper and therefore expenditure made on armed forces should not be viewed as a burden on the country's economy.

If the analogy of previous COAS is carried forward, it should emerge that adequate budgetary support should be provided for defence forces including non lapsable funds for the capital procurement. Not only this, since man behind the machine matters, adequate compensation and quality living should be also ensured for all the members of the Armed forces including veterans and probably, multiple current drives to cut costs on account of pensionary benefits and related expenditure should be looked at differently and there are multiple better options.

While need of budgetary support for the defence forces may be absolute but amidst the various other national challenges which the Government of the Day has to face, it is important to analyse as to whether our big ticket expenditure on equipment procurement is in tune with our current and future threat profile and towards this, procurement of S-400 missile defence system from Russia needs to be examined. It is assumed that the S-400 missile defence system being procured from Russia will make the Indian airspace impregnable and its forces invulnerable. Whether this assertion/aim is doable or not, is a matter of detail which will hopefully emerge by the end of this article.

The S-400 missile defence system of Russia is an improved version of its own S-300 missile defence system. While it was developed in 1990 as an upgrade to the S-300 missile defence system (more than three decades earlier), it was introduced into the service only in Apr 2007, a whopping gap of 17 years since its upgrade was attempted. What are the real changes, why did it take such a long time to introduce (disintegration of USSR being one of the reasons) are matters of details but what is an absolute truth is that it has been in service for last 15 years (one and a half decade) with probably three decade old technology and capability. It is probably one of the reasons that Russia has already come up with the S-500 missile defence system, a further upgraded version of S-400. It is also believed that the S-500 missile defence system has been introduced in Russian armed forces from Sep21 though further details are not available in the open source domain.

Procurement of the S-400 missile defence system has happened due to a decision at the apex leadership level wherein India has planned to purchase five such regiments at approximate cost of Rupees 40,000 crores. India has opted for this weapon system despite the USA offering a similar system. It is reasonable to assume that due to deliberation about the procurement of the S-400 missile defence system would have been done over the USA options by the experts and an appropriate decision probably has been taken as even USA alternate options would not have been cheaper. Before coming to suggest better options for its alternate use, it is important to analyse some of the aspects related to this missile defence system:

Russia had deployed this weapon system in Syria despite which Israeli AF bombarding the areas protected by it and being under its advertised range. It is believed that Russia did not target Israeli AF deliberately due to their probable mutual understanding of not destroying each other's resources. The issue, however, still remains whether its layered coverage from 40km to 400km is really achievable. During the current conflict of Russia and Ukraine, detailed deployment of this missile defence system is assumed. However, it has been able to destroy only one SU-27 ac and one MI-17 helicopter. One reason could be the absence of air strikes by Ukraine.

There are reports that besides itself and India, No of other countries have got/purchased this missile defence system or its earlier version. China has brought S-400 from Russia and is able to cover Taiwan from its Fujian and Diavoyu islands. USA has invoked CAATSA on China (countering America's Adversaries through sanctions Act). Turkey has also purchased this system and has also been subjected to CAATSA. Turkey has highlighted that this missile defence system is not very accurate against low and slow flying aerial objects which will pose a huge challenge on the Indian borders especially in view of emerging threats. Pakistan has a derivative of S-300 developed by China as HQ-9 which has probably been deployed on Indian Western borders. Though an accidental launch of BRAHMOS missile by India showed that the Pakistani air defence could neither detect it in a timely manner nor could it neutralise it. It therefore demonstrates not only the efficacy of Pakistan's air defence capability but also pits to question the effectiveness of the Russian missile defence system, though indirectly.

When this contract of the S-400 missile defence system was negotiated in 2019, it is obvious that the S-500 version would have been in an advanced stage of development as otherwise it would not have been operationalised in 2021. The S-500 missile defence system has multiple advantages over the Indian procured S-400 missile defence system. Range of S-500 missile defence is close to 600km even for ballistic missiles which are a more potent threat as compared to fighters. It is believed that S-500 can also target B-2, F-22 and F-35 stealth categories of aerial

effort effectively. It is not known if balance missile regiments for India will be from S-500 category or one has to manage S-400 whatever worth they are.

It therefore clearly emerges that the S-400 missile defence system is quite old technologically, its upgraded version S-500 already in operational service and it doesn't have a very high degree of reliability against the aerial threat which we have to handle in future battlefields. In addition to the above, the mute question is- whether spending close to 40,000 crores on this missile system is worth it given the above analysis. Especially so, when small arms procurement is being prioritised and non-availability of funds is one of the very many considerations. Not only this, the issue of adequate stocks of ammunition, critical infrastructure and many more important aspects are pending to be executed for the defence forces.

New World order and emerging lessons from the Russia-Ukraine war have transformed the battlefield milieu in a big way. While Russia may attempt to supply adequate equipment to facilitate raising of five regiments of S-400 missile defence system; albeit with some delay due to its ongoing conflict with Ukraine, it may be a point worth reconsidering not only to get the upgraded version of S-400 as S-500 but also to reassess the total need as well as prioritise this whopping expenditure of Rs 40,000 crores or so specially even when our infantry soldiers are not fully equipped to fight appropriately.

<https://www.financialexpress.com/defence/those-whopping-40000-crore-relevance-of-s-400-missile-defence-system/2541283/lite/>

THE ECONOMIC TIMES

Fri, 27 May 2022

Defence Minister Rajnath Singh Takes a Sea Sortie in Submarine

Defence Minister Rajnath Singh on Friday said the preparations being made by the Indian Navy are not a provocation to any aggression, but a guarantee of peace and security in the Indian Ocean Region. After spending hours under the sea, witnessing the combat capabilities and offensive strength of the state-of-the-art Kalvari class submarine- 'INS Khanderi', he termed the experience as "wonderful and thrilling", and said, he is more assured of India's security. He said the Indian Navy is a modern, potent and credible force which has the capability to remain vigilant, valiant and victorious in each and every situation.

The Defence Minister is on a two-day visit to the Naval Base in Karwar, which began on Thursday, during which he interacted with the Indian Navy personnel. "Today the Indian Navy is counted among the front line Navies of the world and world's big maritime forces are ready for cooperation with India. The preparations being made by the Indian Navy is not against anyone, but it is aimed at peace and prosperity of the Indian Ocean Region," Singh said. During his interaction with the media here, he said, "the preparations made by the Indian Navy are not a provocation to any aggression, but a guarantee to people in the Indian Ocean Region." Noting that INS Khanderi is the best example of 'Make-in- India' capabilities, the Minister said, out of the order given for 41 ships or submarines for the Indian Navy, 39 of them are being built at Indian Shipyards.

"I have myself launched two ships in Mumbai about 10 days ago," he said, adding that the INS Khanderi in which he took the sea sortie on Friday was commissioned by him in September, 2019. Singh said that the fast phase at which the Indian Navy has launched ships and other platforms recently, has given strength to Prime Minister Narendra Modi's campaign of "Aatma Nirbhar Bharat".

https://m.economictimes.com/news/defence/defence-minister-rajnath-singh-takes-a-sea-sortie-in-submarine/amp_articleshow/91834862.cms#aoh=16538809665442&referrer=https%3A%2F%2Fwww.google.com&tf=From%20%251%24s

BusinessToday.In

Fri, 27 May 2022

Indian Drone Industry Eyes Commercial, Defence Sectors at Drone Festival 2022

The new liberalised drone rules announced by the government in 2021 gave wings to the grounded drone industry. A glimpse of this could be seen at the two-day drone festival organised in New Delhi with over 150 companies -- from hardware to software to component OEMs showcasing their solutions. While drones are used for recreation, commercial and defence purpose, the former was missing with focus on the latter two. The exhibition area was swamped with some big names such as Adani Defence and Aerospace, IdeaForge, MapmyIndia, Dassault Systèmes, and Esri, to name a few, representing an end-to-end drone and UAV ecosystem. Companies like Dassault Systèmes have a software platform which companies can conceptualize and design drones with and even seek the mandatory certification put in place by the government. Then there were GIS companies like ESRI and MapmyIndia. Drone manufacturers can use mapping and GIS location data from home-grown company MapmyIndia, which is also powering the government's Digital Sky Platform.

While the majority of the companies were displaying their drone technology, the Zen Anti-Drone System had showcased its drone countering setup. This included both a soft counter using nets and a hard counter where the drone can be shot down. Zen Technologies had also bagged an order worth Rs 155 crore for the anti-drone system from the Indian Airforce. There was also Bengaluru-based RC Dhamaka which had displayed components that go into drones. Interestingly, Business Today spotted many officials of the Indian armed forces enquiring about the new technologies that they can evaluate and deploy. This two-day drone festival was inaugurated by Prime Minister Narendra Modi, who said that promotion of drone technology is another medium of advancing India's commitment to good governance and ease of living.

He added, "Technology has helped a lot in furthering the vision of saturation and in ensuring last-mile delivery. And I know that we can achieve the goal of Antyodaya by moving forward at this pace." Amidst all these developments in the Indian drone industry, research firm Research and Markets has estimated that India's UAV market will be worth \$1.81 billion (or Rs 13,575 crore) by FY26, while the Drone Federation of India estimates the industry to touch Rs 50,000 crore in the next five years. Agriculture, real estate, homeland security and defence will be the few areas that will be the biggest drivers for the industry, strategic defence procurements are not

part of this estimate. That said, if the potential of drone delivery and drone taxis is unlocked quickly, the market will expand 10X.

<https://www.businesstoday.in/latest/story/indian-drone-industry-eyes-commercial-defence-sectors-at-drone-festival-2022-335391-2022-05-27>

THE ECONOMIC TIMES

Sat, 28 May 2022

Russia Says Carried Out Hypersonic Missile Test

Russian forces Saturday announced a latest successful test of their Zircon hypersonic cruise missile as Moscow steps up its Ukraine offensive. The missile was fired from the Admiral Gorshkov frigate stationed in the Barents Sea and "successfully hit" a target stationed 1,000 kilometres (625 miles) away in the White Sea in the Arctic, the defence ministry said. The ministry added the test was undertaken as part of ongoing "testing of new weapons". The first official Zircon test, which President Vladimir Putin described as a "great event," came in October 2020. Other tests followed, from the same frigate and from a submerged submarine.

The latest test of a hypersonic weapon comes as Russia looks to be making ground in its offensive launched in Ukraine in late February. The weapon can reach speeds of between five and ten times the speed of sound and has a maximum range of around 1,000 kilometres. In March, Moscow said it had used for the first time in combat its high-precision Kinzhal, or dagger, hypersonic missile. Putin has described the missiles as a family of new "invincible" arms in Russia's arsenal.

The new generation-weaponry, unveiled by Putin in 2018, are more difficult to track and intercept by missile defence systems than conventional weapons, owing to their speed but also as they are launched at lower altitude towards their target.

<https://economictimes.indiatimes.com/news/defence/russia-says-carried-out-hypersonic-missile-test/articleshow/91854857.cms>



Sun, 29 May 2022

Ukraine Receives Missiles and Howitzers, Zelenskyy Expects 'Good News' on Arms Supplies

Ukraine has started receiving Harpoon anti-ship missiles from Denmark and self-propelled howitzers from the United States, Ukrainian Defence Minister Oleksiy Reznikov said on Saturday, saying the arms would bolster forces fighting Russia's invasion. "The coastal defence of our country will not only be strengthened by Harpoon missiles – they will be used by trained Ukrainian teams," Reznikov wrote on his Facebook page. He said Harpoon shore-to-ship

missiles would be operated alongside Ukrainian Neptune missiles in the defence of the country's coast including the southern port of Odesa.

Serhiy Bratchuk, a spokesman for the Odesa regional military administration in southern Ukraine, said in an online post that "so many Harpoons have been handed over to us that we can sink the entire Russian Black Sea Fleet. Why not?" Last month the Moskva, the flagship of Russia's Black Sea fleet, sank after what Ukraine says was an anti-ship missile attack. Moscow says a fire sparked an ammunition blast. After launching its invasion of Ukraine on Feb. 24, Russia imposed a naval blockade of Ukrainian ports, hampering vital grain exports. It has also used its Black Sea fleet to launch missile attacks against Ukraine.

Reznikov said Ukraine had also received a range of heavy artillery pieces, including modified U.S.-made M109 self-propelled howitzers that will allow the Ukrainian military to strike targets from longer distances. Ukraine says it wants to secure deliveries of U.S.-made long-range M270 multiple-rocket launchers (MLRS). President Volodymyr Zelenskiy said Ukraine, working to boost weapons supplies, was approaching the point where it would outnumber the Russians both technologically and in terms of its ability to strike.

"Of course, a lot depends on our partners and their readiness to provide Ukraine with everything necessary to protect freedom. And I expect good news on this next week," he said in a late-night video, without giving details. Russia says its forces are on a special operation to demilitarise Ukraine and rid it of radical anti-Russian nationalists. Ukraine and its allies call that a false pretext to for invading Ukraine.

<https://www.news18.com/news/world/ukraine-receives-missiles-and-howitzers-zelenskyy-expects-good-news-on-arms-supplies-5267653.html>

Science & Technology News



Sun, 29 May 2022

ISRO Taking Help of Doctors in Developing Human-Rated Spacecraft for Gaganyaan Mission

The Indian Space Research Organisation (ISRO) is taking help of doctors in building its human-rated spacecraft for the Gaganyaan mission, India's first human spaceflight that aims to take astronauts into a low earth orbit. The ISRO has roped in doctors to understand the impact of the spaceflight on humans and will design the spacecraft accordingly. The astronauts selected for the mission have also been involved in making of the orbital module. "There are four astronauts who are part of Gaganyaan. We talk to them. They sit in a cockpit. We ask them to go through this and tell us whether the placing of equipment is correct, whether the lighting is correct or whether the edges are causing discomfort," ISRO Chairman S. Somnath said during a brainstorming session with health experts on the use of space technology in emergency medical services.

Somanth said scientists at the ISRO were developing the human-rated spacecraft. "We also look at various measures of quality to increase the reliability and finally to prove the redundancy," Mr. Somnath said, adding that space agencies the world over, including ISRO, have imbibed developing failsafe systems as a culture. "We are also looking at how doctors can connect with the human spacecraft design. There is an interaction happening with doctors and engineers on the designing of the human spacecraft. If you have to conduct a successful human space flight and sustain it in India, we need a strong pool of doctors who will get involved in this human spaceflight mission as well," he said.

Union Minister Jitendra Singh has said that the first unmanned mission in the Gaganyaan series was expected to be launched next year. This would be followed by another unmanned mission, before Indian astronauts board the spacecraft for a sojourn in a low earth orbit. According to a senior ISRO official, a human-rated spacecraft should be able to accommodate the crew as if they are living in normal acceptable conditions and they should be able to perform various activities during their stay. The engineers have to design the spacecraft by identifying potential hazards and developing systems to control such happenings. The spacecraft also should have the facility to safely recover the crew from any hazardous situation.

<https://www.thehindu.com/sci-tech/technology/isro-taking-help-of-doctors-in-developing-human-rated-spacecraft-for-gaganyaan-mission/article65473081.ece>



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Fundamental Breakthrough: Error-Free Quantum Computing Gets Real

Due to high-quality fabrication, errors during processing and storage of information have become a rarity in modern computers. However, for critical applications, where even single errors can have serious effects, error correction mechanisms based on the redundancy of the processed data are still used. Quantum computers are inherently much more susceptible to disturbances and therefore error correction mechanisms will almost certainly always be required. Otherwise, errors would propagate uncontrolled in the system and information would be lost. Because the fundamental laws of quantum mechanics forbid copying quantum information, redundancy can be achieved by distributing logical quantum information into an entangled state of several physical systems, for example, multiple individual atoms.

The research team, led by Thomas Monz of the Department of Experimental Physics at the University of Innsbruck and Markus Müller of RWTH Aachen University and Forschungszentrum Jülich in Germany, has now succeeded for the first time in realizing a set of computational operations on two logical quantum bits that can be used to implement any possible operation. "For a real-world quantum computer, we need a universal set of gates with which we can program all algorithms," explains Lukas Postler, an experimental physicist from Innsbruck.

Fundamental quantum operation realized

The team of researchers implemented this universal gate set on an ion trap quantum computer featuring 16 trapped atoms. The quantum information was stored in two logical quantum bits, each distributed over seven atoms. Now, for the first time, it has been possible to implement two computational gates on these fault-tolerant quantum bits, which are necessary for a universal set of gates: a computational operation on two quantum bits (a CNOT gate) and a logical T gate, which is particularly difficult to implement on fault-tolerant quantum bits.

“T gates are very fundamental operations,” explains theoretical physicist Markus Müller. “They are particularly interesting because quantum algorithms without T gates can be simulated relatively easily on classical computers, negating any possible speed-up. This is no longer possible for algorithms with T gates.” The physicists demonstrated the T-gate by preparing a special state in a logical quantum bit and teleporting it to another quantum bit via an entangled gate operation.

Complexity increases, but accuracy also

In encoded logical quantum bits, the stored quantum information is protected from errors. But this is useless without computational operations and these operations are themselves error-prone. The researchers have implemented operations on the logical qubits in such a way that errors caused by the underlying physical operations can also be detected and corrected. Thus, they have implemented the first fault-tolerant implementation of a universal set of gates on encoded logical quantum bits.

“The fault-tolerant implementation requires more operations than non-fault-tolerant operations. This will introduce more errors on the scale of single atoms, but nevertheless the experimental operations on the logical qubits are better than non-fault-tolerant logical operations,” Thomas Monz is pleased to report. “The effort and complexity increase, but the resulting quality is better.” The researchers also checked and confirmed their experimental results using numerical simulations on classical computers. The physicists have now demonstrated all the building blocks for fault-tolerant computing on a quantum computer. The task now is to implement these methods on larger and hence more useful quantum computers. The methods demonstrated in Innsbruck on an ion trap quantum computer can also be used on other architectures for quantum computers.

<https://scitechdaily.com/fundamental-breakthrough-error-free-quantum-computing-gets-real/>



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Improving Battery Performance at Low Temperatures

Energy storage via rechargeable battery technology powers our digital lifestyles and supports renewable energy integration into the power grid. However, battery function under cold conditions remains a challenge, motivating research on improving the low-temperature performance of batteries. Aqueous batteries (in a liquid solution) do better than non-aqueous

batteries in terms of rate capability (a measure of energy discharged per unit of time) at low temperatures. New research from engineers at the China University of Hong Kong, which was recently published in the journal *Nano Research Energy*, proposes optimal design elements of aqueous electrolytes for use in low-temperature aqueous batteries. The research reviews the physicochemical properties of aqueous electrolytes (that determine their performance in batteries) based on several metrics: phase diagrams, ion diffusion rates, and the kinetics of the redox reactions.

The main challenges for low-temperature aqueous batteries are that the electrolytes freeze, the ions diffuse slowly, and the redox kinetics (electron transfer processes) are consequently sluggish. These parameters are closely related to the physicochemical properties of the low-temperature aqueous electrolytes used in batteries. In order to improve battery performance under cold conditions, therefore, requires an understanding of how the electrolytes respond to cold ($-50\text{ }^{\circ}\text{C}$ to $-95\text{ }^{\circ}\text{C}$ / $-58\text{ }^{\circ}\text{F}$ to $-139\text{ }^{\circ}\text{F}$). Says study author and associate professor Yi-Chun Lu, “To obtain high-performance low-temperature aqueous batteries (LT-ABs), it is important to investigate the temperature-dependent physicochemical properties of aqueous electrolytes to guide the design of low-temperature aqueous electrolytes (LT-AEs).”

Evaluating Aqueous Electrolytes

The researchers compared various LT-AEs used in energy storage technologies, including aqueous $\text{Li}^+/\text{Na}^+/\text{K}^+/\text{H}^+/\text{Zn}^{2+}$ -batteries, supercapacitors, and flow batteries. The study collated information from many other reports regarding the performance of diverse LT-AEs, for example an antifreezing hydrogel electrolyte for an aqueous Zn/MnO_2 battery; and an ethylene glycol (EG)- H_2O based hybrid electrolyte for a Zn metal battery. They systematically examined equilibrium and non-equilibrium phase diagrams for these reported LT-AEs in order to understand their antifreezing mechanisms. The phase diagrams showed how the electrolyte phase change across changing temperatures. The study also examined conductivity in LT-AEs with respect to temperature, electrolyte concentrations, and charge carriers.

Study author Lu predicted that “ideal antifreezing aqueous electrolytes should not only exhibit low freezing temperature T_m but also possess strong supercooling ability,” i.e. the liquid electrolyte medium remains liquid even below freezing temperature, thus enabling ion transport at ultra-low temperature. The study authors found that, indeed, the LT-AEs that enable batteries to operate at ultralow temperatures mostly demonstrate low freezing points and strong supercooling abilities. Further, Lu proposes that “the strong supercooling ability can be realized by improving the minimum crystallization time t and increasing the ratio value of glass transition temperature and freezing temperature (T_g/T_m) of electrolytes.”

The charge conductivity of the reported LT-AEs for use in batteries could be improved by lowering the amount of energy required for ion transfer to occur, adjusting the concentration of electrolytes, and choosing certain charge carriers that promote fast redox reaction rates. Says Lu “Lowering the diffusion activation energy, optimizing electrolyte concentration, choosing charge carriers with low hydrated radius, and designing concerted diffusion mechanism[s] would be effective strategies to improve the ionic conductivity of LT-AEs.”

In the future, the authors hope to further study the physicochemical properties of electrolytes that contribute to improved aqueous battery performance at low temperatures. “We would like to develop high-performance low-temperature aqueous batteries (LT-ABs) by designing aqueous

electrolytes possessing low freezing temperature, strong supercooling ability, high ionic conductivity, and fast interfacial redox kinetic,” says Lu.

<https://scitechdaily.com/improving-battery-performance-at-low-temperatures/amp/>



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Quarter of World’s Internet Users’ Infrastructure Susceptible to Attacks

The study found that a large number of internet users live in regions where attackers could just target one or a few companies can cripple the entire nation's internet access. About a quarter of the world’s internet users live in countries with internet infrastructure that are more susceptible to targeted attacks than previously thought, according to a large scale study conducted by researchers at the University of California San Diego. The computer scientists surveyed a total of 75 countries. The study was presented at the Passive and Active Measurement Conference 2022 held online.

“We wanted to study the topology of the Internet to find weak links that, if compromised, would expose an entire nation’s traffic. But a large portion of the Internet doesn’t function with peering agreements for network connectivity,” said Alexander Gamero-Garrido, the paper’s first author, in a press statement. Depending on the country you are in, the structure of the internet can differ dramatically. In some places like the United States, a large number of internet service providers (ISPs) compete and offer services to a large number of users. These ISPs have networks that are directly connected to one another and exchange content; a process called direct peering.

But the study found that in some countries, many of whom are in the global south, internet users rely on just a few ISPs for internet access. And in some of these countries, one ISP serves a large majority of users. These providers often rely on a limited number of companies to get access to the global internet and internet traffic from other countries. This could mean that attackers would only need to target one or few of these companies, called transit autonomous systems, to cripple an entire nation’s internet access. In countries like Cuba and Sierra Leone, one transit autonomous system provider provides a connection for almost all the users in the country; presenting a worst-case scenario.

<https://indianexpress.com/article/technology/science/quarter-of-worlds-internet-users-infrastructure-susceptible-to-attacks-7942342/lite/>

