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A Daily service to keep DRDO Fraternity abreast with DRDO Technologies, Defence Technologies, Defence Policies, International Relations and Science & Technology

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DRDO News

DRDO on Twitter

DRDO Retweeted

DSTIndia @IndiaDST · 17h

On the occasion of #InternationalDayofWomenandGirlsinScience WISE-KIRAN Division @IndiaDST is organising a Role Model Talk on theme 'Sky is not the Limit', by Dr Tessa Thomas, DG, Aeronautical Systems, @DRDO_India under Vigyan Jyoti on 11 February, 2022 under #AmritMahotsav .



The poster for the 'Vigyan Jyoti Role Model Talk' is organized by the WISE-KIRAN Division, Department of Science & Technology (DST). It is held on the occasion of International Day of Women and Girls in Science with the theme 'THEME: SKY IS NOT THE LIMIT'. The event is scheduled for 11th February, 2022, at 02:00 PM. Two speakers are featured: Dr. Tessa Thomas, Director General, Aeronautical Systems, Former Project Director - Agni-IV Missile, DRDO; and Dr. S. Chandrasekhar, Secretary, Department of Science & Technology. The poster also provides webex and YouTube links for the event.

Dr Jitendra Singh and 7 others

10 February 2022

DRDO Retweeted

SpokespersonNavy @indiannavy · Feb 10

VCNS also saw autonomous boats & prototype of Autonomous Modular Inflatable Target (AMIT) for which a patent application has been filed by #IndianNavy.

These projects are a result of close #collaboration between the pvt sector, academia, R&D Estb(Engrs) @DRDO_India & #NIIO (4/5)



The first photograph shows a group of naval personnel in white uniforms gathered around a large, black, autonomous boat with 'MERCURY' written on its side. The second photograph shows a group of people, including some in white uniforms, gathered around a table, examining a prototype of an Autonomous Modular Inflatable Target (AMIT).

Sagar Defence Engineering and 9 others

Business Standard

Fri, 11 Feb 2022

Indian Army is alive to threats in the cyber domain: Gen Naravane

The Indian Army is alive to the threats in the cyber domain and it has taken a number of steps to consolidate its capabilities to deal with them, Chief of Army Staff Gen MM Naravane said on Thursday

New Delhi: The Indian Army is alive to the threats in the cyber domain and it has taken a number of steps to consolidate its capabilities to deal with them, Chief of Army Staff Gen MM Naravane said on Thursday.

He made the comments while felicitating the winners of a hackathon during an online ceremony.

To promote proficiency and expertise in the use of emerging technologies, a first-of-its-kind hackathon was conducted at the Military College of Telecommunication Engineering (MCTE) in Mhow, the Army said.

The event, 'Sainya Ranakshetram', was conducted from October 1 to December 31 and 15,000 participants took part.

The Army Chief felicitated the winners of the hackathon at an online ceremony held on Thursday.

"While acknowledging that cyber threats from a host of actors were one of the most critical challenges faced by the nation today, the Chief of Army Staff said the Indian Army was alive to the threat and had taken a number of steps to consolidate its capabilities in the cyber domain," the Army said in a statement.

https://www.business-standard.com/article/current-affairs/indian-army-is-alive-to-threats-in-the-cyber-domain-gen-naravane-122021001756_1.html



Army Chief General MM Naravane.
Photo: ANI



Press Information Bureau
Government of India

Ministry of Defence

Thu, 10 Feb 2022 4:23PM

Indian Army conducts first ever hackathon at Military College of Telecommunication Engineering, Mhow

In a bid to promote proficiency and expertise in the use of emerging technologies, and showcase the technological side of the Indian Army, a first-of-its-kind Hackathon was conducted at the Military College of Telecommunication Engineering (MCTE), Mhow under the overall guidance of the Shimla based Army Training Command (ARTRAC).

The event, “Sainya Ranakshetram”, was conducted from 01 Oct 2021 to 31 Dec 2021 in collaboration with the Rashtriya Raksha University, in which over 15000 participants took part. The event was conducted virtually over the Internet and comprised a number of challenges based on Secure Coding, Software Defined Radio exploitation and Cyber Offensive skills. The highlights of the event included participants competing with each other in cyber space against simulated threats. The event also hosted a number of training sessions and expert talks for the participants. Cyber enthusiasts from across the country took part in the event, with substantial response from rural and remote areas.

Chief of the Army Staff General MM Naravane felicitated the winners of the Hackathon during an online ceremony held today. While acknowledging that cyber threats from a host of actors were one of the most critical challenges faced by the Nation today, the COAS said the Indian Army was alive to the threat and had taken a number of steps to consolidate its capabilities in the cyber domain. He lauded the efforts made by the organisers and the participants for their motivation, zeal and spirit towards each activity during the Hackathon. He also wished them the best for their future endeavours, adding that this maiden effort would grow and evolve over time to encourage innovation and creativity in young minds.



<https://pib.gov.in/PressReleasePage.aspx?PRID=1797235>



Fri, 11 Feb 2022

As Indian Army hunts for light-weight tanks to battle China, Hanwha Defense, L&T could collaborate on the project — reports

Indian defense manufacturer Larsen & Toubro (L&T) is reportedly preparing to develop light tanks for the Indian Army in collaboration with Hanwha Defense of South Korea.

By Ashish Dangwal

The two companies have previously teamed up to manufacture the K9 Vajra-T self-propelled howitzer (SPH) for the Indian Army, which is a derivative of the K9 Thunder. An L&T spokesperson told Janes on February 7 that the company intends to collaborate with Hanwha Defense on the development of light tanks.

India’s Ministry of Defence (MoD) has only released a request for information (RFI) for the light tanks, not a tender, the spokeswoman added. Details about the tank will be known when the tender comes out.

This classification will decide whether or not a foreign vendor will be engaged in the production of the light tanks, and to what extent. “Given this situation, I believe it is far too early for any global player to offer their product to India,” said the L&T spokesperson.



South Korea's K21-105 light Tank (via Twitter)

Need For A Light Tank

Last year, India issued an RFI for 350 light tanks, looking for potential manufacturers to meet the forces' long-standing demand. The decision was apparently made after the first sighting of the new Chinese light tank, the Type 15 or ZTQ 15, in Eastern Ladakh, where the Indian Army and the Chinese PLA have been locked in a border dispute for almost 22 months now.

India had also stationed a fleet of T-90 tanks weighing around 46 tonnes in Ladakh. This was in addition to the T-72 tanks, which weigh roughly 45 tonnes and were previously deployed.

The RFI called for a modern light tank with a maximum weight of 25 tonnes that is amphibious, easily transportable by air, road, and water, and has cutting-edge mobility, armament, and protection systems and which can operate in a variety of terrain, including high-altitude places.

“The advancement in technology also facilitates that the ‘Light Tank’ is having weapon systems and protection of adequate capacity and is equipped suitably to operate in current/future threat spectrum, to support combat operations as a weapon system,” the RFI issued in April 2021 said. Moreover, the light tank would be purchased under the ‘Make in India’ ethos and spirit of the Defence Acquisition Procedure (DAP) 2020.

Ajai Shukla, a leading defense analyst, noted in his article that light tanks are useful not only on the high-altitude Sino-Indian border but also on the mountain frontier with Pakistan in J&K. They can also be employed to combat insurgents in the jungle and urban environments.

Options for India

Additionally, India is believed to be interested in Russian-made Sprut-SDM1 light tanks in order to confront China's rugged terrain near the Line of Actual Control (LAC), the de facto border.

The Sprut-SDM1 is the world's only light amphibious fighting vehicle with a 125mm main gun and the firepower of a major battle tank. The capacity to fire a cannon while afloat is another unique feature.

The Chinese Type 15 light tank and the Turkish Kaplan MT medium tank are two other products that are comparable to their Russian counterparts. However, unlike the Sprut, which has a 125mm main gun, both these tanks have 105mm main cannons.

In addition, Sprut-SDM1 can launch guided missiles and possesses a formidable weapon package that comprises a 125mm gun, a 7.62mm remote-controlled machine gun, and a 7.62mm coaxial machine gun.

The tank's onboard guided missile weapon system can strike armored targets up to 5 kilometers away, including those armed with explosive reactive armor (ERA), while the roof-mounted machine gun can combat low-flying helicopters.

The Sprut is capable of going 500 kilometers without refueling and can be transported by military cargo planes, landing ships, and parachuted with a crew within it.

Meanwhile, Larson & Toubro and the state-run Defence Research and Development Organisation (DRDO) were said to be in discussions to modify the K9 Vajra SPH into a light or medium weight tank. However, there is no further development in this regard.

Hanwha Defence is reportedly offering its K21-105 light tank to the Indian Army. This light tank is a potent system, with a 105 mm turret that can achieve nearly 42 degrees of elevation, useful for firing at targets on higher slopes, and a 10-degree depression angle. L&T is most likely seeking a new collaboration with Hanwha Defence for the K21-105 light tank.

<https://eurasianimes.com/indian-army-hunts-for-light-weight-tanks-to-battle-china-hanwha/>

Bharat Dynamics Limited boasts of orders worth Rs 11,400 crore over meeting with Defense Minister

The company has built up a strong in-house R&D division with talent drawn from premier institutions.

Hyderabad: The order book position of Bharat Dynamics Limited (BDL), which recently signed a contract with Indian Army for manufacturing and supplying Konkurs-M anti-tank guided missiles, stands at Rs 11,400 crore. This was revealed during a review meeting Defence Minister Rajnath Singh with senior BDL officials here on Thursday. BDL CMD Commodore Siddharth Mishra (retd) apprised Singh about the progress of various ongoing projects.

The company is expecting more orders in the coming days with most of those at various stages of approval in the Ministry of Defence. In addition to the domestic market, BDL is also look to foreign customers to consolidate its order book and become a global exporter of weapon systems. According to an official statement, BDL has a well-established infrastructure and expertise to execute the orders from domestic as well export markets and meet the delivery schedule.



Chinna Jeeyar Swamy felicitates Defence Minister Rajnath Singh during his visit to the former's ashram at Muchintal near Hyderabad on Thursday.

The company has built up a strong in-house R&D division with talent drawn from premier institutions. The division is leveraging emerging technologies like AI to develop state-of-the-art weapons. The missile development group set up within the R&D division is working on next generation missile programmes. BDL has also signed agreements with foreign original equipment manufacturers and start-up companies to develop next generation weapons.

<https://www.newindianexpress.com/states/telegana/2022/feb/11/bharat-dynamics-limited-boasts-of-orders-worth-rs-11400-crore-over-meeting-with-defense-minister-2418049.html>

Liaison officer from Mauritius posted at Indian Navy's Information Fusion Centre

New Delhi: A liaison officer from Mauritius was on Thursday posted at the Indian Navy's Information Fusion Centre (IFC) which has emerged as a key hub in tracking developments in the Indian Ocean.

With the posting of the officer, Mauritius joined a select group of countries such as the UK, the US, Australia, Japan, France and Seychelles to depute officials at the Gurgaon-based facility.

The Indian Navy established the Information Fusion Centre-Indian Ocean Region (IFC-IOR) in 2018 to effectively keep track of the shipping traffic as well as other critical developments in the region under a collaborative framework with like-minded countries.

"1st International Liaison Officer (ILO) from Mauritius inducted in presence of HE Santi Bai Hanoomanjee, High Commissioner of Mauritius to India," the IFC-IOR said on Twitter.

The positioning of the officer at the centre comes amid growing maritime security ties between India and Mauritius.

In October last year, a liaison officer from Seychelles was posted at the IFC-IOR.

In February last year, Australia posted a liaison officer at the facility.

The Indian Ocean, considered the backyard of the Indian Navy, is critical for India's strategic interests. China has been making concerted efforts to increase its presence in the region.

<https://theprint.in/india/liaison-officer-from-mauritius-posted-at-indian-navys-information-fusion-centre/827463/>

THE ECONOMIC TIMES

Fri, 11 Feb 2022

Myanmar and Pakistan in arms deal, guided by China

By Dipanjan Roy Chaudhury

Synopsis

Islamabad is expecting deeper cooperation with Beijing in terms of sub-warfare equipment development, letting Pakistan do maintenance and overhaul for Chinese origin equipment, and more importantly, let Pakistani's Defense industries become an avenue for Chinese defence sales.

New Delhi: Pakistan's military partnership with India's eastern neighbour Myanmar is gathering momentum with a military delegation from the Directorate of Military Procurement from the SE Asian country scheduled to visit Pakistan for pre-shipment inspection of arms.

Myanmar military is planning to purchase 60 & 81 mm mortars, M-79 grenade launchers and Heavy Machine Guns from Pakistan and a senior-level delegation is planning to visit to inspect the products ahead of their shipment, ET has reliably learnt.

Myanmar is also eyeing to purchase air-to-surface missiles from Pakistan, ET has further learnt. These missiles are for their JF-17 fighter aircraft. Myanmar cannot directly purchase these missiles from China due to a ban imposed by Beijing. It may be recalled that in 2015, Myanmar became the first country to import JF-17 Thunder fighter aircraft, a light weight multi-role combat aircraft developed jointly by Pakistan Aeronautical Complex and Chengdu Aircraft Industries Corporation of China.

After the military coup in Myanmar, Pakistan, egged by China, has sensed an opportunity to expand defence partnership with Myanmar, an expert on Myanmar who did not wish to be identified told ET. Islamabad is expecting deeper cooperation with Beijing in terms of sub-warfare equipment development, letting Pakistan do maintenance and overhaul for Chinese origin equipment, and more importantly, let Pakistani's Defense industries become an avenue for Chinese defence sales.

One of the key inpersons pushing military ties with Pakistan is Aye Ne Win, grandson of the country's former military dictator General Ne Win. Aye Ne Win has been a key figure in Myanmar's defence sector under military rulers over the last two decades and has been in touch with Pakistani diplomats in Myanmar in the recent past.

It may be recalled that last September a high-level delegation from Pakistan's defense ministry made a visit to Myanmar unannounced by either side.

<https://economictimes.indiatimes.com/news/defence/myanmar-and-pakistan-in-arms-deal-guided-by-china/articleshow/89491351.cms>



Myanmar cannot directly purchase these missiles from China due to a ban imposed by Beijing.

Fri, 11 Feb 2022

Turkish firm offers combat aircraft co-production in RMAF contract race

The Hürjet, which will be co-manufactured with Malaysian partners, will be a long-term investment in local engineers

By Priya Vasu

The Turkish bidders for the hotly contested Royal Malaysian Air Force (RMAF) fighter aircraft said they are offering Malaysia co-production of a new fighter jet as part of their offerings.

Turkish Aerospace Industries Inc management said it will also provide technology transfer and is willing to cut its bid price by as much as 30%, in order to secure RMAF's open tender for military aircraft.

Turkish Aerospace is one of six international companies that submitted bids to supply 18 light combat aircraft (LCA) to RMAF.

The Turks are offering their "Hürjet", which is yet to be in production.

The "Hür", which means free, offers planned capabilities including air-to-air refuelling, helmet-mounted display, full glass cockpit with head-up display and embedded tactical training system, as well as fitted with human-machine-interface with Turkish fifth-generation fighter aircraft programme and more.

The "Hürjet" was developed by Turkish Aerospace in 2017 via internally-generated fund. The Presidency of Turkish Defence Industries (SSB), which is a government entity, owns 45.45% of Turkish Aerospace with 54.49% owned by the Turkish Armed Forces Foundation.

The Turkish jet is still at the prototype stage with planned production in 2023.

SSB president Ismail Demir said the jet — which will be co-manufactured with Malaysian partners — will be a long-term investment in Malaysian engineers.

He said such investment would help Malaysia to reduce dependency on foreign aircraft suppliers (direct purchase) and work towards achieving total self-sufficiency in producing domestic battle-proven military aircraft.

"In 10 years, Malaysia will be able to jointly produce battle aircraft with Turkey or a more advanced version. In 20 years from now, you will have Malaysian-made jet fighters. This is what we promise.

"We would engage your engineers and technicians into the project. Besides the 'know-how', we transfer to your local engineers the 'know-why' information too. These are the knowledge you can only acquire in the working process. This process may not be offered by other parties (bidders). We are investing in Malaysian engineers and we hope the Malaysian officials can see the bigger picture. Others might assemble aircraft in Malaysia, but they may not be committed to teaching and investing in your workforce, mainly engineers like the Turkish would do," said Demir to the Malaysian media delegation in Ankara, Turkey recently.

The other five companies that submitted their bid to the RMAF are India's Tejas fighter jet manufactured by Hindustan Aeronautics Ltd (HAL), Korea Aerospace Industries with its FA 50 fighter jet, L-15 fighter jet manufactured by China National Aero-Technology Import & Export Corp and Italy's Leonardo made M-346 planes and Aerospace Technology Systems Bhd with Russian made MiG 35 fighter jets.

The RMAF listed five requirements for the LCA bidders which are 30% of the fighter jet production has to be local content, must deliver the LCAs 36 months after the contract is signed, air-to-air refuelling capabilities, beyond visual range missile and supersonic capabilities.



Turkish Aerospace decided to set up an office in Cyberjaya, Selangor, and a science park in Putrajaya in November last year as part of its initiative to woo the Malaysian officials to collaborate on the “Hürjet” project and to further solidify its presence and ties in Malaysia.

In 2020, HAL too expressed its interest to establish maintenance facilities in Malaysia.

However, there are no further developments into this to date.

While other bidders have not made any announcements on possibly establishing a logistics presence in Malaysia.

Malaysia has long been a Russian-origin military aircraft customer. However, poor services of aircraft maintenance and the difficulty obtaining original equipment manufacturer parts and replacement components have been an issue in the past.

RMAF is looking to retire some of the older Malaysian aircrafts such as Bae Hawk Mk 108 and Mk 208 in service to make room for newer ones.

<https://themalaysianreserve.com/2022/02/11/turkish-firm-offers-combat-aircraft-co-production-in-rmaf-contract-race/>



Fri, 11 Feb 2022

Bangladesh sizes up Typhoons for Fighter requirement

By Jon Lake

Bangladesh has a requirement for 16 new multirole combat aircraft (MRCA) to augment and eventually replace its aging Chengdu F-7s and MiG-29s, and the nation wants to turn westward after decades of purchasing its fighter aircraft from Russia and China. The impetus for the shift came in 2015, with the appointment of a new Chief of the Air Staff, Air Chief Marshal Abu Esrar, who wanted to phase out the Bangladesh Air Force fleet of Russian and Chinese fighters and replace them with Western aircraft. Esrar evaluated the Eurofighter Typhoon at the 2016 Farnborough International Airshow and he reportedly “fell in love with it.” Esrar’s successor, Air Chief Marshal Masihuzzaman Serniabat, appears equally enthusiastic, though a planned evaluation with Leonardo fell victim to the Covid pandemic.

Bangladesh’s Directorate General Defence Purchase (DGDP) launched a tender in 2017 for the purchase of eight fighters, plus options for an additional four, under the Forces Goal 2030 program. Later increased to 16 aircraft, the tender calls for a new-build, twin-engine fighter, with each engine producing at least 12,125 pounds of dry thrust and over 17,635 pounds with afterburner. The minimum payload will be five tonnes with at least eight weapons hardpoints. Additional stipulations call for the new fighter to come with active electronically-scanned array (AESA) radar with an air-to-air range of 93 miles and an air-to-surface range of 31 miles, an infrared search and track (IRST) system, and an integrated electronic warfare (IEW) and electronic countermeasures (ECM) suite.

Bangladesh now fields a modest force of about 44 fighter aircraft, consisting of eight MiG-29s and MiG-29UBs assigned to No. 8 Squadron at Kurmitola (Bangabandhu airbase), the military enclave of Dhaka International Airport, and the survivors of 28 Chengdu F-7BGs and four FT-7BGs assigned to Nos. 5 and 35 Squadrons at the same location. Some 16 older F-7MB and eight FT-7MB aircraft have retired from service. Four of the MiG-29s were updated to MiG-29BM/UBM standards in Belarus between 2019 and 2020 and the remaining four are expected to follow, but they are no match for modern 4.5 generation fighters, while the F-7s are verging on obsolescence.



Italy is the nominated lead partner nation for the Typhoon campaign in Bangladesh, although the UK has also signaled its strong support for the bid. (Photo: Eurofighter/Giovanni Colla)

Under the 2009 Bangladesh Armed Forces Forces Goal 2030 modernization program, the Bangladesh Air Force received 16 Yak-130 advanced jet trainer and light combat aircraft ordered in 2013, and planned to purchase eight Sukhoi Su-30SME aircraft in 2017. Relations with Moscow soured after it supported Myanmar over the Rohingya issue, however, and worsened after Russia agreed to sell the Yak-130 and Su-30 to Myanmar. Dhaka also did not like Moscow's stipulation that it should buy MiG-35s along with the Su-30, and began seeking a new solution.

Accordingly, the Bangladesh Air Force asked the government to earmark around 25,200 Crore Taka (\$3 billion) for 16 Western multi-role fighters with an advance of 6,300 Crore Taka for the financial year 2021-22. That will allow the Bangladesh Air Force to seek a complete package with aircraft, support, training, and a variety of weapons. It must also include the creation of a maintenance, repair, and overhaul (MRO) facility in the country.

Quite apart from the difficulties experienced by Dhaka in reaching an agreement on the Su-30, senior Bangladeshi officers felt that the aircraft would not provide sufficient operational advantage or overmatch because the Su-30 remains the mainstay of regional rivals India and Myanmar. Since the Bangladesh Air Force is so much smaller than those of potential foes it needs to achieve a favorable exchange ratio to impose a sufficiently heavy cost to deter any aggression. Using the same aircraft type would make that harder to achieve.

Western fighters carry significant advantages over Russian and Chinese types, and the Saab Gripen and Lockheed Martin F-16 reportedly have been offered and considered, though Bangladesh now plans to acquire more capable twin-engined fighters. The Dassault Rafale (in service with the Indian Air Force, which could be a drawback) and the Eurofighter Typhoon stand as the aircraft under consideration.

Although Italy is the Eurofighter partner designated to market the aircraft in Bangladesh, it seems likely that the UK also would support any formal campaign. The report following the third Bangladesh-UK strategic dialogue in 2019 stated: "The UK further expressed its readiness to support Bangladesh with procurement of high-caliber multi-role combat aircraft alongside other modernization programs."

Many in the Dhaka defense establishment believe that the Eurofighter Typhoon could give Bangladesh the capability edge it needs and could provide the deterrent capability it has lacked since the country became independent in 1971. For the Bangladesh Air Force, operating the Typhoon would provide a useful route toward forging relationships with the four high-tech Eurofighter partner nations and their air forces, and could provide opportunities to operate and train with the four GCC air arms that also fly the Typhoon.

<https://www.ainonline.com/aviation-news/defense/2022-02-10/bangladesh-sizes-typhoons-fighter-requirement>



Fri, 11 Feb 2022

U.S. critical and emerging technology list forecasts future military needs

By Vikram Mittal

The development of military technology is essentially a cat-and-mouse game, where a country must constantly develop new technologies to stay ahead of its adversaries. Part of this game involves forecasting out future needs and determining the underlying technologies. As such, the U.S. National Science and Technology Council published its set of Critical and Emerging Technologies (CETs) on Tuesday, which highlights the technology areas that are perceived as being key for U.S. national defense. This list serves as guidance for defense research, development, and acquisition efforts and prioritization.

The CET list includes fourteen technical areas from previous lists and five new technical areas. The lists of continuing technologies include advanced computing, advanced engineering materials, advanced gas turbine engine technologies, advanced manufacturing, advanced and networked sensing and signature management, artificial intelligence, autonomous systems and robotics, biotechnologies, communication and networking technologies, human-machine interfaces, networked sensors and sensing, quantum information technologies, semiconductors and microelectronics, and space technologies and systems. These technology areas relate to current weapon systems and existing modernization efforts, encompassing a range of capabilities from aircraft to cyber warfare to autonomous systems. Furthermore, many of the research and development efforts from the National Defense Authorization Act aligned with these areas.

The five new technology areas in the CET list are hypersonics, directed energy, renewable energy generation and storage, nuclear energy, and financial technologies. These additions are not surprising, given recent military developments. Indeed, the U.S. military has numerous efforts tied to each of these areas; however, by adding these technology areas to the CET list, the Department of Defense is elevating their importance. Further, the inclusion of these technology areas provides insight into the capabilities that the U.S. military forecasts as needing in future wars.

The first new technology included in the CET is hypersonic weapons, a field that has seen significant growth and investment over the past year. Hypersonic weapons can achieve speeds in excess of 10,000 mph, while still maneuvering at low altitudes. The combination of speed and maneuverability makes hypersonic weapons difficult to track, and there are currently no systems to counter them. China and Russia have already developed hypersonic weapons, and most other countries, including the U.S., are investing heavily in developing their own offensive and defensive capabilities. Last week, the Pentagon met with executives from the defense industry to stress the urgency of hypersonic weapons.

The CET also added directed energy weapons, which includes lasers, high-power microwaves, and particle beams. Directed energy weapons are powerful, fast, and accurate, while also being able to operate over a substantial range. Many potential applications include using space-based directed energy systems, allowing a military to destroy targets anywhere in the world. Furthermore, a recent study by the Air Force indicated that directed energy weapons will play a key role in combating new technologies entering the battlefield, including hypersonic weapons and drone swarms.

The third new CET is renewable energy generation and storage. The Achilles heel of modern militaries is their reliance on fuels. For example, during the Global War on Terror, fuel convoys were a common target; these convoys would likely make for an attractive target in future wars. This technology area focuses on both reducing fuel consumption and identifying replacements for fuel. One attractive option is “edge-sustainment” where energy is harvested from local sources. This includes renewable energy, such as solar, as well as producing biofuels from locally procured organic material.

Tied into the need for renewable energy is the fourth new CET — nuclear energy. The U.S. Navy already uses nuclear power for its aircraft carriers and submarines, so advances in nuclear energy would enhance the fleet capabilities. Furthermore, the Department of Defense has an initiative called Project Pele, which seeks to develop small, portable nuclear power systems capable of powering a forward operating base. Overall, nuclear power provides an opportunity to reduce supply lines while providing troops with continuous, reliable power.

The first four new CETs are in line with recent military investments. However, the fifth new CET, financial technology, is not. The National Science and Technology Council specifies that this technology area consists of distributed ledger technologies, digital assets, digital payment technologies, and digital identity infrastructure. The inclusion of this technology area is likely due to the expectation that future wars will be multi-domain, including the financial domain. As such, a military could try to disrupt another country’s economy through financial technology. Meanwhile, the country must safeguard its own economy from such an attack. Moreover, digital currency is an enabler for terrorist groups, so denying them access to funds would limit their capabilities.

These five diverse technology areas align with the move by the U.S. military to “multi-domain operations” where they are expected to fight battles across multiple domains. Hypersonic weapons and directed energy weapons are intended to be strategic assets that provide standoff from the enemy. Meanwhile, addressing energy challenges is key for conventional warfare including providing power to aircrafts, ships, and “boots on the ground.” Meanwhile financial technology is a new domain that could play a major role in future wars.

Inherently, as time progresses, war gets more complex, as does the underlying technology. The new set of CETs released by the National Science and Technology Council should pose the U.S. military to be ready for this complex battlefield.

<https://www.forbes.com/sites/vikrammittal/2022/02/10/us-critical-and-emerging-technology-list-forecasts-future-military-needs/?sh=4e021b9a29e7>

Science & Technology News

mint

Fri, 11 Feb 2022

ISRO has launched 129 Indian-origin satellites since 1975: Govt

India has a total of 53 operational satellites in space, providing various identified services to the nation

The Indian Space Research Organisation (ISRO) has launched a total of 129 satellites of Indian-origin and 342 foreign satellites belonging to 36 countries since 1975, said Jitendra Singh, the Union minister of state (independent charge) of science and technology.

Of the total foreign satellites, 39 are commercial satellites and the rest are nano-satellites.

Further, Singh said in a written reply in Rajya Sabha, India has a total of 53 operational satellites in space, providing various identified services to the nation.

A total of 21 of these are communication satellites, eight are navigation satellites, 21 are Earth observation satellites and three are science satellites.

“The satellite-enabled data and services are being used for the benefit of various sectors of the country. These include television broadcasting, direct-to-home, ATM, mobile communication, tele-education, tele-medicine and advisories on weather, pest infestation, agro-meteorology and potential fishing zones,” said the minister.

“Satellite data is also used for crop production estimation, crop intensification, and agricultural drought assessment, wasteland inventory, identifying ground water prospect zones, inland aquaculture suitability and disaster risk reduction,” he added.

Singh informed that ISRO has plans to launch more satellites to further enhance operational applications and cater to the needs of emerging applications and user ministerial requirements in the country.

“Many of the applications have been effectively adopted by stakeholder departments for operational use,” he said, listing the applications.

He said the technology has been effectively used by the Potential Fishing Zone Forecast & Ocean State Forecast by Indian National Centre for Ocean Information Services, (MoES), Crop Acreage and Production Forecasting & National Agricultural Drought Assessment and Monitoring System by Mahalanobis National Crop Forecast Centre, (MoA&FW), Biennial Forest Cover Assessment by Forest Survey of India (MoEF&CC), Irrigation Infrastructure Assessment by Central Water Commission (Ministry of Jal Shakti), Weather forecasting by India Meteorological

Department (MoES), Ground Water Prospect and Suitable Recharge Locations' mapping (Ministry of Jal Shakti), Integrated Watershed Management Programme & MGNREGA by MoRD.

<https://www.livemint.com/news/india/isro-has-launched-129-indian-origin-satellites-since-1975-govt-11644489234447.html>



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Decoding mechanisms of atomic energy transport in the world of quantum physics

The energy transport between atoms and molecules is the basis of all life. Such transport is based on interatomic forces known as the dipole-dipole interaction. Prof. Dr. Herwig Ott's research group at Technische Universität Kaiserslautern (TUK) has now succeeded in reproducing such a transport mechanism in a disordered system. For this purpose, the researchers experimentally observed the quantum mechanical interaction between different Rydberg atoms. This allowed them to understand the influence of disorder on the distribution and mobility of the excitation energy between the atoms. The scientific journal *Nature Communications* has published the results.

The transport of energy between atoms and molecules is illustrated by photosynthesis, for example: When light arrives at a cell, its energy is first absorbed by a molecule and then transported between many other, disordered molecules. Once this energy package finally arrives at the so-called reaction center, it is permanently stored in the form of a chemical conversion.



Ultracold atomic cloud of rubidium atoms used in this experiment: You can see the fluorescence that occurs during laser cooling. Credit: AG Ott/TUK

To better understand such transport mechanisms, the research team chose a special experimental approach and advanced into the quantum regime: "In the process, we have overcome several technological challenges," explains Carsten Lippe, lead author of the study. "This becomes clear just by looking at the necessary framework conditions: At an ambient pressure about 1000 times lower than in space around the ISS and at temperatures close to absolute zero, some atoms are excited by irradiation with lasers and put into a so-called Rydberg state. When an electron is in this state, placed in a distant orbit around the atomic nucleus, the atom is about 10000 times larger than in the normal state."

This gigantic size makes an atom in the Rydberg state very sensitive to other such atoms and thus allows interactions between atoms to be studied experimentally that would otherwise take place on much smaller length scales.

As part of their experiment, the researchers have now used different laser systems to create two different types of Rydberg atoms in sequence and investigated the energy transport between them. In the process, they discovered quantum physical effects that contradict our everyday imagination. "You can think of such a transport process conventionally as a bouncing or hooping process. The energy or excitation jumps back and forth between the molecules. But in quantum physics it is different because of the so-called superposition principle: For example, the excitation can also hop to several molecules at the same time and thus be transported much more efficiently in the system. This is called coherent transport," says Ott.

The researchers were able to demonstrate that the proportion of classical hopping and coherent transport can be adjusted in a controlled manner in the experiment. This is achieved by tiny modifications to the wavelength of the excitation lasers used. "Quantum physical effects are

normally fragile and disappear as soon as disturbances are present, such as those caused by the atomic disorder in the gas in the present system," says Thomas Niederprüm, who led the project together with Ott. "The observation of these effects in the study can help us to better understand other complex systems. The interaction between the Rydberg atoms can be transferred to other areas of current research, for example to the absorption and transport of light in molecules during photosynthesis. Recent studies have shown that quantum mechanical effects also play an important role in photosynthesis and that the energy transport takes place surprisingly loss-free despite the disorder.

The work on this study took place as part of the collaborative research center OSCAR ("Open System Control of Atomic and Photonic Matter"), in which both TUK and the University of Bonn are funded by the German Research Foundation. The results of the measurements and simulations as well as a description of the experimental setup have been published in *Nature Communications*.

More information: Carsten Lippe et al, Experimental realization of a 3D random hopping model, *Nature Communications* (2021). DOI: [10.1038/s41467-021-27243-2](https://doi.org/10.1038/s41467-021-27243-2)

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