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CONTENTS

DRDO News

DRDO Technology News

FINANCIAL EXPRESS
Read to Lead

Tue, 23 Nov 2021

India to get its own 5th Gen fighter! AMCA prototype to get approval next year

Prototype design for the twin engine AMCA is in the process of being finalized and is expected to be sent for approval to the Cabinet Committee on Security (CCS)

By Huma Siddiqui

Stage is getting ready for the launch of India's own fifth generation stealth fighter aircraft — Advanced Medium Combat Aircraft (AMCA). Prototype design for the twin engine AMCA is in the process of being finalized and is expected to be sent for approval to the Cabinet Committee on Security (CCS). This will happen at the end of consultations between all the stakeholders including Indian Air Force (IAF), Hindustan Aeronautics Limited, Defence Research and Development Organisation (DRDO), Aeronautical Development Agency (ADA), Ministry of Defence & Ministry of Finance.

The former air Chief RKS Bhadauria had ruled out importing a fifth-generation aircraft in the near future and had stated that IAF will push for the indigenous AMCA.

Expected Cost of AMCA

The estimated cost of just developing the prototype of AMCA is pegged at Rs 15,000 crore and the rollout of the first prototype is scheduled for 2025-26.

The design and development of AMCA has been carried out by ADA for almost a decade and as reported in Financial Express Online earlier, ADA officials had indicated that the prototype of AMCA will be ready by 2025. However, the engine for AMCA has yet to be decided.

The former air chief RKS Bhadauria had ruled out importing a fifth-generation aircraft in the near future and had stated that IAF will push for the indigenous AMCA.

It has been reported earlier that the production of Mark-1 is expected to start by next decade and timelines set are aggressive, as the IAF is looking to induct the AMCA in its fleet soon. Most likely the IAF will be able to induct AMCA by 2035.

IAF's Fleet & Modernisation

IAF, which is facing a critical shortage of fighters in its fleet (has around 32 fighter squadrons) has already announced its support for AMCA and has planned the modernization of its fleet accordingly.

Support from global aerospace companies

Aerospace giants including US based Lockheed Martin & Boeing Company; and Swedish Company SAAB have offered their expertise to India for the AMCA project.

More about AMCA

Sources have indicated that the first two squadrons of AMCA Mk-1 will be powered by GE-414 which is already being used in the Light Combat Aircraft (LCA) `Tejas'.

The HAL CMD had indicated earlier this year on the sidelines of Aero-India 2021 that in collaboration with a foreign company work will start soon on a new engine.

The swing-role AMCA will come with advanced stealth features. There will be an internal bay for smart weapons.

It will have supercruise capability useful to attain supersonic cruise speeds without using afterburners and as data fusion and multi-sensor integration with Active Electronically Scanned Array radars.

https://www.financialexpress.com/defence/india-to-get-its-own-5th-gen-fighter-amca-prototype-to-get-approval-next-year/2373842/

The EurAsian Times

Tue, 23 Nov 2021

India could become 4th country with indigenous Stealth Fighters; to get Prototype approval early next year — reports

By Aashish Dangwal

In what could be a big boost to India's fifth-gen AMCA fighter program, the proposal for full-scale engineering development of its prototypes has been finalized. This will be sent to the Cabinet Committee on Security (CCS) for approval early next year, according to The Times of India.

A model of HAL AMCA. (via Twitter)

The Advanced Medium Combat Aircraft (AMCA) would feature enhanced stealth qualities and 'supercruise' capabilities.

Reports suggest that discussions between the Ministry of Defense and the Ministry of Finance on the development of AMCA prototypes were over. The CCS, the highest decision-making body on India's national security, is expected to put its stamp of approval early next year.

AMCA would ensure India's entry into the elite club of countries with fifth-generation stealth warplanes. So far, only the US (F-35 and F-22 Raptor), Russia (Su-57 Felon), and China (J-20) have fifth-generation aircraft in their arsenal. Many experts believe that India could become the fourth country to operate an indigenous stealth fighter aircraft.

The cost of developing the 25-ton AMCA is expected to be roughly Rs 15,000 crore, with Mark-1 jet production starting in 2030-31.

The AMCA project is critical for the IAF, which now operates only 30-32 fighter squadrons. Despite the 36 4.5 generation French-made Rafale fighters, the service will not be able to reach the sanctioned strength of 42 squadrons in the next 10-15 years.

However, one major hurdle in the AMCA program is the engine. The AMCA design that was approved in December 2018 meets the IAF's "preliminary staff qualitative requirements". However, the lack of a powerful engine could be a major issue.

As a result, the first two AMCA Mark-1 squadrons will be equipped with the existing General Electric-414 afterburning turbofan engine with a thrust rating of 98 kilonewtons, while the next five squadrons of mark-2 will be equipped with a more powerful 110-kilonewton engine.

The foreign collaborator will be chosen by early-2022, and the new engine will be built in-house at the same time, as reported by TOI. The swing-role AMCA will have advanced stealth features such as "serpentine air-intake" and an internal bay for smart weapons, as well as radar dampening materials and a conformal antenna.

The fighter will also have data fusion and multi-sensor integration with AESA (active electronically scanned array) radars, as well as the supercruise capability, to achieve supersonic cruise speeds without the use of afterburners.

Earlier this year, India's Ministry of Defence (MoD) awarded a whopping Rs 48,000-crore contract to HAL for 83 LCA Mk-1A fighters for the Indian Air Force. The IAF's first Mk-1A aircraft is expected to be delivered in March 2024, while the rest will be inducted into service by 2029.

Then there's the long-awaited "Make in India" project for 114 new 4.5-generation fighters with "some fifth-generation capabilities" worth over Rs 1.25 lakh crore, which involves seven international contenders and is expected to receive initial "acceptance of necessity" next year.

The AMCA Program

The AMCA is a project of India to build a fifth-generation fighter plane for the Indian Air Force and Navy. Aeronautical Development Agency (ADA), an aircraft design and development agency under Defence Research and Development Organisation, is in charge of the aircraft design.

A public-private partnership between the DRDO, Hindustan Aeronautics Limited (HAL), and an Indian private business is slated to produce it. By 2028, the programme hopes to be in full production.

The AMCA, which is designed to perform a variety of missions such as air superiority, ground-strike, SEAD (Suppression of Enemy Air Defenses), and electronic warfare (EW), would replace the Sukhoi Su-30MKI air superiority fighter, which currently serves as the backbone of the IAF fighter fleet. Low radar cross-section and supercruise capability are key features of the AMCA design.

The feasibility study for AMCA has been completed, as has the preliminary design stage, and the project has now entered the detailed design phase, which began in February 2019. At Aero India 2019, a CAD model of the plane was displayed. By 2025, the maiden flight is expected, and serial production might start by 2030.

After the HAL Marut and HAL Tejas, the AMCA would be India's third supersonic jet. AMCA will be built in two stages — AMCA Mk-1 and AMCA Mk-2. The former will be a fifth-generation fighter, while the AMCA Mk-2 will be more sophisticated, incorporating certain sixth-generation features.

https://eurasiantimes.com/india-set-to-become-4th-country-with-indigenous-stealth-fighters-to-get-prototype-approval-early-next-year-reports/

THE ECONOMIC TIMES

Tue, 23 Nov 2021

AMCA: Made-in-India stealth fighter jets for Indian Air Force

1. Stealth fighter project

India is now finally getting set to launch its most ambitious indigenous military aviation project to build a fifth-generation fighter or the advanced medium combat aircraft (AMCA) with advanced stealth features as well as 'supercruise' capabilities.

2. Set to take off

The case for the full-scale engineering development of the twin-engine AMCA prototypes has been finalized and will be sent for approval to the Cabinet Committee on Security (CCS) by early next year after consultations between the defence and finance ministries, top sources told TOI.

3. Huge challenge

Production of fifth-generation jets is an extremely complex and expensive affair, with the American F/A-22 Raptor and F-35 Lightning-II Joint Strike Fighter, the Chinese Chengdu J-20 and Russian Sukhoi-57 being the only operational ones around the globe at present.

4. Quest for a desi stealth fighter

Experts, however, contend the J-20 and Sukhoi-57 fighters are still somewhat short of being true-blue fifth-generation fighters. The 36 Rafales being inducted by IAF, under the Rs 59,000 crore deal inked with France in September 2016, are 4.5-generation jets.

5. Long way to go

As of now, the development cost of the 25-tonne AMCA is estimated to be around Rs 15,000 crore, with the first prototype's "rollout" by 2025-26 and production of the Mark-1 jets slated to begin in 2030-31 under the "aggressive timelines" set by DRDO and its Aeronautical Development Agency (ADA). A more realistic timeframe for the AMCA induction to kick-off, however, would be around 2035.

https://economictimes.indiatimes.com/news/defence/amca-made-in-india-stealth-fighter-jets-for-indian-air-force/huge-challenge/slideshow/87849363.cms

moneycontrol

Tue, 23 Nov 2021

IAF aerobatics team enthrals spectators at Dubai Air show

The Sarang team participated in the Al Ain Grand Prix in the UAE in 2005 but the DAS was the first occasion for the Surya Kirans and the Tejas to show off their manoeuvres in Dubai.

By Ashwini Phadnis

After enthraling the residents of Hyderabad with their daredevil flying activities over Begumpet airport in 2020, the Indian Air Force (IAF) did the same over the skies of Dubai where the first international air show after the Hyderabad Air Show opened on November 14 at the DWC or Dubai World Central Airport.

Dubai's biennial Air Show opened on November 14 to a world still reeling from the pandemic and an aviation industry hard-hit by the coronavirus, but on the mend. (Image: AP)

The IAF aircraft flew to join planes from the aerobatics teams of Saudi Arabia (Hawks), Russia (Knights) and the United Arab Emirates (Al Fursan), among others. These and many other aircraft took part in the flying display on all four days of the air show. On Monday, the display began with IAF's Surya Kiran aerobatics team and light combat aircraft Tejas followed by a host of others including the Airbus 350, the US Air Force's F16, the Mirage 2000 of the UAE Air Force; and ended with the Russian Knights taking to the skies.

Wing Commander Ashish Sudhir Moghe, public relations officer and spokesperson, IAF, said that a 180-strong contingent of the IAF took part in the Dubai Air Show (DAS). The contingent included three teams—Surya Kiran, Tejas (indigenously developed by Hindustan Aeronautics Ltd) and Sarang, the IAF's helicopter display team, along with support staff.

The Sarang team participated in the Al Ain Grand Prix in the UAE in 2005 but the DAS was the first occasion for the Surya Kirans and the Tejas to show off their manoeuvres in Dubai.

Wing Commander Moghe added that while the Surya Kiran and Tejas flew directly, the support staff and the Sarang contingent along with the helicopters were flown in on IAF's C-17 and C-130 aircraft.

According to Group Captain Manish Tolani, who flies the Tejas, the "vertical Charlie" —a manoeuvre where the plane climbs vertically and does a series of in before resuming normal flight—and flying the aircraft Tejas inverted were part of the IAF's repertoire.

Tolani said all the groundwork and planning for the DAS was completed in India. "How we will fly, what we will see (on the ground), the dimensions of the box (the area on the ground that has to be kept in mind while flying so that people get a clear view of the aerobatics being done by the team) were all completed in India. In a manner we were ready to go the moment we landed in Dubai," he said. The team, however, had to do two sorties in Dubai to meet the local flying norms.

"The aircraft systems and avionics play a major role in helping the pilot carry out the manoeuvres," he added.

Moghe added that the manoeuvres were the same as in the Hyderabad Air Show but the setting was different. "In Hyderabad, there was construction, high-tension wires, bird and animal activity and airspace restrictions which were not there in Dubai. But there were challenges of flying in Dubai and doing the manoeuvres as they were being performed using a visual point on the ground. The desert is more or less featureless so it is a challenge to mark out points," he said. The pilots

who participated at DAS were part of a team chosen after a rigorous selection process and remain a part of the team for three to four years, he added.

"The induction began on November 3 with the Sarang team removing the blades of the helicopters to put them on board the transport aircraft to be flown to Dubai," Moghe said, adding that assembly of the blades is done in a few hours. He added that after the helicopter is assembled it also has to be tested.

(Ashwini Phadnis was at the Dubai Air Show at the invitation of flydubai)

https://www.moneycontrol.com/news/india/iaf-aerobatics-team-enthrals-spectators-at-dubai-air-show-7747681.html

india.com

Tue, 23 Nov 2021

5 Things that make INS Vishakhapatnam deadly combination of lethality and stealth

In a boost to become "Atmanirbhar", INS Vishakhapatnam has over 72% of indigenous content as against 59% of its predecessor Project 15A (Kolkata Class) and 42% of Project 15 (Delhi Class)

By Amit Bansal

In naval technology terms, destroyers have significant strategic importance. They are the teeth elements of the naval expeditionary force that can inflict serious damage to any enemy located on land or in the sea. India started to conceptualise building its own destroyers in the late 1980s when it started an ambitious project by the name of *Project 15*. There was a reason in the form of a lesson learnt during the Indo-Pak war of 1971, that India had its own unique requirements and it needed specialised ships to cater for them which was not possible by buying ships made by foreign manufacturers.

Sailors are seen onboard the INS Visakhapatnam, the stealth guided-missile destroyer ships of Project 15B, during its commissioning ceremony at the naval base in Mumbai on November 21, 2021. (AFP Photo)

Indian shipbuilding was in its nascent stage, and they had the infrastructure and experience of making only small patrol boats. Efforts were made by the government as well as the Indian Navy which ultimately paid off and India started manufacturing its own ships in the early nineties starting from small Corvettes and Frigates. The first indigenously made warship was *INS Godavari* which was a 3600-tonne Frigate commissioned in 1983 followed by several other frigates and corvettes. Making a destroyer was a challenging task and for this, project 15 was launched in the late nineties with the design of 6200 tonne *Delhi Class Guided Missile Destroyers*. Indian Shipbuilders did not stop here and took another leap of technology when an advancement of Project 15 which was launched by the name of *Project 15A* and the keel was laid for *Kolkata class destroyers* who were not only bigger (7400 tonnes), fast and lethal but also had a significant amount of stealth incorporated in them. India built three warships in this category and completed their induction by 2016.

The leap of technology did not stop at this level and the Indian Navy's Directorate of Naval Design located in the busy streets of Kailash Colony in New Delhi was working on another step in the form of *Project 15 B or Vishakhapatnam class Destroyers.* The first ship of this category was commissioned today as INS Vishakhapatnam. Since the ship is an advancement of Project 15A (Kolkata Class Destroyer), it has the same displacement (7400 Tonne) but is different in many ways. Let us understand five major aspects which make this ship as one of the best in its class.

1. High Indigenous Content- In a boost to become "*Atmanirbhar*", INS Vishakhapatnam has *over 72% of indigenous content* as against 59% of its predecessor Project 15A (Kolkata Class) and 42% of Project 15 (Delhi Class). It is equipped with BEL developed Bow mounted Sonar, DRDO's Signal Intelligence Suite and Shakti Electronic Warfare system, Kavach Decoy Launchers, Radar Fingerprinting system, Mareech Advanced Torpedo defence system and almost all major weapons made in India. This will not only give a lethal punch to the Indian Navy but will also remove the dependence on other countries for weapon systems or sensors.

2. Design & Stealth- When the Indian Navy's Directorate of Naval Design started working on this ship, they had three things in mind. First was the stealth technology to make it invisible to the enemy, the second was to make it strong enough to have better survivability on the battlefield and thirdly to give it a lethal punch of weapon systems capable to inflict a heavy blow to the enemy. Although the structure was like its predecessor Kolkata class, they used a very special kind of steel in the fabrication and that was *DMR 249A grade steel* which was developed by DRDO and indigenously manufactured by Steel Authority of India Limited at Bokaro. This steel was a low carbon micro-alloy having traces of Titanium, Vanadium and Niobium and has very high grades of strength bearing capacity. Unique design parameters have reduced its radar cross-section significantly making it more invisible to the enemy eyes. It also had a rail-less design to secure the helicopters in adverse sea conditions.

3. Firepower- The lethal punch came from a deadly combination of various weapon systems on this ship. It has Indian made *Barak Extended Range* Surface to Air Missiles with a range of over 150 Km for protection against Air/ missile Attacks and *16 cell Brahmos land-attack cruise missiles*. It also had a *76 mm Naval Gun and 4 AK-639M Close-in Weapon Systems (CIWS)*. Other weapons include two *7mm remote-operated guns*, two units of *RBU-6000* anti-submarine rocket systems and four tubes for launching *533 mm Indian made Varunastra torpedoes* with over 40Km range. Wrath of these weapon systems can vaporise any enemy port or flotilla in no time.

4. Sensors and Electronic Warfare- The survivability of any naval combat ship depends upon its sensors and electronic warfare systems. INS Vishakhapatnam has one of the most advanced Radars of its kind which can track enemy ships and aircraft from 300-450 Kilometres distance and can direct the missiles on the target. Another radar can track enemy aircraft under an intense electronic warfare environment. It has a bow-mounted as well as another towed sonar to detect underwater objects and a *Mareech Torpedo defence system* making it safe from enemy torpedo attacks. It can launch anti-missile decoys and has its own electronic warfare suite. *Data link-based communication system* keeps the security of information intact, and a *Radar fingerprinting system* can decode the type and details of its target in no time.

5. Very High Manoeuvrability – The ship is fitted with two main Zorya M36E gas turbines with a combined gas and gas propulsion system giving it a speed of almost 30Knots or 56 Kilometres per hour which is significantly high. It has four more reversible gas DT-59 Gas turbines, 2 Diesel Engines with the power of almost 10000 Hp each and generators to drive the gas propulsion. This gives the ship very high manoeuvrability, especially under extreme battle stress. Further, its range of over 7500Km made the movements in far seas possible without any replenishment.

From INS Godavari to INS Delhi, INS Kolkata and now INS Vishakhapatnam, the Indian shipbuilding industry has been taking leaps of technology and we are due to commission our own Indigenous Aircraft Carrier now. A country that had to pledge its gold to survive a few decades back is now building Nuclear Submarines, Intercontinental Ballistic Missiles, Advanced Stealth Warships and designing fifth-generation fighter aircraft. INS Vishakhapatnam is just another milestone passed and many more need to be achieved now.

(Disclaimer: The views and opinions expressed in this article are those of the author and do not necessarily reflect the official policy or position of India.com. The writer is solely responsible for any claims arising out of the contents of this article.)

https://www.google.com/search?q=indian+air+force+news&ie=utf-8&oe=utf-8&client=firefox-b-ab

THE NEW INDIAN EXPRESS

Tue, 23 Nov 2021

IAF VR Chaudhari Chief to attend Aerospace Medicine meet

In the backdrop of the Covid-19 pandemic, the conference 'Aerospace Medicine: Atmosphere and Beyond', will be in hybrid mode

Bengaluru: The diamond jubilee conference of the Indian Society of Aerospace Medicine will be held at the Institute of Aerospace Medicine here from November 25 to 27. Air Chief Marshal VR Chaudhari, Chief of Air Staff, will inaugurate the conference.

IAF Chief Marshal VR Chaudhari.

In the backdrop of the Covid-19 pandemic, the conference 'Aerospace Medicine: Atmosphere and Beyond', will be in hybrid mode. Around 200 participants are expected to attend online from various parts of the country and about 75 delegates from various institutes will physically attend the conference.

Professionals from the field of aerospace medicine, military and civil, aircrew, civil aviation industry and DRDO will attend the conference. The Subroto Mukerjee Memorial Oration will be delivered by Dr Quay C Synder, president, Aviation Medicine Advisory Service, on the topic -- Pilot Physician's Evolution to HIMS. Steve Roberts of Martin Baker Aircrafts Co Ltd will deliver the Air Vice Marshal MM Srinagesh Memorial Oration on 'Evolution of Escape Systems: A Safety Perspective'.

Dr Pratima Murthy, professor and head, Department of Psychiatry, National Institute of Mental Health and Neuro Sciences (NIMHANS), and Dr AK Ghosh, Scientist 'H', Project Director, Advanced Medium Combat Aircraft, Aeronautical Development Agency (ADA), Bengaluru, will deliver the guest lectures. They will also discuss social media effects on safe flying and aeromedical issues related to 5th generation fighter aircraft, the release stated.

https://www.newindianexpress.com/states/karnataka/2021/nov/23/iaf-vr-chaudhari-chief-to-attend-aerospace-medicine-meet-2386906.html

THE TIMES OF INDIA

Tue, 23 Nov 2021

China's hypersonic missile test: All you need to know

New DelhI: The purported test launch of a nuclear-capable hypersonic missile by China in August this year has brought into focus a cutting-edge technology being hotly pursued by over half a dozen countries (including India), and that experts hail as having the capability to change the face of warfare.

A replica of Brahmos II at a defence expo.

Hypersonic weapons can travel faster than five times the speed of sound (about 6,200 km per hour).

Why hypersonic?

Proponents of hypersonic weapons say the technology has several advantages over traditional ballistic missiles. Hypersonic cruise missiles are highly manoeuvrable as they are powered by engines. They also fly at lower altitudes, making them more difficult to detect.

Ballistic missiles on the other hand fly on predictable trajectories and are easier to intercept.

There are two categories of hypersonic weapons: cruise missiles (powered by engines), and glide vehicles (launched via rocket into the upper atmosphere, from where it dives down to the target).

China launched a rocket carrying a hypersonic glide vehicle that flew through low-orbit space —circling the globe before cruising towards its target, which it allegedly missed by about 30 km.

The new weapons race

China has been aggressively developing the technology, seeing it as a crucial defence against the United States.

The test, which caught American intelligence agencies by surprise, comes as US-China tensions have mounted and Beijing has stepped up military activity near Taiwan, in the South China Sea, and at its borders with India.

BrahMos II

India tested an indigenously built hypersonic weapon in September, making it only the fourth country in the world after the US, China and Russia to develop and test such technology.

The Defence Research and Development Organisation has said it plans to conduct three more tests in the next five years.

India appears increasingly focused on developing a deterrent to Chinese hypersonic capabilities.

India is also developing a hypersonic cruise missile (BrahMos II) in cooperation with Russia.

Russian programme

Russia's hypersonic weapons such as the 3M22 Zircon fly at speeds of up to Mach 6 and at low atmospheric-ballistic trajectory giving them the capability to penetrate traditional anti-missile defence systems. It successfully tested the missile in July.

In fact, the Zircon is so fast that the air pressure in front of the weapon forms a plasma cloud as it moves, absorbing radio waves and making it practically invisible to active radar systems.

These developments are a major cause for concern in the US, as its current warning systems might not be able to see the weapons coming.

No defence

The Aegis missile interceptor system used by the US requires 8-10 seconds to intercept attacks. In that time, the Zircon can cover 20 kms, and the interceptor missiles do not fly fast enough to catch up. In order to intercept a Russian Zircon missile, the US would either need to intercept it at launch or fly an object into its path.

Russia's shift to hypersonic weapons is likely a means of contending with American superiority in size, technology and number of aircraft carriers.

The US Navy intends to maintain a force of 12 nuclear-powered aircraft carriers. By contrast, Russia has one — and it deploys with a tugboat in case its engine breaks down.

While at sea, any of Russia's 15 Buyan-class corvettes will be able to carry up to 25 Zircon hypersonic missiles. It would take fewer than a half-dozen to sink the most advanced American aircraft carrier.

Experts say innovations like the Zircon are moving the development of military technology away from aircraft carrier-based systems, calling for the US Navy to reconsider the role of the carrier entirely.

Prohibitive cost

US arms manufacturing companies such as Lockheed Martin and Raytheon Technologies have been developing hypersonic weapons technology for nearly three decades.

The Pentagon's budget request in the 2022 fiscal year for hypersonic research was $3.8 billion, up from $3.2 billion the year before.

A single hypersonic missile still costs tens of millions of dollars per unit.

The Pentagon recently said it wants defence contractors to cut the ultimate cost of hypersonic weapons. Currently, the US uses cruise missiles (costing less than $5 million per unit) to strike deep into enemy territory.

https://timesofindia.indiatimes.com/world/china/chinas-hypersonic-missile-test-all-you-need-to-know/articleshow/87853547.cms

Firstpost.

Tue, 23 Nov 2021

India needs to bridge the widening AI gap with China before it's too late

China is heavily investing in artificial intelligence with an aggressive push in the military domain

By Maj Gen PK Chakravorty

India and China held the 13th Corps Commander level talks on the Ladakh stand-off on 10 October, 2021. The meeting, which started at 10.30 am, lasted for around eight-and-a-half hours and concluded at 7 pm. During the meeting the discussions between the two sides focused on resolution of the remaining issues along the Line of Actual Control (LAC) in eastern Ladakh.

The Indian side pointed out that the situation has been created by China violating the bilateral agreements. The Chinese side was not agreeable and could not provide any forward-looking proposals. As a matter of fact, there has been a build-up of Chinese forces along the LAC, compelling India to undertake suitable defensive measures.

China is using artificial intelligence (AI) in eastern Ladakh to strengthen its capabilities.

China and AI

Of late the Chinese People's Liberation Army (PLA) has been focusing on Multi Domain Warfare. Multi Domain Warfare is primarily based on AI and Quantum Communications. China is leaving no stone unturned to be a front-runner in this field and is procuring a host of AI equipment.

A few aspects of Chinese AI are as enumerated:

- Chinese military leaders are already procuring AI-related systems and equipment for intelligentised warfare.
- It is likely that the PLA spends more than $1.6 billion each year on AI-related systems and equipment.
- PLA hopes to use AI to generate asymmetric advantages vis-à-vis its adversaries.
- China is heavily investing in AI with an aggressive push in the military domain. It exports armed autonomous platforms to numerous countries, mainly Pakistan and Saudi Arabia. China has been experimenting and developing UGVs, UAVs, AI-enabled satellites, UUVs and unmanned Ground warfare platforms. They have converted T59 tanks into unmanned platforms. They are using their UUVs in the South China Sea.
- China has moved AI into new domains of Space Warfare and Information Warfare using a plethora of devices. They have developed satellites with AI having the capability to destroy satellites and other missiles in outer space. China has left no stone unturned to fine-tune its missiles to attain fire and forget capabilities as also if the need arises to change targets in flight. The country is making great strides in the employment of UAV Swarms. Often, they have demonstrated more than 1,000 drones moving in a synchronised manner to undertake a variety of tasks. It is amazing to watch the enthusiasm with which China is going ahead with this aspect and in all probability is assisting Pakistan to attain this capability.
- There is no doubt that no country in the world is focusing on AI as much as China. In terms of finance, China spends nine times more than India on AI. It has seven times more manpower than India on AI. Further its robot density surpassed the world average in 2017 and 2018. The focus is gradually being upgraded to the Cognitive Domain for usage of AI in Command Control Communications Computers Information Intelligence Surveillance and Reconnaissance (C^4I^2SR). China is using AI in the cyber domain and undertaking numerous cyber developments in offensive and defensive operations. China is only second to the United States. An estimate of the number of end user industrial robots; China has 154 end user robots vis-à-vis 55 of Japan, 40 of the US and 4 of India. The day is not far when combat robots will be

participating in logistics and thereafter in operations. We have to traverse a long way to stand up to China's challenge.

Indian Perspective

Defence Research and Development Organisation (DRDO) have a specialised laboratory, Centre for Artificial Intelligence and Robotics (CAIR), with about 150 scientists which focus on AI Robotics, Control Systems, Command Control Communications and Intelligence (C^3I), Networking and Communications Secrecy. It has produced a family of robots for surveillance and reconnaissance applications. The robot has been named RoboSen, a mobile robot for reconnaissance and surveillance.

Further, there's a miniaturised man portable UGV for low intensity conflicts, a wall climbing flapping wing robot and a walking robot with four and six legs for logistics support. They have developed robots with cognitive capabilities which can play chess and inspect the serviceability of components. They have also developed an intelligent wheel-chair for physically challenged persons. CAIR has also developed a Net Work Traffic Analysis (NETRA) which can monitor Internet traffic. This device can intercept key words such as bomb blast, kill and others in real time.

AI has also attracted the Government of India and in this context a report was submitted by Tata Sons chairman N Chandrasekaran in 2018 to the Ministry of Defence. Based on the recommendations of the Task Force, the Department of Defence Production issued a government order on 8 February 2019 that listed the following:

- Formation of Defence AI Council (DAIC) was constituted with the Defence Minister as chairman. It included the three Service Chiefs, the Defence Secretary, Secretary of Defence Production, Secretary of DRDO, Financial Adviser of Defence Services, National Cyber Security coordinator and eminent representatives from the industry and the academia. The Council would meet twice a year to provide strategic direction towards AI-driven transformation in defence, and provide guidance in addressing issues related to data sharing. It would also enable strategic partnership with industry, decide acquisitions of technology, review ethical, and safe and privacy assured usage of AI in defence. Also, it would further set policies in partnership with government institutions and industries.
- A Defence AI Project Agency (DAIPA) will also be established with the Secretary of Defence Production as the chairman. The other members will be from the Service Headquarters, Headquarters of Integrated Defence Staff, Defence Public Sector units, DRDO, industry and academia.
- Each Service Headquarters has been directed to earmark Rs 100 crore for AI-specific application development for the next five years
- The Indian Navy has taken the lead and has divided AI usage into short, medium and long-term goals for implementation.
- The Indian Army during the Army Day in 2021 demonstrated a Swarm Attack by drones on multiple targets. Further efforts are being made to directly translate spoken Mandarin to English.
- In a recent webinar held at Vivekananda International Foundation the Chief of Defence Staff spoke of usage of AI for predictive maintenance of equipment in the Indian Army.

Way ahead

Albert Einstein had stated, "Imagination is more important than Knowledge." The Indian Navy and Indian Air Force are focusing on UUVs, Unmanned Aerial Systems (UAS) and Lethal Autonomous Weapon Systems.

The Indian Army must focus on a few issues which are as elucidated:

- Image interpretation for target identification and classification.
- System for diagnosis and maintenance of sophisticated weapon systems.
- Analysis of trajectory of missiles.
- Use of robots for anti-Improvised Explosive Device and firing of weapons.

- Logistics applications particularly in high-altitude terrain.

In the current Grey Zone Warfare scenario, where troops are operating in small teams, it would be important to apply AI as listed below:

- Gathering of real-time intelligence by use of satellites and UAS.
- Devices to detect sensors, mines and booby traps.
- Use of loitering munition which can be used for surveillance and target engagement.
- Gradually move into the field of combat robots, who can act as buddies and thereafter with greater improvement of cognitive abilities be able to act as path finders, navigators and possibly undertake kinetic strikes.

The point is how we can achieve it. We need a task force which operates directly with the Chief of Defence Staff and DRDO in conjunction with the private sector that would help us to achieve our targets.

Conclusion

AI would be intensively used in future conflicts. China is straining every sinew to apply AI in defence to become a world power. China is an adversary of India and is likely to assist Pakistan in improving AI. Currently our armed forces have made nascent progress in this field. We need to accelerate and the only way to do it is link up with the private sector.

We have no other options but take this issue seriously to match China and Pakistan in the battlespace. The Chinese attitude in the Corps Commanders' conference indicates its confidence in the field of AI and Multi Domain Warfare.

The writer is a former Deputy Director General of Perspective Planning Directorate, Defence Attaché to Vietnam and Additional Director General Artillery at Army Headquarters. Post-retirement, he was an advisor to BrahMos Aerospace. Views expressed are personal.

https://www.firstpost.com/india/india-needs-to-bridge-the-widening-ai-gap-with-china-before-its-too-late-10155881.html

Defence News

Defence Strategic: National/International

Press Information Bureau
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Ministry of Defence

Mon, 22 Nov 2021 8:46PM

Raksha Mantri Shri Rajnath Singh visits Bangladesh High Commission on the occasion of Armed Forces Day of Bangladesh

Key Highlights of RM's speech:

- ***Bangladesh War of Liberation an unprecedented event in 20th century history***
- ***India keen to continue working closely with Bangladesh to support each other's defence and security concerns***
- ***India is deeply sensitive to the security and development concerns of its neighbours; hopes for reciprocal level of sensitivity on the part the neighbours***
- ***Armed Forces must remain engaged with each other for mutual capability enhancement, to respond to contingencies & realise the shared goals of providing security & prosperity to our people***
- ***Spirit of Liberation War need to be kept alive in the minds of younger generations***

Raksha Mantri Shri Rajnath Singh visited the Bangladesh High Commission in New Delhi on November 22, 2021 on the occasion of Armed Forces Day of Bangladesh, which is celebrated on 21st November every year. The event was organised by the Bangladesh High Commission. High Commissioner of Bangladesh Mr Muhammad Imran, Ambassadors and Heads of Mission, Officers from Armed Forces of Bangladesh and other friendly nations and war veterans were among those present.

In his address, the Raksha Mantri congratulated the Armed Forces of Bangladesh on behalf of the Indian Armed Forces & Government of India and wished them the very best in their endeavour towards peace and security. "This year is of extraordinary significance for India-Bangladesh relations as we commemorate the Golden Jubilee of the Liberation of Bangladesh, the fifty years India-Bangladesh diplomatic ties and the birth centenary of Banga Bandhu Sheikh Mujibur Rahman. In this momentous time, I salute the valiant struggle of the Muktibahini in the Mutktijudda – War of Liberation - in 1971. Spirit of Mukti judhha forms the core of today's Armed Forces of Bangladesh," he said.

Paying glowing tributes to Banga Bandhu Sheikh Mujibur Rahman, Shri Rajnath Singh said, the inspiring leadership of the first President of Bangladesh was the guiding light for the people of the country in their struggle for freedom. Banga Bandhu's ideals form the foundation of the shinning Bangladesh steadily advancing in its path of development, he added.

The Raksha Mantri also paid rich tributes to brave soldiers of the Indian Armed Forces who stood steadfast with Bangladesh during the War of Liberation of Bangladesh, saying that it marked a golden chapter in the world history in 20th century. He also remembered the extraordinary leadership in India, which rose to the occasion against all odds and limitations in 1971, in support of a nation fighting against the injustice and unspeakable atrocities. He stated that India's response

to the events of 1971 was a reflection of a civilization, more than a mere matter of state policy. "India's all-out support came naturally out of historical experience and deep emotional, cultural, linguistic and fraternal ties that bind together the people of India and Bangladesh. We are proud that this friendship, founded in the shared sacrifice, has prospered by leaps and bounds," he added.

Shri Rajnath Singh described the Bangladesh War of Liberation as an unprecedented event in the 20th century history. "It was a moral fight against injustice, atrocities and oppression. Ordinary people were brutally maimed and murdered. The barbaric atrocities of Operation Searchlight stirred the conscience of the world. However, the atrocities resonated strongest in the hearts and minds of ordinary Indians. Each in India truly felt that his or her own brother and sister were under attack. India herself was in poverty, but there was no hesitation in wholehearted moral and material support to the people of Bangladesh in their fight for liberation. This was a fight to the end from an oppressive and undemocratic regime, which defied people's mandate. India gave shelter to millions of refugees even when we did not have enough for our own. A struggling nation gave shoulder to another," he said. The Raksha Mantri appreciated the gesture of Government of Bangladesh for erecting a memorial for the Indian soldiers at Ashuganj in Bangladesh.

The Raksha Mantri asserted that the proud and professional Bangladesh Armed Forces of today owe their foundational values to the Liberation War of 1971. He appreciated the fact that today the Armed Forces of Bangladesh are one of the highest contributors to the UN Peace Keeping Forces and are respected globally for their professionalism and commitment to just causes.

Shri Rajnath Singh called for keeping the spirit of Liberation War alive in the minds of the younger generations, especially those who join the Armed Forces. "It is all the more important, because the forces which brought untold atrocities and miseries on Bangladesh in 1971, and forces against whom we spilt our blood together, are far from finished and gone. They are lurking around us in different forms and excuses, but indistinguishable from their past in spewing hatred, intolerance and violence. Our tasks are no less formidable than they were in 1971. Reaching out to new generations with true stories of 1971 is the least we can do," he said.

The Raksha Mantri expressed satisfaction that the close defence cooperation between India & Bangladesh, which started during the Liberation War, is continuing apace. "Defence cooperation between the two countries has grown steadily in the last few years by way of several activities - defence dialogue, staff talks, joint training, exercise and high-level exchanges. It is remarkable that all three Service Chiefs of Bangladesh have visited India this year and from India, the Chiefs of Army and Air Force visited Bangladesh this year. India has extended a Line of Credit worth USD 500 million to Bangladesh for defence equipment. We hope that this gesture will spur joint activities not only in acquisition of assets but also in co-development and co-production of defence material," he added.

Shri Rajnath Singh added that India is keen to continue working closely with Bangladesh helping and supporting each other's defence and security concerns. He said, India is deeply sensitive to the security and development concerns of its neighbours and hopes for reciprocal level of sensitivity on the part the neighbours towards the concerns of India. "In this context, it is critical for our Armed Forces to remain engaged with each other for mutual capability enhancement, to respond to contingencies and to realise the shared goals of providing security and prosperity to our people," he said.

The Raksha Mantri added that India & Bangladesh strong partners in bringing progress and prosperity for the peoples of South Asia through robust and expanding regional cooperation. "Both are facing challenges which are similar. Today, we are fighting shoulder to shoulder against common challenges such poverty and hunger, surge of terrorism and extremist ideologies and climate change," he said.

Shri Rajnath Singh lauded the progress achieved by Bangladesh over the years and said that it currently one of the fastest growing economies in the world. "Various developmental works are taking place across the country. India is privileged to be one of Bangladesh's major development partners with a total portfolio of close to US $10 billion. The partnership is mutual – as the darkest

moments of recent second wave of the pandemic showed – when we received substantial medical help from Bangladesh," he said.

Shri Rajnath Singh added that for India, Bangladesh's success is its own success and in its own interest. "India-Bangladesh bilateral ties have been passing through a '*shonali adhyay'* - golden phase. While cooperation in traditional areas like security, trade, connectivity and people to people exchanges have steadily deepened, the partnership is expanding to new and emerging areas like nuclear technology, IT, innovation and blue economy," he said.

The Raksha Mantri congratulated Bangladesh as 6th December, the date on which India recognised independent sovereign Bangladesh, will be commemorated as 'Maitree Diwas' in India and Bangladesh as well as in 18 other countries around the world.

https://pib.gov.in/PressReleasePage.aspx?PRID=1774060

Hindustan Times

Tue, 23 Nov 2021

Drones figure in DGPs conference for manning troubled borders

PM Modi, Union home minister Amit Shah and National Security Advisor (NSA) Ajit Doval were briefed on threat posed by terrorism and China to India.

By Shishir Gupta

New Delhi: Even as unarmed and armed drones figured in a big way in the DGPs conference in Lucknow for manning international borders this weekend, the Indian military is in the process of getting upgraded surveillance drones and examining the options of procuring armed drones from Israel.

India is set to buy 30 Predator armed drones while examining the options of purchasing Israeli Heron TP armed drones for future purchases.

While the Indian Navy, the designated service for armed drones, is soon approaching the Defence Acquisition Council (DAC) for acquiring 30 MQ-9B Predator drones from US, it is also examining the armed Heron TP drone from Israel for additional purchases.

According to officials in knowledge of developments, a separate session on drone technology was held during the DGPs conference, with Prime Minister Narendra Modi part of the discussions. It was emphasised that India should be using drone technology for surveillance and response on the borders till such time the border infrastructure is upgraded to meet the future challenges posed by neighbours.

Already, India is getting its surveillance Herons upgraded from Israel with advanced communication and data links, it is also examining the Heron TP, which virtually carries the same weapon payload as the Predator albeit has a larger radar cross-sector as compared to the US craft. The earlier plan of acquiring Heron TP on lease from Israel has apparently been shelved and there is a strong possibility of the craft being acquired from Israel on government-to-government basis.

While indigenous design and development of surveillance and armed drones is work in progress, the regional security environment has changed with China stationing Wing Loong II armed drone at Ngari Gar Gunsa air base across the Demchok LAC in Ladakh. To complicate matter, China is also supplying the same drones to Pakistan with the possibility of technology transfer or joint development.

If the issue with China is surveillance of the Line of Actual Control (LAC), the issue gets escalated on the western borders with Pakistan using drones for supplying weapons to terrorists

with the aim of fomenting trouble in the Indian hinterland. Since 2019, the Pakistani deep state has chosen the low-cost option of not only supplying assault rifles and grenades to the terrorists in Kashmir and Punjab, they have also gone to the extent of targeting Jammu airbase with explosives this June. That the threat on western border is real becomes evident as the grenade used in the attack on Indian army establishment in Pathankot was part of the Pakistani drone consignment.

At the DGPs conference, there were discussions and presentations on threat posed by radicalization and terrorism as well as the military challenge from China. The prognosis was that as India should use technologies like drones to manage the LAC as it cannot match border infrastructure put up by the Chinese PLA overnight with each military post connected by road and optical fiber for better response and decision making on the spot.

https://www.hindustantimes.com/india-news/drones-figure-in-dgp-conference-for-manning-troubled-borders-101637560316006.html

THE NEW INDIAN EXPRESS

Tue, 23 Nov 2021

Bharat Electronics Limited receives export order worth USD 93.15 million

'The contract with Airbus Defence and Space is the biggest export order received till date by BEL,' said Vinay Kumar Katyal, Director of Bengaluru Complex, BEL.

Bengaluru: Under the C295 aircraft programme of the Government of India, Airbus Defence and Space has signed a contract with Navratna Defence PSU Bharat Electronics Limited (BEL) for the manufacture and supply of Radar Warning Receiver (RWR) and Missile Approach Warning System (MAWS).

This export order, which is worth $93.15 million, is the biggest received till date by BEL. (Representational Photo)

This export order, which is worth $93.15 million, is the biggest received till date by BEL. "The contract with Airbus Defence and Space is the biggest export order received till date by BEL," said Vinay Kumar Katyal, Director of Bengaluru Complex, BEL.

BEL recently achieved a turnover of Rs 3,622.42 crore, registering a growth of 14.45% during the 2nd Quarter of FY 2021-22 over the turnover of Rs 3,164.99 crore in the corresponding period of the previous year.

"We are happy to be associated with Airbus Defence and Space in manufacturing and delivering the Radar Warning Receiver (RWR) and Missile Approach Warning System (MAWS) for the prestigious C295 aircraft programme," said Anandi Ramalingam, Chairman & Managing Director, BEL.

https://www.newindianexpress.com/business/2021/nov/23/bharat-electronics-limited-receives-export-order-worth-usd-9315-million-2386960.html

mint

Tue, 23 Nov 2021

Ahead of Putin's India visit, DAC to discuss AK-203 deal in high-level meeting

The AK-203 assault rifles deal, which may be signed during the visit, would be taken up for discussion in the special Defence Acquisition Council (DAC) meeting to be held on Tuesday, the report says

New Delhi : With Russian President Vladimir Putin scheduled to visit India from December 5, a high-level Defence Ministry meeting would be held on Tuesday to discuss the finalisation of the over ₹5,000 crore deal with Russia to manufacture 7.5 lakh AK-203 assault rifles in Uttar Pradesh's Amethi.

The Russian designed AK-203 will be made in a factory in Amethi, Uttar Pradesh (Photo: Reuters)

The AK-203 assault rifles deal, which may be signed during the visit, would be taken up for discussion in the special defence acquisition council meeting to be held on Tuesday, defence sources told ANI.

The Russian designed AK-203 will be made in a factory in Amethi, Uttar Pradesh.

The deal had been agreed upon between the two sides a few years ago and now the last major issue would be resolving the issues on the transfer of technology, they said.

Of the 7.5 lakh rifles to be acquired by the Indian Army, the first 70,000 will include Russian made components as the transfer of technology slowly happens.

These will be delivered to the army 32 months after the production process begins.

https://www.livemint.com/news/india/ahead-of-putin-s-india-visit-dac-to-discuss-ak-203-deal-in-high-level-meeting-11637593610919.html

Hindustan Times

Tue, 23 Nov 2021

Indian Army conducts major drills in Gujarat's Creek area

The India Army's Pune-based Southern Command on Monday concluded high-intensity combat manoeuvres in Kutch's Creek sector, with the multi-agency drills involving the army, air force, navy, coast guard, Border Security Force, Gujarat state police and the fisheries department, officials familiar with the development said

By Rahul Singh

The India Army's Pune-based Southern Command on Monday concluded high-intensity combat manoeuvres in Kutch's Creek sector, with the multi-agency drills involving the army, air force, navy, coast guard, Border Security Force, Gujarat state police and the fisheries department, officials familiar with the development said.

File photo: Special Forces simulate a raid on an enemy post. (Indian Army)

Sir Creek is a 96-km maritime strip disputed between India and Pakistan in the Rann of Kutch. It divides the Kutch region of Gujarat and the Sindh province of Pakistan.

The four-day exercise, codenamed Dakshin Shakti, was conducted in training areas scattered across Gujarat and Rajasthan.

"The exercise involved the insertion of troops and manoeuvres by forces in all three dimensions simultaneously in an integrated manner. It involved comprehensive coordination for effective response in a multi-domain environment, real-time communication, and sharing of operational data to overcome emerging threats," the army said in a statement. Top officials from the organisations taking part in the exercise witnessed the joint drills.

The exercise saw India's marine commandos being dropped from IAF's Mi-17 helicopters into boats to simulate an attack on an enemy target, the officials said. Hovercraft from the coast guard also landed army reinforcements at the shore to neutralise an enemy post, they added.

The exercise validated future concepts of warfighting in a tri-service battlefield environment, the Southern Command said in a tweet.

https://www.hindustantimes.com/india-news/indian-army-conducts-major-drills-in-gujarat-s-creek-area-101637599069062.html

THE HINDU

Tue, 23 Nov 2021

Crew module components handed over to ISRO

Thiruvananthapuram: Kortas Industries Pvt Ltd (KIPL), an aerospace manufacturing firm at Veli here, has handed over the first set of crew module components for the Gaganyaan mission to the Indian Space Research Organisation (ISRO).

Kortas Industries director M. Shahabudeen handed over the parts to S. Somanath, director, Vikram Sarabhai Space Centre (VSSC), at a function held at the factory.

The Gaganyaan mission of ISRO aims to send a three-member crew to space and safely return them to earth.

Senior officials of VSSC and KIPL were present at Monday's function.

KIPL had been manufacturing and supplying mechanical hardware and sub-assemblies for the ISRO for the past 20 years, the company said in a statement.

KIPL became a subsidiary of Alpha Design Technologies, Bangalore, last year as part of an expansion programme and to contribute major rocket hardware systems for PSLV, SSLV, and the GSLV MK-III programmes of the ISRO.

KIPL director Babu Tom Joseph was also present at the function on Monday.

https://www.thehindu.com/news/national/kerala/crew-module-components-handed-over-to-isro/article37632944.ece

ZEENEWS

Tue, 23 Nov 2021

ISRO working on hack-proof comms, robots, self-healing materials, debris-free rockets and satellites

Speaking at the Inaugural session of the ISRO's Directorate of Technology Development and Innovation (DTDI) Conclave, Dr. K. Sivan, Chairman, ISRO said that DTDI was formed as a dedicated Directorate at ISRO headquarters to sow the seeds of futuristic and disruptive technology for the space sector.

By Sidharth MP, Edited By Surabhi Pathak

Highlights

1. ***A global effort is underway to maximize the operations of reusable rockets***
2. ***Some of the disruptive technologies that ISRO was working on are quantum radars, low-temperature lithium-ion cells***

Chennai: The Indian Space Research Organization(ISRO) is working on nearly 50 futuristic, innovative technologies that will cater to the country's technological needs, in the coming decades. Some of them include Quantum communications, space debris mitigation technologies, robotic arms, interplanetary rovers, etc.

Top officials of the space agency enlisted these technologies at the Inaugural session of the ISRO's Directorate of Technology Development and Innovation (DTDI) Conclave.

Speaking at the event, Dr. K. Sivan, Chairman, ISRO said that DTDI was formed as a dedicated Directorate at ISRO headquarters to sow the seeds of futuristic and disruptive technology for the

space sector. He added that the technologies were being developed based on the global trends and a SWOT analysis of their possible applications.

Image credit: Twitter/ISRO

ISRO, Indian industry and academia would be collaborating and investing their resources to realize these technologies, said Dr. Sivan, who also serves as Secretary, Department of Space.

"Over the last 3 years, ISRO initiated 46 technological endeavors such as Quantum communication, space-debris mitigation technologies like self-eating rockets, self-vanishing satellites and robotic arms to catch space debris" Dr. Sivan said. He elaborated that quantum communication and satellite-based quantum communication, quantum cryptography could provide unconditional data security in secure communications. With space debris from destroyed satellites, overpopulation of space by defunct satellites and active ones, spent rocket stages being a major concern, there is a growing need for mitigating this challenge.

A global effort is underway to maximize the operations of re-usable rockets, enable in-space refueling, servicing of satellites, minimizing, collecting and removing space debris, developing materials that don't pose a long-threat to other space assets etc. It is in that context that ISRO's plan for self-eating rockets and self-vanishing satellites, robotic arms needs to be seen.

Quantum mechanics is a theory in physics that describes the physical properties of nature at the level of atoms and sub-atomic particles. This is different from Classical physics that describes many aspects of nature at an ordinary (macroscopic) scale.

Conventionally, sensitive data is sent via cable or other means along with the digital keys needed to decode the information. This is sent via a stream of electrical or optical pulses that are representing 0s and 1s (bits). However, this is prone to hacking, without the knowledge of the sender and receiver.

In Quantum communication, particles (photons of light) are transmitted in qubits(quantum bits), which have both 0 and 1 value at the same time. So, if a hacker were to try and eavesdrop on it, they must measure these qubits, which leaves a detectable trace and alerts the sender and receiver. This is based on the principle that - a quantum state cannot be measured without disturbing it. If qubits are disturbed, then both parties know it and can abandon the exchange.

On disruptive technologies that ISRO was working on, R. Umamaheswaran, Scientific Secretary, ISRO, mentioned quantum radars, low temperature lithium-ion cells that can power sub-systems in sub zero temperatures and space-based solar power etc.

He added that ISRO had created a 'Vision 2030', based on ideas received from its scientists and engineers. This included "General purpose Humanoid robots, in-situ propellant production for interplanetary exploration, planetary rock sampling, intelligent space vehicle, robotic arm in space, spider rover, AI enabled spacecraft, Lattice composite structure etc."

On the status of these technologies, he said that few of them were in the feasibility study stages, whereas the development of some others had been initiated at the lab level.

ISRO will also be harnessing Artificial Intelligence, Machine learning and Big data analysis to make better use of data from satellites, in order to cater to the understanding of earth's resources.

"We are looking at ensuring preparedness for handling celestial and anthropogenic challenges, developing AI-Based models for on-board anomaly detection in spacecrafts, Spatio-temporal weather prediction, Ground water level prediction, generation of land cover maps, AI driven quality inspection, AI-driven Agriculture etc." Dr. Umamaheshwaran added.

Via initiatives such as DTDI Connect and DTDI extend, ISRO aims to unite technology developers from across the country with potential users to enable customized products that are ready-to-induct. The spin-offs from such technological products are services are also expected to be of great utility to the country and its rapidly-growing advanced requirements.

https://zeenews.india.com/india/isro-working-on-hack-proof-comms-robots-self-healing-materials-debris-free-rockets-and-satellites-2412679.html

PHYS.ORG

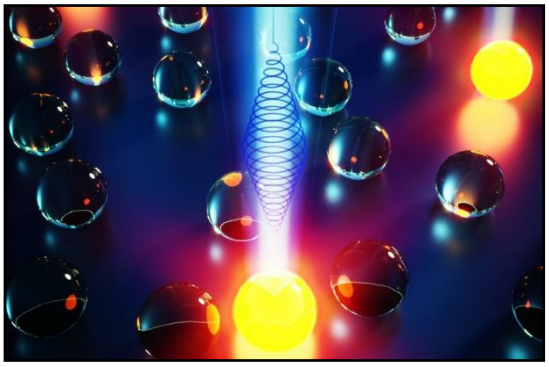
Tue, 23 Nov 2021

Getting quantum dots to stop blinking

By David L. Chandler

Quantum dots, discovered in the 1990s, have a wide range of applications and are perhaps best known for producing vivid colors in some high-end televisions. But for some potential uses, such as tracking biochemical pathways of a drug as it interacts with living cells, progress has been hampered by one seemingly uncontrollable characteristic: a tendency to blink off at random intervals. That doesn't matter when the dots are used in the aggregate, as in TV screens, but for precision applications it can be a significant drawback.

Now, a team of chemists at MIT has come up with a way to control this unwanted blinking without requiring any modification to the formulation or the manufacturing process. By firing a beam of mid-infrared laser light for an infinitesimal moment—a few trillionths of a second—the quantum dot's blinking is eliminated for a relatively long period, tens of billions of times longer than the laser pulse.



MIT chemists have come up with a way to control the unwanted blinking of quantum dots, depicted here as yellow spheres, without requiring any modification to the formulation or the manufacturing process. Credit: Jiaojian Shi, Weiwei Sun, and Hendrik Utzat, Keith Nelson and Moungi Bawendi, et. al

The new technique is described in a paper appearing in the journal *Nature Nanotechnology*, by doctoral students Jiaojian Shi, Weiwei Sun, and Hendrik Utzat, professors of chemistry Keith Nelson and Moungi Bawendi, and five others at MIT.

Quantum dots are tiny particles, just a few nanometers across, made of semiconductor material, which has a "bandgap" between the energy levels of its electrons. When such materials gain energy from light shining on them, electrons can jump to a higher energy band; when they revert to their previous level, energy is released in the form of a photon, a particle of light. The frequency of this light, which determines its color, can be precisely tuned by selecting the shapes and dimensions of the dots. Besides display screens, quantum dots have potential for uses as solar cells, transistors, lasers, and quantum information devices.

The blinking phenomenon was first observed in the 1990s, soon after quantum dots were first made. "From that time on," Bawendi says, "I would give presentations [about quantum dots], and people would say, 'just make this go away!' So, a lot of effort went into trying to eliminate it by engineering the interface between the dot and its environment, or by adding other molecules. But none of these things really worked well or were very reproducible."

"We know that for some quantum information applications, we want a perfect single-photon emitter source," Sun explains. But with currently available quantum dots, which otherwise might be well-suited to such applications, "they will turn on off randomly, and this is actually detrimental for any of the applications that utilize the photoluminescence from the dots."

But now, she says, thanks to the team's research, "we use these ultra-fast mid-infrared pulses, and the quantum dots can stay in the 'on' state. This can potentially be very useful for applications, like in quantum information science, where you really need a bright source of single photons without any intermittency."

Similarly, for biomedical research applications, eliminating the blinking is essential, Shi says. "There are many biological processes that really require visualization with a steady photoluminescent tag, like tracking applications. For example, when we take medicines, you want to visualize how those drug molecules are being internalized in the cell, and where in the subcellular organelles it ends up." This could lead to more efficient drug-discovery processes, he

says, "but if the quantum dots start blinking a lot, you basically lose track of where the molecule is."

Nelson, who is the Haslam and Dewey Professor of Chemistry, explains that the cause of the blinking phenomenon probably has to do with extra electrical charges, such as extra electrons, attaching to the outer part of the quantum dots, altering the surface properties so that there are other alternative pathways for the extra energy to be released instead of by emitting light.

"Various things can happen in a real environment," Nelson says, "such that perhaps the quantum dot has an electron glommed onto it somewhere at the surface." Instead of being electrically neutral, the quantum dot now has a net charge, and while it can still return to its ground state by emitting a photon, "the extra charge unfortunately also opens up a whole bunch of additional pathways for the electron's excited state to return to the ground state without emitting a photon," for example by shedding heat instead.

But when zapped with a burst of mid-infrared light, the extra charges tend to get knocked off the surface, allowing the quantum dots to produce stable emissions and stop their blinking.

It turns out, Utzat says, that this is "a very general process," which might turn out to be useful for dealing with anomalous intermittency in some other devices, such as in so-called nitrogen vacancy centers in diamond, which are being harnessed for ultra-high-resolution microscopy and as sources of single-photons in optical quantum technologies. "Even though we have shown it for only one kind of workhorse material, the quantum dot, I believe that we can apply this method to other emitters," he says. "I think the fundamental effect of using this mid-infrared light is applicable to a wide variety of different materials."

Nelson says the effect also may not be limited to the mid-infrared pulses, which currently rely on bulky and expensive laboratory laser equipment and are not yet ready for commercial applications. The same principle could also extend to terahertz frequencies, he says, an area that has been under development in his lab and others and that in principle could lead to much smaller and less expensive devices.

The research team also included Ardavan Farahvash, Frank Gao, Zhuquan Zhang, Ulugbek Barotov, and Adam Willard, all at MIT. The work was supported by the U.S. Army Research Lab and the U.S. Army Research Office through the Institute for Soldier Nanotechnologies, the U.S. Department of Energy, and the Samsung Global Outreach Program.

More information: Keith Nelson, All-optical fluorescence blinking control in quantum dots with ultrafast mid-infrared pulses, *Nature Nanotechnology* (2021). DOI: 10.1038/s41565-021-01016-w. www.nature.com/articles/s41565-021-01016-w

Journal information: *Nature Nanotechnology*

https://phys.org/news/2021-11-quantum-dots.html

PHYS.ORG

Tue, 23 Nov 2021

Heat flow controls the movement of skyrmions in an insulating magnet

Tiny amounts of heat can be used to control the movement of magnetic whirlpools called skyrmions, RIKEN physicists have shown. This ability could help to develop energy-efficient forms of computing that harness waste heat.

Skyrmions are minuscule vortices that form when the magnetic flux of a group of atoms organizes into swirling patterns. Skyrmions can move around inside a material, and under certain conditions they cluster together to form a regular arrangement known as a skyrmion lattice (upper part of Fig. 1).

Skyrmions are promising information carriers in next-generation computer chips that have very low power requirements. Researchers can already control skyrmions by applying electrical currents and magnetic fields, but they are seeking to manipulate them using heat flow instead. "This is an exciting prospect since it would raise the possibility of using waste heat to move skyrmions around," says Xiuzhen Yu at the RIKEN Center for Emergent Matter Science.

Now, Yu and her colleagues have shown how a temperature gradient can be used to propel skyrmions in an electrically insulating magnetic material.

The team built a device that consisted of a plate of this material, a miniature heating element and two electric thermometers. They then generated skyrmions that were roughly 60 nanometers wide in the plate by cooling it to about −253 degrees Celsius and applying a magnetic field. These skyrmions gathered into a stable honeycomb structure known as a hexagonal skyrmion lattice.

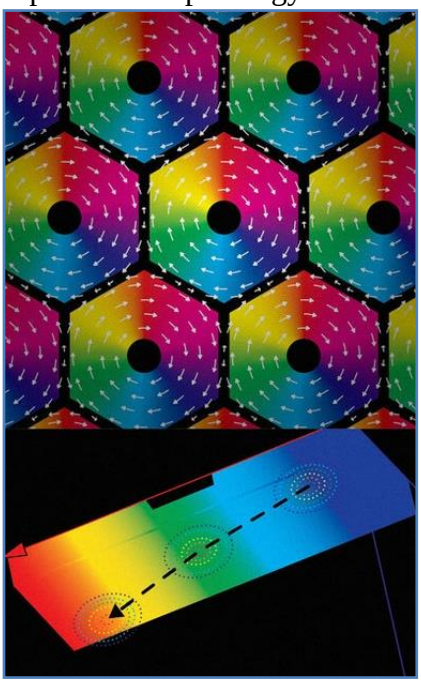


Figure 1: Skyrmions often arrange themselves into hexagonal lattices (top). RIKEN researchers have shown that a temperature gradient in a thin plate of an insulating magnetic material (bottom) can be used to propel such skyrmion lattices from the cooler (blue) to the warmer side (red) of the device. Credit: RIKEN Center for Emergent Matter Science

Yu's team then increased the temperature slightly at one end of the plate and used a transmission electron microscope to watch how this affected the skyrmions. A temperature gradient of 100th of a degree per millimeter of plate was enough to nudge the skyrmions into motion. Above this threshold, the edge of the honeycomb lattice drifted from the cooler to the warmer end of the plate, traveling in the opposite direction to the flow of heat (lower part of Fig. 1). This required a very low heat power of just 10 microwatts, which is hundreds or thousands of times smaller than the power needed to move skyrmions using electrical currents or magnetic fields. Using a slightly higher power, individual skyrmions could be driven through the plate by the temperature gradient.

The researchers say that this is the first time that heat-driven skyrmion motion has been seen in an insulating magnet. "This finding should stimulate researchers to develop energy-efficient devices by using skyrmions," says Yu.

The team is now studying the heat-induced dynamics of skyrmions, including their transformation into their anti-particles—anti-skyrmions in metallic systems at room temperature.

More information: Xiuzhen Yu et al, Real-space observations of 60-nm skyrmion dynamics in an insulating magnet under low heat flow, *Nature Communications* (2021). DOI: 10.1038/s41467-021-25291-2

Journal information: *Nature Communications*

https://phys.org/news/2021-11-movement-skyrmions-insulating-magnet.html

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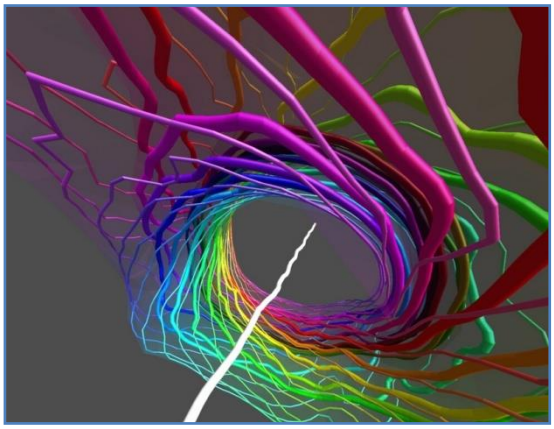
Tue, 23 Nov 2021

Skyrmions: Fundamental particles modeled in beam of light

Scientists at the University of Birmingham have succeeded in creating an experimental model of an elusive kind of fundamental particle called a skyrmion in a beam of light.

The breakthrough provides physicists with a real system demonstrating the behavior of skyrmions, first proposed 60 years ago by a University of Birmingham mathematical physicist, Professor Tony Skyrme.



Skyrmion particle modeled in light. Credit: University of Birmingham

Skyrme's idea used the structure of spheres in 4-dimensional space to guarantee the indivisible nature of a skyrmion particle in 3 dimensions. 3D particle-like skyrmions are theorized to tell us about the early origins of the Universe, or about the physics of exotic materials or cold atoms. However, despite being investigated for over 50 years, 3D skyrmions have been seen very rarely in experiments. The most current research into skyrmions focuses on 2D analogs, which shows promise for new technologies.

In a new study, published in *Nature Communications*, the international collaboration between researchers at the University of Birmingham, Lancaster, Münster (Germany) and RIKEN (Japan) has demonstrated for the first time how skyrmions can be measured in three dimensions.

Professor Mark Dennis, who led the research, said: "Skyrmions have intrigued and challenged physicists for many decades. Although we're making good progress investigating skyrmions in 2D, we live in a 3D world. We need a system that can model a skyrmion in all its possible states in a way that could be measured. We realized that a beam of light could be harnessed for this purpose because we are able to closely control its properties, and so use it as a platform to model our skyrmions. With this approach, we can start to truly understand these objects and realize their scientific potential."

To create their model, Dr. Danica Sugic and Professor Dennis, in the University's School of Physics and Astronomy, cast the standard description of light, the polarization (direction the in which the light waves travel) and phase (the position of the light waves' vibration) in terms of a sphere in 4-dimensional space, crucial to Skyrme's original vision. This then allowed the Skyrmion field to be designed and engineered into a beam of laser light in an experiment led by Professor Cornelia Denz, University of Münster. The team used cutting-edge measurements to determine the precise structure of the skyrmion.

"These objects are actually quite intricate, from a geometric point of view," said Dr. Sugic. "They resemble a complex system of interlocking rings, with the whole forming a particle-like structure. What's particularly interesting is the skyrmion's topological properties—they can be distorted, stretched or squeezed, but will not come apart. This robustness is one of the properties that scientists are most interested in exploiting."

More information: Particle-like topologies in light, *Nature Communications* (2021). DOI: 10.1038/s41467-021-26171-5

Journal information: *Nature Communications*

https://phys.org/news/2021-11-skyrmions-fundamental-particles.html

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Tue, 23 Nov 2021

Research suggests malaria exposure could reduce COVID-19 severity

By Sara Jerving

New research from Uganda and Mali suggests malaria exposure might lower the incidence of severe disease, hospitalization, and death for people exposed to SARS-CoV-2, the virus that causes COVID-19.

A scientist examines a blood sample from a patient with malaria. Photo by: felipe caparros cruz / Alamy via Reuters

The research findings, presented at the American Society of Tropical Medicine and Hygiene's annual meeting last week, found low levels of severe COVID-19 symptoms among people exposed to SARS-CoV-2 in areas with high malaria burdens, leading researchers to hypothesize that previous malaria exposure could offer its survivors a shield against COVID-19.

Severe cases of COVID-19 are often associated with a surge of proteins called cytokines that cause an inflammatory response and tissue damage. Researchers in Uganda found that COVID-19 patients with a history of malaria infections, as measured by antigen levels in the body, had lower levels of cytokines.

"All of the patients who were categorized as having a high exposure to malaria in the past, had lower levels of the cytokines, across the board, for the different cytokines we measured, in comparison to those who had low previous exposure to malaria," Dr. Jane Achan, senior research advisor at the Malaria Consortium, a United Kingdom-based non-governmental organization, and a co-author of the study, told Devex.

"It's not that we're not seeing any markers of disease severity, it is that the rates of reporting of hospitalizations, symptomatic illness, and death are lower than would be expected."

— Dr. John Woodford, a malaria researcher at NIAID and co-author of the study

This was based on a study of nearly 600 COVID-19 patients — looking at whether they were currently or previously exposed to malaria infection. Only 5% of these patients with high levels of previous exposure to malaria developed severe cases of the disease or death, as opposed to about 30% of those with lower levels of previous malaria exposure.

"We went into this project thinking we would see a higher rate of negative outcomes in people with a history of malaria infections because that's what was seen in patients co-infected with malaria and Ebola," wrote Achan in a press release. "We were actually quite surprised to see the opposite — that malaria may have a protective effect."

Achan said this effect, where cytokines don't spike in the bodies of people with previous malaria exposure, has already been documented before the pandemic in older children and adults living in parts of Africa with a high malaria burden.

But she said that previous malaria exposure could also have other impacts on a COVID-19 patient. She said the researchers didn't measure the change in viral load over time — but previous malaria exposure could also impact viral load, which could impact the severity of symptoms in COVID-19 patients. Other groups are currently investigating this, she said.

Achan told Devex that these findings could influence the development of treatment options for COVID-19.

She said that the next research steps would include looking at this effect in a larger population of people. And there is further work to be done on whether previous exposure to malaria impacts the long-term complications associated with COVID-19.

Another study presented at the meeting found that despite widespread infection of SARS-CoV-2 in Mali, severe disease, hospitalization, and death were rare.

The researchers, from the United States National Institute of Allergy and Infectious Diseases and the Malaria Research Training Center in Bamako, Mali, conducted seroprevalence surveys of over 3,500 people in four communities in Mali's capital city of Bamako, and its surrounding areas, as well as documenting their symptoms, according to Dr. John Woodford, a malaria researcher at NIAID and co-author of the study. This type of study examines what percentage of a population has antibodies to the virus in their blood over time.

As of January 2021, about 59% of community members had been exposed to the SARS-CoV-2 virus, but this high level of exposure was not accompanied by a large influx of people into health centers. Some of these communities had not reported any COVID-19 cases throughout the pandemic.

The COVID-19 attributable symptoms people reported weren't substantially higher than the typical rates of illness experienced in the communities. In fact, the number of hospitalizations and deaths we're lower than those for age-adjusted U.S. rates of severe disease — to account for the fact that, like much of the rest of sub-Saharan Africa, the population of Mali is relatively young.

"It's not that we're not seeing any markers of disease severity, it is that the rates of reporting of hospitalizations, symptomatic illness, and death are lower than would be expected. Sometimes, several fold lower," Woodford said.

Wood said they found that these communities had high rates of exposure to other coronaviruses previously, but no evidence that antibodies from other coronaviruses provided protection against SARS-CoV-2. Because of this, key hypotheses include low rates of co-morbidities in the community — or high exposure to other infections, particularly malaria, which has been previously linked to protection against other severe viral infections.

Mali has a high malaria burden. Woodford said that about 35% of the population in one of the rural villages was diagnosed with malaria over the study period. One hypothesis is that the findings could suggest that these individuals' immune systems have been trained by recurrent infection from malaria to not overreact with inflammation when it encounters SARS-CoV-2.

Woodford said "it starts to paint a picture."

The researchers are interested in further testing around this, and will release data from August and September in the near future, but it's very hard to test, he said, because "getting direct evidence to show that malaria infection reduces severe illness, and understanding how, will be challenging."

And ultimately, these findings raise questions about how to best allocate limited health resources, to balance the COVID-19 response with other deadly illnesses such as malaria, Woodford said.

"We really need to understand the effects of the pandemic, locally, in Mali and in West Africa, in order to help prioritize the allocation of public health resources. Countries might not be using the most effective public health interventions," he said. Mali's Ministry of Health made an early decision to continue malaria program activities in 2020.

"In light of our findings, this was a good decision," Woodford said. "The COVID pandemic has had a lesser impact than expected, while malaria continues to have a marked seasonal burden on the population."

https://www.devex.com/news/research-suggests-malaria-exposure-could-reduce-covid-19-severity-102106