

Oct
2021

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खंड : 46 अंक : 208 20 अक्टूबर 2021

Vol.: 46 Issue : 208 20 October 2021



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Wed, 20 Oct 2021

Argentina confirms Indian HAL Tejas ‘Key Contender’ for FAA Fighter Jet contract; awaits official proposal

By Nitin J Ticku, Shreya Mundhra

The Fuerza Aérea Argentina (FAA) or Argentina’s air force has been aggressively on a hunt for advanced fighter jets. Where does India’s indigenous HAL Tejas aircraft stand after there were reports that the country had opted for Chinese/Pakistani JF-17?

Argentina’s Ailing Jet Fleet

The Fuerza Aérea Argentina (FAA) or Argentina’s air force has an aging fleet comprising French-designed Mirage III and V fighter aircraft along with the US-built A-4 Skyhawk subsonic jets. The Mirage fighters were phased out in 2015. This left the South American country’s air force in a very vulnerable position.

Argentina had recently set aside a budget worth \$664 million to procure warplanes to enhance its airpower. However, procuring these fighters doesn’t seem to be an easy task.

Ever since the 1982 Falklands War, Britain has maintained an arms embargo on Argentina. It has been blocking exports of aircraft to Buenos Aires by placing sanctions on parts of aircraft built by the UK.

Instances of this include London putting pressure on Spain to scrap a deal to supply surplus Mirage F1M fighters to Argentina. A contract for Israeli Kfir jets is also believed to have fallen through owing to Britain’s pressure along with Washington having control of the aircraft’s J79 engine production.

The UK not only effectively vetoed the export of Brazilian-license-built Swedish JAS Gripen and the South Korean KAI FA-50 Fighting Eagle to Argentina but also splashed cold water on the country’s attempt to procure five French Dassault Super Etendard Modernise jets.

The latter was rebuffed because the UK decided to levy an arms embargo over the Martin Baker-manufactured MK6 ejection seat used in the fighter jet. This resulted in the cancellation of the potential deal.

The considerably hefty number of canceled deals has left Argentina in an extremely precarious position. The nation’s neighbors – Chile and Brazil – are far better equipped, qualitatively and quantitatively, with fighter planes. The Brazilian Air Force is also expecting to receive 36 Saab Gripen E fighters. This Swedish-designed jet will be assembled, in part, in Brazil itself.



The HAL Tejas (via Twitter)

The JF-17 Fiasco

Multiple affronts by London and its western allies pushed Argentina to turn towards China. To bolster its airpower, Argentina looked towards the JF-17 Thunder, a multi-role combat aircraft that is jointly developed by China's Chengdu Aircraft Corporation (CAC) and Pakistan Aeronautical Complex (PAC).

The aircraft became wrapped in controversy when it made headlines due to Pakistan Strategic Forum (PSF), an Islamabad-based think tank, stating, "the Government of the Argentine Republic has officially included funding for the purchase of 12 PAC JF-17 A Block III fighters in a draft budget for 2022 presented to Argentina's Parliament."

The Argentinian officials denied these and other related rumors. In the statement, the Ministry of Defense said – We have requested a credit up to USD 664 million for the 2022 budget for the acquisition of multipurpose fighter aircraft, for the surveillance and control of the air space. Likewise, this ministry clarifies that it has not selected any supersonic aircraft of any origin and is in the technical-economic and financial evaluation stage of five alternatives.

Last week, in an interview given to Infodefensa, a Spanish language website covering South American military news, Brigadier Xavier Julian Isaac, the chief of the Argentine Air Force said that the service, having received offers for new fighters from both Russia and China, was awaiting proposals from the US and India as well.

Explaining the primary needs of the FAA, Isaac said, "The needs, honestly, are multiple. I like to make it clear that the FAA's primary mission is the surveillance and control of airspace, which is effectively controlled by fighter jets.

"We have several offers, there is the Chinese JF-17, the Russian MIG-35 and MIG-29. While we do not have any specific offer from the United States, we do know that they are preparing one. We also had a rapprochement with India, which is wanting to offer us the Tejas but we are just in the first talks."

According to Isaac, the Argentine Air Force wants to receive all offers for a new aircraft by the end of this year and will decide on a platform and financing for it by the "first quarter of next year".

Earlier, FE reported that India's Tejas could be an attractive option for the FAA which is looking for multi-purpose jets for the surveillance and control of its airspace.

If Tejas is preferred by FAA, it will help in promoting ties between the two countries and could be a bridge to reinforce ties with the West that India has and with Russia too," Professor Juan Battaleme told FE Online.

Chances for India's Tejas

India has been intensively focusing on boosting its domestic aerospace industry. Tejas is a central element in the country's movement to create an 'Aatmanirbhar Bharat' (self-reliant India).

R Madhavan, Chairman and Managing Director of Hindustan Aeronautics Limited, had announced earlier this year that the delivery of the Tejas Light Combat Aircraft (LCA) for the Indian Air Force will commence from March 2024.

Madhavan had said that several countries had shown interest in the procurement of Tejas jet. The LCA makes for a great choice for nations looking for a budget fighter aircraft. Its Mark-1A variant will be equipped with an active electronically scanned array (AESA) radar, beyond visual range (BVR) missile, electronic warfare suite, and an air-to-air refueling system.

The aircraft was already pitched to the Royal Malaysian Air Force (RMAF). Since the Argentine Air Force is looking for multi-purpose fighters that it plans to employ in surveillance and airspace control roles, India's indigenous Light Combat Aircraft (LCA) Tejas could be a desirable option.

However, the LCA's first opportunity to be exported might also be blocked by Britain. This is because Tejas also employs a Martin-Baker ejection seat. The seat is called the MK16 IN16 GS Tejas.

In addition, the aircraft features other British-supplied equipment, notably its air-to-air refueling probe and quartz radome. These are both supplied by UK-based firm Cobham.

Theoretically, aircraft manufacturers have the liberty to select and install new ejection seats on a jet of their making. However, this process that involves testing and validating the aircraft and equipment at different heights and under various flight conditions is not only time-consuming but also adds to the cost.

This condition doesn't bode well for Argentina, which has a comparatively tight budget. Whether the Tejas can emerge victorious in light of this challenge besides competition from Chinese, Russian and American aircraft is to be seen.

<https://eurasianimes.com/argentina-confirms-indian-hal-tejas-key-contender-for-faa-fighter-jet-contract-awaits-official-proposal/>



Wed, 20 Oct 2021

Reports on Malaysian fighter jet tender: Tejas in, JF-17 out

By Valius Venckunas

Six bids have been submitted to the Royal Malaysian Air Force (RMAF) light combat aircraft (LCA) tender, according to Malaysian media reports.

The bids include India's Hindustan Aeronautics with the Tejas, a conglomerate of Russian-led companies with the MiG-35, China's Catic with the L-15, Korea Aerospace Industries (KAI) with the FA-50, Turkey Aerospace industries (TAI) with the Hürjet, and Italy's Leonardo with the M-346.

The news was reported by the Malaysian business newspaper, The Edge Malaysia Weekly, with a reference to an unnamed source close to the matter.



Image : Royal Malaysian Air Force

The list does not contain the Pakistani-Chinese JF-17 Thunder, which was rumored to be one of the prime contenders. The Boeing T-7A Red Hawk and the Yakovlev Yak-130 are also absent.

According to The Edge, the tender documents were acquired by nine companies, while just six of them sent their bids before the closing date on October 6, 2021.

Earlier reports by the Malaysian media indicated nine contenders. Besides the T7A, the Yak-130, and the JF-17, they also included the Czech Aero Vodochy L-39NH, but excluded the TAI Hürjet.

Malaysia announced the LCA tender in June 2021 in the wake of international tensions in the region. The country intends to purchase 18 aircraft, with the opportunity to add a further 18 to the order later. Eight aircraft from the initial batch are intended to be used as trainers and 10 will act as light combat aircraft, performing both air-to-ground and air-to-air missions.

According to The Edge's source, requirements for the aircraft include aerial refueling, beyond-visual-range (BVR) combat and supersonic flight capabilities, as well as containing at least 30% of parts produced in Malaysia. The manufacturer will also start deliveries within 36 months after the contract is signed.

These requirements exclude the L-39NH, which is not supersonic. It seems that all the other aircraft meet the requirements, or at least can be modified to do so.

The TAI Hürjet is the only aircraft of the six that has not yet performed a maiden flight – its prototype is expected to enter production in late 2021, and fly before the end of 2022. It is intended to replace the Northrop T-38 Talon as an advanced trainer for the Turkish Air Force, and also has a light combat variant.

The Indian HAL Tejas has been one of the primary fighter jets of the Indian Air Force since 2015 but has received no foreign orders so far.

The MiG-35, which has been offered by a corporation called Aerospace Technology Systems, is a deep modification of the Soviet-era MiG-29 fighter jet, which was retired from the Malaysian Royal Air Force in 2017. The MiG-35 was adopted by the Russian Air Force in 2019 but is yet to be mass-produced or sold outside Russia.

The L-15 Falcon, offered to Malaysia by the China National Aero-Technology Import & Export Corporation (CATIC) and produced by the Hongdu Aviation Industry Corporation (HAIC), was introduced in 2010 and is currently on its way to becoming the primary lead-in fighter trainer for China's Air Force and Naval Air Force.

The KAI FA-50 Golden Eagle, a light combat variant of the T-50 trainer, has already been adopted by the Philippines, while several other countries – including Indonesia, Iraq, Thailand, and South Korea – use the trainer variant.

The M-346 Master, developed by Alenia Aermacchi (later absorbed by Leonardo), has been delivered to numerous countries in a trainer variant. Its fighter attack version has been ordered by Turkmenistan and Nigeria.

Malaysia is currently involved in numerous territorial disputes with neighboring states. The Royal Malaysian Air Force employs the Sukhoi Su-30 MKM and the Boeing F/A-18 fighter jets, and has been reportedly scrambling its BAE Hawk light combat aircraft to intercept aircraft that approached its airspace.

AeroTime has contacted the public relations service of the Royal Malaysian Air Force for comment and is waiting to hear back.

<https://www.aerotime.aero/29226-reports-on-malaysian-fighter-jet-tender-tejas-in-jf-17-out>



Wed, 20 Oct 2021

Jaishankar invites Israeli companies to invest in India's post-covid surge

New Delhi: External Affairs Minister, S Jaishankar has invited Israeli companies to invest in India, taking advantage of the expected post-Covid boom in the economy, which is already showing positive signs of revival.



"Many post-Covid priorities including digital, health, agriculture and green growth are natural areas for our collaboration," said the minister after having elaborate discussions with the Israeli chambers of commerce and the innovation ecosystem.

Jaishankar lauded the "visible enthusiasm" for doing business with India, which he said had already unveiled a slew of new business-friendly measures.

Ambassador Yael Ravia-Zadok, the head of the Economic Diplomacy Division of Israel's Ministry of Foreign Affairs, nailed innovation, water, health, energy among several other sectors as areas of collaboration.

Jaishankar's visit takes forward the joint efforts made by New Delhi and Jerusalem since 2017 to engage the talent pool of the two countries in pursuit of path-breaking technological solutions that can be commercially exploited.

India has size and scale, Israel the sharpness and edge

It was during the historic visit of Prime Minister Narendra Modi to Israel in July 2017 that India and Israel had elevated the bilateral relations to a Strategic Partnership. Since then, the relationship between the two countries has focused on expanding knowledge-based partnership, which includes collaboration in innovation and research, including boosting the 'Make in India' initiative.

The 'India-Israel Industrial R&D and Technological Innovation Fund (I4F)' Memorandum of Understanding (MoU) envisages promotion of bilateral industrial R&D and innovation cooperation in the fields of science and technology by extending support to joint projects for innovative or technology-driven new or improved products, services or processes.

In January 2018, while addressing the India-Israel Business Summit during Benjamin Netanyahu's visit to India, Prime Minister Narendra Modi had said that both countries stand on the cusp of a bright new chapter as there is new energy and purpose that has invigorated the bilateral ties.

"India has size and scale, Israel has sharpness and edge. Given the scale of the Indian economy and the relevance of cutting-edge Israeli technologies for us, even sky is not the limit for what we may achieve together," PM Modi had commented then.

Sharing cutting-edge technology in agriculture and defence

Recognising the centrality of agriculture and water sectors in the bilateral relationship, India and Israel had signed a three-year work programme agreement for development in agriculture cooperation, in May, earlier this year.

The Ministry of Agriculture and MASHAV - Israel's Agency for International Development Cooperation - are leading Israel's largest government-to-government cooperation, with 29 operational Centres of Excellence (COEs) across India in 12 states, implementing advanced-intensive agriculture farms with Israeli Agro-technology tailored to local conditions.

"The three-year work program (2021-2023) reflects the strength of our growing partnership and will benefit local farmers both through the Centres of Excellence and the Villages of Excellence," said Ron Malka, the Director General of Israel's Ministry of Economy and Industry.

Meanwhile, giving a significant boost to India's defence capabilities, the first deliverable Firing Unit (FU) of Medium Range Surface to Air Missile (MRSAM) System was included in the Indian Air Force (IAF), last month.

The MRSAM is an advanced network centric combat Air Defence System developed jointly by Defence Research and Development Organisation (DRDO) and Israel Aerospace Industries (IAI) in collaboration with the Indian industry comprising private and public sectors including MSMEs.

Defence Minister Rajnath Singh had described the system as a shining example of the close partnership between India and Israel, saying that handing over of the system to IAF has taken this decades-old friendship to greater heights.

The Long Range Surface to Air Missiles (LRSAM) system has also been developed by DRDO and IAI Israel to equip the latest ships of the Indian Navy.

Jaishankar to rope in more hi-tech industries

EAM Jaishankar's meetings with the business community working on the Israel-India route are expected to significantly increase cooperation between the two countries.

With bilateral meetings with the Israeli Alternate Prime Minister and Foreign Minister Yair Lapid, President Isaac Herzog, Prime Minister Naftali Bennett, the Knesset Speaker and several other political and business leaders scheduled during the four-day trip, the special relationship between India and Israel is expected to witness a high level of cooperation in economic activity, trade and commerce.

"With Diwali just around the corner, the visit of MEA Dr S Jaishankar is an opportunity to highlight the elements of India-Israel growing partnership that bring light and hope of prosperity to both people and their respected regions: water, agriculture, health tech and education," tweeted Froim Ditzza, the Head of Policy Planning at the Israeli MFA, after Jaishankar's interaction with the business community in Jerusalem Sunday evening.

<http://www.indiandefensenews.in/2021/10/jaishankar-invites-israeli-companies-to.html>



Wed, 20 Oct 2021

India's mega projects! Chenab Bridge is all set to be world's highest rail bridge

The Chenab bridge by the Indian Railways would provide the much-needed connectivity from Kashmir to the rest of the country. The bridge is 35-metre higher than the Eiffel Tower

By Ratika Rana, Edited By Ankita Singh

The Chenab rail link, set to become the world's highest railway bridge, is one of India's most ambitious projects. Earlier in 2021, the majestic arch of the Chenab bridge was completed at the height of 359 metres above the river level and stood 35 metres higher than Eiffel Tower.

With this bridge, Kashmir would finally receive the much-awaited all-weather connectivity with the rest of the country. The Indian Railways is constructing the bridge as a part of the Udhampur-Srinagar-Baramulla Rail Link Project (USBRL). However, the engineering marvel had already missed several deadlines owing to the terrain difficulty in the Young Fold mountains of the Himalayas.

Part of 272-km Rail Link

The project has been pegged as the world's highest link for trains, and the two arms of the arch stretch over the two banks of the treacherous Chenab. The bridge is a part of the ambitious 272-km rail link under construction of the Northern Railway at an estimated cost of ₹28,000. According to Hindustan Times, Steel was mainly chosen for the project to temperatures up to minus 20 degrees Celsius and wind speeds of 200 kilometres per hour. Moreover, using steel would have been the most economical choice. There would be a 14-metre dual carriageway and 1.2-metre-wide central wedge.

The preparation for one of India's most iconic projects began in the early 21st century, in 2002. The initial plan was to connect Kashmir's northernmost city of Baramulla to New Delhi. Back then, the Atal Bihari Vajpayee-led Bhartiya Janata Party government had given high priority status to the project; however, it still suffered delays due to rugged terrain and contractual delays. The bridge's construction involved hefty raw material, including 28,660 metric tonnes of steel, 10 Lakh Cum Earthwork, 66,000 Cum Concrete and 26 Km motorable roads. The concrete material would be put in the steel boxes of the arch to improve stability.

Can withstand an earthquake of Magnitude 8

According to the official website of USBRL, Prime Minister Modi inaugurated the Udhampur-Jammu section, which is 55 km long and is now open to the public. The Chenab Bridge is being constructed to withstand an earthquake of magnitude 8. As per the Press Information Bureau release, this was one of the most challenging projects undertaken over the river of Chenab. The government release mentioned, "It is arguably the biggest civil-engineering challenge faced by any



Image Credit: USBRL Project

railway project in India in recent history." For the first time, Indian Railways have undertaken the erection of arch members by overhead cable cranes.

The marvel of Indian engineering has several noteworthy points, which include that it is designed with blast load in consultation with the Defence Research Development Organization (DRDO). After removing one trestle, the bridge was designed to be operational at a speed of 30km per hour. Apart from that, extensive health monitoring and warning systems were planned throughout the construction of this state-of-the-art bridge.

There is no doubt that the Chenab Bridge is one of the most challenging projects of the Indian Railways; however, the USBRL rail link is also set to have India's longest railway tunnel of 12.75 kilometres. To date, the Pir Panjal tunnel is the longest railway tunnel at 11.215 kilometres.

<https://thelogicalindian.com/trending/chenab-rail-link-31318>



Wed, 20 Oct 2021

Dassault likely to display Rafale Marine Aircraft in India: Report

By Inder Singh Bisht

France's Dassault Aviation has offered to showcase its naval Rafale aircraft in India early next year to pitch it to the Indian Navy, *The Print* revealed, citing sources.

The Indian Navy is looking to replace its more than three-decade-old 45 Russian MiG 29K aircraft in the 2030s.

According to the outlet, the Rafale will take off from the country's shore-based test facility at INS Hansa, Goa in January, not from an aircraft carrier.

India-Specific Capabilities

During its India visit, the aircraft will display its STOBAR (short take-off but arrested recovery) capability, which is different from the CATOBAR (catapult take-off but arrested recovery) currently in use on the French aircraft carrier Charles de Gaulle.

According to the outlet, Indian aircraft carriers employ STOBAR.

The Indian Navy issued a Request for Information to foreign companies for 57 new fighters in 2017 but has yet to announce its next step.

Other Contenders

Apart from Rafale, Boeing's F/A-18 Super Hornet fighter is another contender to fulfill the navy's requirements. However, with the announcement of an indigenous Twin-Engine Carrier-Based Deck Fighter (TEBDF) aircraft development by the country's Defence Research and Development Organisation, the expected global aircraft requirement is likely to be reduced to around 36.

The Indian Navy currently operates its sole aircraft carrier, Vikramaditya, with another carrier, Vikrant, undergoing sea trials. The Vikrant is likely to be fully operational by mid-2023. With two operational carriers in the service, and a possible third to join, the navy has expressed concern about not having enough aircraft to operate on the carriers.

<https://www.thedefensepost.com/2021/10/19/rafale-marine-aircraft-india/>



The Rafale M F3R. Image: French Navy

Russia's Zircon Hypersonic Missile is challenging U.S. dominance

For the first time in a long time, the U.S. might be playing catch-up in defense technology

By Marcia Wendorf

As we reported last week, Russia recently announced that it had successfully launched its new 3M22 Zircon, or Tsirkon, (NATO designation SS-N-33) hypersonic missile from a nuclear submarine. The term *hypersonic* typically refers to craft that travel at speeds of Mach 5 or greater, that is, five times the speed of sound, which is 1,125 feet per second (343 meters per second) at sea level and temperatures of 20 °C (68 °F).

Zircon is part of what Russia is calling its "new generation" of hypersonic weapons. According to an article on AINonline, in an address to the Russian Federal Assembly on February 20, 2019, Russian President Vladimir Putin said that Zircon was, "able to accelerate to about Mach 9." That's nine times the speed of sound, or around 6,850 miles per hour (11,024 km/h).

That same article described Zircon's body length at an estimated 32 to 36 feet (10 - 11 m), and its warhead weight at 660 to 880 pounds (300 to 400 kg). Whatever the size of its warhead, any object traveling at speeds upwards of Mach 6 will impart a devastating amount of kinetic energy to its target.

Zircon was designed to strike both naval and ground targets, and it is estimated to have a range of 620 miles (1,000 km). It is thought that Zircon has a booster stage containing solid-fuel engines that accelerates it to supersonic speeds and a *scramjet* engine in its second stage.

What's a scramjet?

Like conventional jet engines, scramjet engines rely on the combustion of fuel and an oxidizer to produce thrust. Conventional jet engines carry both their fuel and an oxidizing agent on board, while scramjet-powered aircraft carry only the fuel. They obtain the oxidizer from the ingestion of atmospheric oxygen.

That means that scramjets must fly suborbitally, within Earth's atmosphere, where there is sufficient oxygen content to maintain combustion.

Conventional jet engines use rotating, fan-like components to compress the air before combustion, while scramjets use the speed of the craft moving through the atmosphere, along with internal geometry, to compress the air and as such, require no moving parts.

A scramjet is comprised of a converging air inlet where the incoming air is compressed, a combustor where the gaseous fuel, along with atmospheric oxygen, ignites, and a diverging nozzle where the heated air is accelerated to produce thrust.

To compress the air sufficiently, an aircraft containing a scramjet engine must first be accelerated to hypersonic velocities, usually around Mach 4 or 3,096 miles per hour (4,982 km/h), by some other means of propulsion. This can be a turbojet or rocket engine, or a railgun.

Zircon up close

Experts have noted similarities between Zircon and BrahMos-II, which is a hypersonic cruise missile currently under development by India's Defence Research and Development Organization



Ground launched BrahMos Source: India MoD/Wikimedia Commons

and Russia's NPO Mashinostroyenia. Together, they have formed BrahMos Aerospace Private Limited.

During his 2019 annual address to the Russian Federal Assembly, Vladimir Putin said that Zircon was intended to deploy from surface ships and submarines that use the 3S-14 universal shipborne launcher, which is capable of launching both Zircon and Kalibr cruise missiles.

The 3S-14 vertical launchers are currently operational on a number of Russian Navy vessels and are used to fire Kalibr cruise missiles and 3M-55 anti-ship missiles (codename Onix). They are expected to be used on Russia's new Lider-class destroyers, which was once thought to be canceled, but is now reported to be beginning construction in 2023.

Putin has described Zircon as being "truly unparalleled anywhere in the world," and that it is "unstoppable" by Western defenses. Hypersonic weapons may be able to evade the U.S.' missile defense shield because they fly so fast that the air pressure in front of them forms a plasma cloud which absorbs radio waves, making the weapon practically invisible to active radar systems.

According to an article on *Military.com*, U.S. Aegis missile interceptor systems need between 8 and 10 seconds of reaction time in order to intercept an incoming missile. But, in those 8 to 10 seconds, the Zircon will have traveled over 12 miles (20 km), and the interceptor missiles can't fly fast enough to catch up with it.

Even more incredible is a statement made by Kremlin deputy premier Yury Borisov who said, "We have broken forward, specifically, in the sphere of hypersonic weapons and (those) based on *new physical principles*." Was Borisov implying that Zircon's incredible performance is due to new physics?

Does the U.S. have a response?

During the same week that Russia announced Zircon's successful launch from a submarine, we reported on an announcement from the U.S. Defense Advanced Research Projects Agency (DARPA) that it had successfully tested its Hypersonic Air-breathing Weapon Concept (HAWC), which is capable of achieving Mach 5, or 3,836 mph (6,173 km/h).

The missile was developed by Raytheon and Northrop Grumman, while Lockheed Martin is said to be developing a competing design. The design of the missile leverages past work done by Raytheon and Northrop Grumman on hypersonic aerospace vehicles, including the X-43A hypersonic test vehicle project during the 1990s.

During the 2000s, Boeing developed the hypersonic X-51 Waverider, which was flight-tested during the 2010s. Its fourth, and only fully successful test flight, took place on May 1, 2013 where it achieved Mach 5. Last month's test flight is the first time since 2013 that a U.S.-designed, air-launched, air-breathing missile has achieved speeds in excess of Mach 5.

According to *The Drive*, DARPA will end the HAWC program sometime during the Fiscal Year 2022, which started on October 1, 2021, and hypersonic development will move to the Air Force's Hypersonic Attack Cruise Missile (HACM) project.

Besides Russia, as we reported last month, North Korea recently announced that in September, it had successfully launched a new hypersonic missile, the fourth such missile launch in a month. That the U.S. is concerned about a possible hypersonic gap between it and other countries can be deduced from a report that accompanied the Senate Armed Services Committee's markup of a draft of the National Defense Authorization Act (NDAA), which was released last month. It included the phrase, "The committee is concerned that there is a lack of focus on air-launched and airbreathing hypersonic capability."

This may be one of the few times that the U.S. finds itself on the back foot when it comes to defense technology, and it will be interesting to see how it responds.

<https://interestingengineering.com/russias-zircon-hypersonic-missile-is-challenging-us-dominance>

डीआरडीओ यंग साइंटिस्ट पुरस्कार से नवाजा गया

रक्षा मन्त्री राजनाथ सिंह द्वारा मिला पुरस्कार

बाँसगांव: गोरखपुर। दिल्ली में आयोजित डीआरडीओ यंग साइंटिस्ट पुरस्कार रक्षा मन्त्री राजनाथ सिंह के द्वारा डॉ० अखण्ड राय पुत्र अशोक राय ग्राम डड़वा चतुर तहसील बांसगांव जिला गोरखपुर को मिला। डॉ० अखण्ड राय बचपन से ही मेधावी छात्र रहे हैं।

इन्होंने बीटेक और एमटेक, बीएचयू से तथा आईआईटी रुड़की से पीएचडी किये हैं। वर्तमान में अहमदाबाद विश्वविद्यालय में डॉ० अखण्ड राय बतौर प्रोफेसर के पद पर नियुक्त हैं। इनकी माता जी एक सफल गृहणी हैं। इनके पिता जी रेलवे सुरक्षा बल से सब इंस्पेक्टर के पद से रिटायर्ड हैं।

इन्होंने अपनी सफलता का श्रेय अपने माता-पिता तथा गुरुजनों को दिया कि जिनके आशीर्वाद और उनके सहयोग से और अपनी कड़ी मेहनत से इस सफलता के मुकाम को हासिल किया।

इनको रक्षा मन्त्री राजनाथ सिंह द्वारा पुरस्कृत होने पर लोगों ने कहा कि हमें ऐसे होनहार युवा पर गर्व है जिसने अपने क्षेत्र का नाम रोशन किया है। उमापति राय, अशोक राय, अजय राय, रणविजय राय, जिला पंचायत सदस्य अरविन्द राय बिट्टू एवं समस्त ग्रामवासियों ने इनकी सफलता पर बधाई दिया।

<https://swatantraprabhat.com/news/breaking-news/gorakhpurs-latest-top-breaking-news/cid5561412.htm>

India boosts its tech surveillance on China border

Army is deploying surveillance cameras, sensors, radars and drones

By Pradip R Sagar

Amid the ongoing impasse between India and China over the military standoff in eastern Ladakh, the Indian Army is enhancing its surveillance capabilities to keep a close eye on the People's Liberation Army (PLA) movements.

Besides setting up an aviation brigade, looking after the China border, the army is deploying its wide range of surveillance cameras, sensors, radars, motion detectors and drones. These assets are capable to check the movements not only on the border, but also deep inside the enemy territory.

India and China have been engaged in an 18-month long military standoff on the icy heights of eastern Ladakh and multiple rounds of military and diplomatic talks have failed to bring peace on the border.

In the last Corps Commander-level talk, which was the 13th in the series, went without any breakthrough after China accused India of making “unreasonable demands” in response to the army's constructive suggestions for resolving the dispute.

It means troops from both sides will have to spend harsh winters, where the temperature dips to minus 30 degrees, for the second successive year. India has deployed more than 60,000 troops on the eastern Ladakh to counter any aggression by the Chinese military.

The Chinese military has stationed its long-endurance unmanned aerial vehicles in the Tibet autonomous region to boost its intelligence, surveillance and reconnaissance, prompting the Indian side to step up their surveillance assets, too. Heron drones from Israel, electronic radars and air and ground-based sensors for real-time inputs of movements are being deployed by the army under its eastern command, which overlooks the Line of Actual Control (LAC) in Sikkim and Arunachal Pradesh.

The army maintains that it's not possible to monitor every inch of the LAC, as it would require massive deployment of troops. However, Artificial Intelligence (AI) and air and ground-based sensors will help the Army scan the LAC.

India is also in the process of procuring armed drones from the United States. With these drones, the military will be able to launch remote control operations like cross-border strikes or engage with targets on the borders. Besides, under Project Cheetah, the Indian Air Force (IAF) is finalising its plan to upgrade its existing fleet of Heron drones for offensive missions. As per the plan, the Medium Altitude Long Endurance Israeli Heron drones, which are in service with the IAF, Army, and Navy are being upgraded to be armed with laser-guided bombs, air to ground and air-launched anti-tank guided missiles. The IAF, which is the lead agency for the project, is expected to spend close to Rs 5,000 crore for the upgrades.



India and China have been engaged in border standoff for the past 18 months | PTI

India first got a UAV back in 1996 when the Army acquired an Israeli Searcher MKI. Indian military currently operates a fleet of Israel's UAVs along with indigenously built Nishant and Rustom drones for surveillance and intelligence gathering.

Since early 2020, the Chinese military has been carrying out massive infrastructure development work along the border in terms of airstrips, rail and road network to border towns like Nyngchi, accommodation and other activities for its soldiers. Interestingly, in the recent past, several Chinese top leaders, including President Xi Jinping, have visited Tibet and Xinjiang region. Moreover, commanders of the western theatre, responsible for the border with India, were also changed multiple times in the last one year.

<https://www.theweek.in/news/india/2021/10/19/india-boosts-its-tech-surveillance-on-china-border.html>

The Tribune

Wed, 20 Oct 2021

Challenges in India's bid to be military power

In the revamp, over 70,000 employees of the erstwhile OFB have been transferred to the seven new DPSUs and this is being hailed as a reform that will enable India to develop a modern military industry. If the OFB was originally inefficiency-riddled, it defies logic as to how the new entities (with the same HR) in their corporate avatar will become 'productive & profitable'

By C Uday Bhaskar

A long-delayed policy decision related to the revamping of India's moribund defence production capability was formally unveiled by PM Narendra Modi on October 15 by way of the inauguration of seven new defence public sector units (DPSUs). They have been culled from the venerable Ordnance Factory Board (OFB) that had 41 disparate units spread across the country. They have now been corporatised as seven new entities.

The OFB, which traces its origin to 1801 and the East India Company, is now a closed chapter and a part of Indian history.

In his address, PM Modi dwelt on the Atmanirbhar Bharat (self-reliant India) initiative that he has championed. He declared that the abiding goal was to make India a major military power through its own efforts.

Describing this revamp of the OFB as part of the "new resolutions to build a new future" as India entered its 75th year of Independence, he added that "many major reforms have happened in the defence sector" on his watch.

This resolve by the PM to turn India into a major military power ("Bharat ko apne dum par duniya ki badi sainya taakat banana hai") is welcome and unexceptionable.

It has a special resonance against the backdrop of October 20 and the 'surprise' attack by China on that day in 1962. At the time, PM Nehru and his higher defence management team were stunned and the ill-equipped Indian military was routed despite the gallantry and professionalism of the Army at the tactical level.

Almost six decades later, there is a sense of déjà vu. In the last year, the China challenge has morphed from the Galwan setback in Ladakh (June 2021) to the more recent incursions by the PLA in the central and eastern sectors of the disputed Line of Actual Control (LAC). The 13th round of Corps Commanders' talks (on October 10) failed to resolve the impasse and it is estimated that as many as 50,000 PLA troops will be strung across the uneasy LAC for an extended period.

Hence, this winter will be challenging for the Indian military. The Army Chief, General Manoj Naravane, has cautioned that "it is a matter of concern that the large-scale build-up has occurred



Lapses: The OFB has been unable to provide quality & cost-effective products to the Army. PTI

and continues to be in place; and to sustain that kind of a build-up, there has been an equal amount of infrastructure development on the Chinese side.” He added: “So, it means that they (China) are there to stay. We are keeping a close watch on all these developments, but if they are there to stay, we are there to stay too.”

On the politico-diplomatic front, tension increased with the Chinese Foreign Ministry issuing a terse statement protesting the visit of Vice-President Venkaiah Naidu to Arunachal Pradesh and asking India to “stop taking actions that would complicate and expand the boundary issue.”

Delhi was quick in ‘rejecting’ it with a rejoinder that “Arunachal Pradesh is an integral and inalienable part of India.”

The more grave development is the preliminary agreement arrived at between China and Bhutan (October 14) to resolve their long-pending boundary dispute and what is of considerable import is that Delhi was totally out of the loop apropos this bilateral meeting.

The enormity of this development is multi-layered for India. Not only is this a diplomatic setback for Delhi which traditionally guided Bhutan’s foreign policy but it also points to the Chinese footprint being extended in the Indian periphery with a country considered to be India’s closest and most special neighbour.

It would be premature to suggest that Bhutan will go down the Sri Lanka-Nepal path in the consolidation of the Chinese presence, but the Doklam tri-junction has a critical locus for India by way of the proximity to the slender ‘chicken’s neck’ corridor that connects the Indian heartland to the North-East.

While there is little doubt that the India of 2021 is not that of 1962 and is now a nuclear weapon power, the correspondence lies in the refusal by Delhi to objectively review its composite military index and the attendant implications in relation to managing the troubled bilateral relationship with China.

The amber lights were flickering in March 2018 when the report of the Parliamentary Standing Committee on Defence observed that the prevailing fund allocation “is not supportive to the inevitable needs of the Army” and added that there are “huge deficiencies and obsolescence of weapons, stores and ammunition existing in the Indian Army.” The report further said that almost two-third of the equipment inventory of the Army was deemed to be “vintage”.

Much the same applies to the Indian Air Force and the depletion in combat air power is stark.

While the pressure on the national exchequer due to Covid is understandable and belt-tightening in the budgetary allocation is inevitable, the reality check about the military modernisation blueprint is distressing.

The Defence Budget of 2021 saw capital allocation slashed by more than Rs 76,000 crore and the OFB revamp is illustrative about taking recourse to misleading rhetoric.

The PM’s exhortation to make India a major military power on the back of its own effort is laudable and the corporatisation of the OFB is being held up as an example of this resolve. The OFB’s track record in providing high quality products in a cost-effective and timely manner to the Army has been well below par and these lapses have been highlighted in many CAG reports.

In the so-called revamp, over 70,000 employees of the erstwhile OFB have been transferred to the seven new DPSUs, including their senior leadership, and this is being hailed as a major reform that will enable India to develop a modern military industry. If the OFB was riddled with inefficiency and corruption in its original identity, it defies logic as to how the seven new entities (with the same HR) in their corporate avatar will become “productive and profitable assets”, as envisioned by Defence Minister Rajnath Singh.

The OFB’s inability to design and produce high-quality personal weapons for the Indian soldiers is a grim reminder of the daunting R&D challenges that India faces as it strives to become a reasonably self-reliant military power. Resorting to make-believe in matters of national security can have disastrous consequences, as October 1962 demonstrated.

<https://www.tribuneindia.com/news/comment/challenges-in-indias-bid-to-be-military-power-326767>

Explained: How hypersonic missiles work and who leads the race

Seoul: China reportedly tested a nuclear-capable hypersonic glide vehicle from an near-orbital trajectory in August, amid an intensifying race for the next generation of long-range weapons that are harder to detect and intercept.

The United States and Russia have conducted tests of hypersonic weapons in recent months, and North Korea said last month it had tested a newly developed hypersonic missile.

How hypersonic missile works

Hypersonic missiles travel at more than five times the speed of sound in the upper atmosphere - or about 6,200 km per hour (3,850 mph). This is slower than an intercontinental ballistic missile, but the shape of a hypersonic glide vehicle allows it to manoeuvre toward a target or away from defences. Combining a glide vehicle with a missile that can launch it partially into orbit - a so-called fractional orbital bombardment system (FOBS) - could strip adversaries of reaction time and traditional defences mechanisms.

Intercontinental ballistic missiles (ICBMs), by contrast, carry nuclear warheads on ballistic trajectories that travel into space but never reach orbit.

Both the US and USSR studied FOBS during the Cold War, and the USSR deployed such a system starting in the 1970s. It was removed from service by the mid-80s. Submarine-launched ballistic missiles had many of the advantages of FOBS - reducing detection times and making it impossible to know where a strike would come from - and were seen as less destabilising than FOBS.

Who leads the race

The Financial Times reported on Saturday that China had launched a rocket carrying a hypersonic glide vehicle that flew through space, circling the globe before cruising down toward its target, which it missed by about two dozen miles. In July, Russia successfully tested a Tsirkon (Zircon) hypersonic cruise missile, which President Vladimir Putin touted as part of a new generation of missile systems. Moscow also tested the weapon from a submarine for the first time.

The United States said in late September that it had tested an air-breathing hypersonic weapon - meaning it sustain flight on its own through the atmosphere like a cruise missile - marking the first successful test of that class of weapon since 2013.

Days after the US announcement, North Korea fired a newly developed hypersonic missile, calling it a "strategic weapon" that boosted its defence capabilities, though some South Korean analysts described the test as a failure.

Why it matters

The recent tests are the moves in a dangerous arms race in which smaller Asian nations are striving to develop advanced long-range missiles, alongside major military powers.

Hypersonic weapons, and FOBS, could be a concern as they can potentially evade missile shields and early warning systems. Some experts cautioned against hype surrounding missiles such as the one China tested in August.

"China already has ~100 nuclear-armed ICBMs that can strike the US," said Jeffrey Lewis, a missile specialist at the US-based James Martin Center for Nonproliferation Studies, responding to the FT report on Twitter. "Although the glider is a nice touch ... this is an old concept that is newly relevant as a way to defeat missile defences."

<https://timesofindia.indiatimes.com/home/science/explained-how-hypersonic-missiles-work-and-who-leads-the-race/articleshow/87132762.cms>

Why ISRO may be prioritizing Gaganyaan mission over Chandrayaan 3

The COVID-19 pandemic had disrupted the delivery schedules of the Gaganyaan mission

By Abhinav Singh

As the work on Chandrayaan 3 mission continues across ISRO (Indian Space Research Organisation) centres, there have been reports that ISRO may prioritize Gaganyaan over the Chandrayaan-3 mission. Though when contacted by THE WEEK there was no response from the ISRO PR team on any latest update for the Chandrayaan-3 mission, experts and sources have pointed out that due to the huge scale of the Gaganyaan mission there is a possibility of giving priority for the uncrewed Gaganyaan mission at the earliest. THE WEEK in an earlier report in July 2021 had mentioned that ISRO was carrying out an internal assessment of the Gaganyaan mission as to whether the mission can take off as per its schedule in December 2021. The lockdowns due to the two waves of the Covid-19 pandemic had disrupted the delivery schedules of the Gaganyaan mission.



ISRO successfully conducted the first hot test of the System Demonstration Model (SDM) of the Gaganyaan Service Module Propulsion System at the test facility of ISRO Propulsion Complex (IPRC) | ISRO Twitter

“ISRO may be strongly focusing on its efforts centrally to make Gaganyaan a success since there are a lot of new technologies and safety protocols needed for the mission to be successful. On the other

hand, ISRO may be performing further tests on the propulsion systems for safe lunar surface insertion based on the learnings of Chandrayaan 2 for the Chandrayaan-3 mission,” remarked Narayan Prasad, the Chief Operations Officer, Satsearch.

As per regular updates from ISRO, it seems that the Gaganyaan mission is a priority. ISRO had been updating on regular successful tests for the Gaganyaan mission at regular intervals but not much on the Chandrayaan-3 mission. It includes successfully conducting the third hot test of the Vikas engine at the engine test facility of ISRO Propulsion Complex, at Mahendragiri in Tamil Nadu. The third successful test of the Vikas engine assumed immense significance as the success of the tests were necessary to ensure both the safety and the reliability of the engine for the special and specific requirements of the Gaganyaan mission.

ISRO had also successfully conducted the first hot test of the System Demonstration Model (SDM) of the Gaganyaan Service Module Propulsion System for a duration of 450 s at their test facility the Propulsion Complex (IPRC), Mahendragiri, Tamil Nadu. The system performance met the test objectives and there was a close match with the pre-test predictions. Further, a series of hot tests had been planned to simulate various mission conditions as well as off-nominal conditions. The Service Module is part of the Gaganyaan Orbital module and is located below the crew module and remains connected to it until re-entry.

“We got very close to being one of the few countries to successfully land on the moon with Chandrayaan-2. With the lessons learnt, Chandrayaan-3 will have a significantly higher chance of sticking that landing and putting India on the global map again. Delays are a part of the space

industry and especially with Covid-19 wreaking havoc with the schedules, what ISRO has managed to keep going is commendable,” observed Awais Ahmed, the Founder and CEO of Pixxel.

This expert further explains that Chandrayaan-3 will carry a lander and rover which is expected to explore the lunar surface. “It will not carry an orbiter since the orbiter was already demonstrated with Chandrayaan 2. The instruments will help us understand the composition of the surface and whether there is ice or water that can be used for settlements on the moon down the line,” added Ahmed.

Experts have pointed out that modifications are already underway when compared to the Chandrayaan-2 mission. “Chandrayaan-3 is likely to see changes in terms of tweaking of software and algorithm when compared to the Chandrayaan-2 mission. The most important aspect is Chandrayaan-3's objective of soft landing on the moon in which Chandrayaan-2 failed. A perfect soft landing for the Chandrayaan-3 mission is likely to demonstrate ISRO's capability of future landing capabilities of other missions. If successful the Chandrayaan-3 mission will demonstrate a soft landing on the southern hemisphere of the moon. Post a successful soft landing the mission is likely to provide significant information on the moon's surface and also evidence of any possible life on the moon,” Girish Linganna, a space expert and Managing Director of ADD Engineering India an Indo-German Company told THE WEEK.

In an exclusive interview with THE WEEK earlier this year the ISRO chairman K Sivan had mentioned that in Chandrayaan-2, that there was an orbiter, a lander, and a rover inside the lander. Since the Chandrayaan-2 orbiter is already functioning, Chandrayaan-3 will not have an orbiter. There is a propulsion system to take the Chandrayaan-3 lander and the rover to the moon. The Chandrayaan-2 orbiter will be utilised for all the orbiter functions of Chandrayaan-3. Data generated from the Chandrayaan-2 orbiter had been going on and ISRO had published the Chandrayaan-2 phase 1 data from the orbiter for public use, for scientific purposes.

<https://www.theweek.in/news/india/2021/10/19/why-isro-may-be-prioritizing-gaganyaan-mission-over-chandrayaan-3.html>



Wed, 20 Oct 2021

A path-setting method to enable vast applications for a graphene

Super strong and only one atom thick, graphene holds promise as a nanomaterial for everything from microelectronics to clean energy storage. But lack of one property has limited its use. Now, researchers at Princeton University and the U.S. Department of Energy's (DOE) Princeton Plasma Physics Laboratory (PPPL) have overcome that problem using low-temperature plasma, creating a novel technique that opens the door to a vast array of industrial and scientific applications for the promising nanomaterial.

Stronger than steel

Graphene, which is harder than diamonds and stronger than steel, could be a foundation for next-generation technologies. But the absence of a property called a band gap in the pencil-lead graphite that composes graphene restricts its ability to function as a semiconductor, the material at the heart of microelectronic devices. Semiconductors both insulate and conduct electric current, but while graphene is an excellent conductor it cannot serve as an insulator without a band gap.



Physicist Fang Zhao with figures from her paper. Credit: Fang Zhao

"People use silicon that has a band gap for semiconductors," said Fang Zhao, lead author of a paper in the journal *Carbon* that describes the new process. "Opening a sizable band gap on graphene has given rise to intense studies for semiconductor use," said Zhao, a physicist at the Fermi National Accelerator Laboratory (Fermilab) who wrote the paper while a Princeton post-doctoral researcher.

The dilemma has led scientists throughout the world to explore ways to produce a band gap in graphene to expand its potential applications. One popular method has been to chemically modify the surface of graphene with hydrogen, a process called "hydrogenation." But the conventional way of doing this produces irreversible etching and sputtering that can seriously damage the surface of graphene—known as a 2D material because of its ultrathin nature—within seconds or minutes.

Scientists at Princeton and PPPL have now shown that a novel method for hydrogenating graphene can safely open the door to wide-ranging microelectronic applications. The method marks a new way to produce hydrogen plasma that substantially broadens hydrogen coverage in the 2D material. "This process creates much longer hydrogen treatments because of its low graphene damage," Zhao said.

Plasma, the hot, charged state of matter composed of free electrons and atomic nuclei, makes up 99 percent of the visible universe. The low-temperature hydrogen plasma that PPPL has developed to hydrogenate graphene contrasts with the million-degree fusion plasmas that have long been the hallmark of PPPL research, which aims to develop safe, clean, and abundant fusion energy for generating electricity.

Spinoff from Ptolemy

The new method spins off from an experiment called Ptolemy, a University project that Princeton physicist Chris Tully has been developing with assistance from Zhao. That project uses the decay of tritium, the radioactive isotope of hydrogen, in the effort to capture relic neutrinos that emerged just seconds after the Big Bang that created the universe. Such relics could shed new light on the Big Bang, according to the Ptolemy project.

To improve the detection rate of the decay, Tully turned to PPPL physicist Yevgeny Raitses, who heads low-temperature plasma research at PPPL. "The readiness of PPPL to join forces and to bring about transformational 2D material properties is inspiring," Tully said. "Breaking the world-record in graphene hydrogenation yield is a tribute to the unique capabilities of PPPL."

Raitses and colleagues developed a method for expanding the coverage of hydrogen in the graphene that houses the tritium decay. The process greatly increases future applications of graphene. "This spinoff from Ptolemy can now be used for microelectronics, QIS [quantum information science] and other applications," Raitses said. "The method can also be applied to other 2D materials."

The spinoff combines electric and magnetic fields to produce a hydrogen plasma that delivers plentiful hydrogen with low damage to the graphene. This gentle and well-controlled method is itself a spinoff from research that Raitses developed while studying Hall thrusters, plasma-based engines of spacecraft propulsion. The technique has hydrogenated graphene for up to 30 minutes in PPPL experiments, greatly increasing the hydrogen coverage and opening a band gap that turns graphene into semiconductor material.

All this, says the *Carbon* paper, creates an attractive method for making 2D materials "exciting and up-and-coming [sources] for vast applications."

Also collaborating on this paper were Princeton physicists Chris Tully and Andi Tan, together with chemist Xiaofang Yang of the Princeton Department of Chemical and Biological Engineering. Support for this work comes from the DOE Office of Science (FES) and the Air Force Office of Scientific Research.

More information: Fang Zhao et al, High hydrogen coverage on graphene via low temperature plasma with applied magnetic field, *Carbon* (2021). [DOI: 10.1016/j.carbon.2021.02.084](https://doi.org/10.1016/j.carbon.2021.02.084)

Journal information: *Carbon*

<https://phys.org/news/2021-10-path-setting-method-enable-vast-applications.html>

Frequency translating add/drop filters designed for on-chip light manipulation

Researchers report the development of frequency translating add/drop filters based on electro-optically modulated photonic molecules. The new class of filters could open important new avenues for on-chip light manipulation.

Hayk Gevorgyan from Boston University, U.S. will present the research at the Frontiers in Optics + Laser Science Conference (FiO LS) all-virtual meeting, 01-04 November 2021.

Add/drop filters are used to add and/or drop an individual light channel without disturbing other channels. These filters are commonly used in optical data communication, but are also important for quantum information processing, optical neural networks and other applications. Being an example of linear time-invariant systems, they drop or add a light channel but never change its wavelength. A key attribute of the new filters is their added ability to shift the frequency of the light signals that are dropped or added.

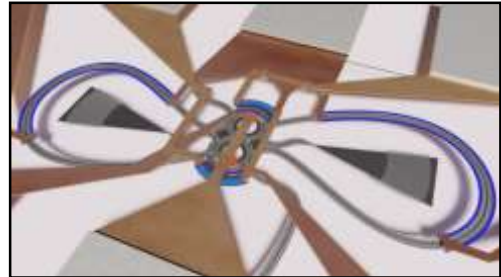
"This is a fundamentally new building block in the toolbox of optical chip designers," said Gevorgyan. "Because we have implemented it in a silicon chip foundry process, it can be used by others to build new more complex systems on chip. This new frequency shifting filter concept may allow easier manipulation of wavelength channels on chip to manage congestion of wavelengths in data communication. But it could also enable a new type of beam splitter for quantum computing using photons."

The new filters build on previous work in which the researchers created frequency translating filters that combined microring modulators and linear filters in a device that produces a shifted drop-port response passband. This design included two actively coupled microring resonators and one bus waveguide. Although the through and drop ports were frequency shifted from each other, they shared the same physical waveguide port, which, for some applications, would require linear filtering to separate the signals spatially.

In the new work, the researchers created a second-order frequency translating add/drop filter with frequency ports that map to distinct waveguide ports. The device uses two coupled microring resonators with built-in electro-optic phase shifters and two waveguides that are coupled to both rings. All four connections feature equal coupling strengths.

To test the new device, the researchers first measured passive optical transmission between the different ports with no electrical signal applied. They then measured the frequency translating response, finding that the device exhibited filter passbands that shifted from their respective frequencies. The cross talk between channels stayed below 40 dB thanks to careful tuning of phase delays in the waveguides using thermo-optic phase shifters.

Gevorgyan adds, "While these first results are encouraging, the insertion loss is somewhat high; the lowest loss demonstrated to date is 13 dB. As with the regular filters, the frequency translating filters should have an insertion loss below 5 dB to find any practical application in data communication. This can be achieved by optimizing the efficiency, speed and propagation loss of p-n junction phase shifters used in the device. For quantum applications, the requirements would be even more stringent, targeting insertion loss below 0.5 dB. Because of inherent loss of the



Three-dimensional rendering of the frequency translating add/drop filter showing two coupled active microring resonators, interferometric input/output waveguides, metal wires connected to electro-optic and thermo-optic phase shifters, and vertical grating couplers. Credit: Hayk Gevorgyan, Boston University

carrier plasma dispersion effect, we believe such efficiencies cannot be achieved using p-n diode phase shifters. However, implementation in material platforms such as lithium niobate, barium titanate or silicon-organic hybrid may make such applications possible as well."

More information: Gevorgyan's presentation is scheduled for Tuesday, 02 November at 16:30 EDT (UTC – 04:00).

<https://phys.org/news/2021-10-frequency-adddrop-filters-on-chip.html>



Wed, 20 Oct 2021

Efficient light with the help of mathematics

How do you make sure that light gets to the right place without loss of energy? To do that, lamps often use mirrors and lenses. But how do you adjust them properly to get the correct light output? Lotte Romijn investigated how to get light from a to b as efficiently as possible with the help of a mathematical algorithm, for very complicated target light outputs. She will obtain her doctorate on 19 October from the Faculty of Mathematics and Computer Science.



Credit: CC0 Public Domain

Imagine: you're driving down the road in the dark. But just as you're whizzing through the corner, an oncoming car blinds you as it passes. Everyone knows how irritating it is to see stars when the light is shining right in your eyes. At such a moment the light of the headlights does not end up on the road, but in the middle of your face and that is quite inconvenient. TU/e researcher Lotte Romijn investigated how you can get light from point a to point b in an efficient manner with the help of fundamental mathematics.

Complicated lamps

Lamps have taken on increasingly complicated shapes in recent years. The TU/e researcher knows that better than anyone. Lotte Romijn grew up in Eindhoven, the city of lights. Her grandfather worked for Philips. "It is therefore extra special to be doing a PhD on this subject," says the researcher. Her research immediately shows that the simple incandescent lamp from her grandfather's time is a thing of the past. "More and more LED lighting has been added. And with it, optical components in lamps such as reflectors and lenses can have more complicated shapes. Because LEDs do not require high temperatures, you can use plastic in all sorts of shapes," says Lotte Romijn. It provides a range of lighting possibilities. On the street: for street lighting or in the car. In the theater, at home and in satellites. But all that light in those lamps with a freer shape has to go from point a to point b efficiently, without losing energy.

Different lighting applications

The TU/e researcher used fundamental mathematics to figure out exactly how to do that. She used an existing algorithm for this, but adapted it to be able to test many different shapes and light sources as possible. "So that you can use the algorithm more generically. Then you don't have to come up with a new algorithm for each separate lamp shape. By making the algorithm easier to use with different types of lighting applications."

Streetlights with a different peanut shape and headlights that shine only on the road instead of your face or your oncoming vehicle are thus easier to make. "Hopefully my research will make it easier to produce these kinds of lights with a distinct shape in the future."

The research was published in *SIAM Journal on Scientific Computing*.

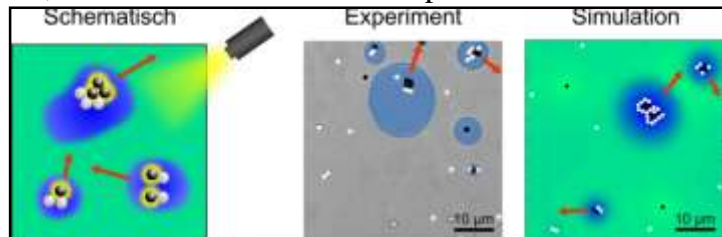
More information: L. B. Romijn et al, An Iterative Least-Squares Method for Generated Jacobian Equations in Freeform Optical Design, *SIAM Journal on Scientific Computing* (2021). [DOI: 10.1137/20M1338940](https://doi.org/10.1137/20M1338940)

<https://phys.org/news/2021-10-efficient-mathematics.html>

Motorized droplets thanks to feedback effects

A team of physicists from Germany and Sweden working with first author Jens Christian Grauer from Heinrich Heine University Düsseldorf (HHU) has examined a special system of colloidal particles that they activated using laser light. The researchers discovered that self-propelling droplets, which they have named 'droploids', formed which contain the particles as an internal motor. They describe these droploids in more detail in the latest edition of the journal *Nature Communications*.

According to an age-old saying, the whole is often more than the sum of its parts. After all, a sandwich made of bread, lettuce and mayonnaise tastes better than its individual components. A team of physicists from HHU, TU Darmstadt and Sweden's University of Gothenburg has determined that this adage is also true in the realm of physics, and that combining individual parts can create something with entirely new properties.



1Formation of 'droploids' (blue droplets) under laser illumination. The droploids contain both hot (black) and cold (white) colloid particles and can self-propel along the red arrow in a motorised manner. Credit: HHU / Jens Grauer (left and right); University of Gothenburg / Falko Schmidt (centre)

The research project involved combining different atoms and larger particles and studying the effects they have on each other. It is ultimately a typical example of what the matter that surrounds us is composed of. The researchers extended this general principle of combination to include additional feedback processes, thus creating new kinds of dynamic structures referred to as 'positive feedback loops'.

Specifically, they combined two different types of colloid particles—in a water-lutidine heat bath. They irradiated the bath with lasers, and the light from the lasers brought the liquid near the particles to the critical point. The fluctuations are particularly strong at this point, allowing droplet-like structures to form that in turn surround the particles.

Inside the droplets, the two types of colloid particles heat up to different temperatures. This results in effective forces that contradict Newton's fundamental law of motion ($actio = reactio$) to propel the droplets forwards. This means that the colloid particles induce the formation of droplets that encapsulate the colloids and are in turn propelled by the particles. This feedback loop results in novel superstructures with a self-organized colloidal motor. The researchers adopted the term 'droploids', a portmanteau of the words 'droplets' and 'colloids', to describe these superstructures.

The research team combined theoretical and experimental approaches, with the system modeling performed in Düsseldorf and Darmstadt, while the colleagues in Gothenburg verified the findings using real-life experiments, thus confirming the theoretical models.

Prof. Dr. Hartmut Löwen, Head of the Institute of Theoretical Physics II at HHU, says that "it's important here that the process can be controlled entirely by laser illumination. This makes it possible to steer the system externally so that it is flexible for different applications."

Prof. Dr. Benno Liebchen, leader of the "Theory of Soft Matter" working group at TU Darmstadt, explained the actual use of the droploids: "Besides justifying a novel concept for micromotors, the droploids and the non-reciprocal interactions involved could serve as important ingredients for generating future biomimetic materials."

More information: Jens Grauer et al, Active droploids, *Nature Communications* (2021). [DOI: 10.1038/S41467-021-26319-3](https://doi.org/10.1038/S41467-021-26319-3)

Journal information: [Nature Communications](https://www.nature.com)
<https://phys.org/news/2021-10-motorized-droplets-feedback-effects.html>

Delta variant ups herd immunity threshold, 80%+ need antibodies: Study

Herd immunity is reached by highly effective vaccines that can stop transmission, but it has been complicated in the case of the coronavirus Sars-Cov-2 due to mutations and waning immunity

By Anonna Dutt

The Delta variant has meant that close to 80-90% of the population needs to be vaccinated or have had a previous infection (and thus antibodies) in order for a protective wall of population immunity to be strong enough to slow down the virus, researchers from two premier Delhi institute have said, citing serosurveillance data from before the April-May wave of infections in Delhi and the outbreak that happened despite it.

Herd immunity is reached by highly effective vaccines that can stop transmission, but it has been complicated in the case of the coronavirus Sars-Cov-2 due to mutations and waning immunity. The mutations in the Delta variant made it significantly more transmissible -- by some estimates, more than twice when compared to the virus that was first found in Wuhan.

With that virus, which was estimated to have a basic reproduction number (the number of people the virus can spread to on average, also known as R-nought or R0) was between 2 and 3, and the herd immunity threshold was considered by 60-70%. Now, according to a pre-print study by researchers from Maulana Azad Medical College, Institute of Liver and Biliary Sciences, and the Delhi government health department, this threshold may be 80-90%.

The research refers to Delhi's January round of sero-surveillance to show that despite 56.13% people testing positive for antibodies, there was a massive wave of Covid-19 with over 28,000 cases reported in a single day at its peak in late April.

"The antibody seroprevalence in January showed a more than two-times increase, coinciding with a rapid decline in the test positivity rate and the daily new incident cases suggestive of high population-level immunity. The high seroprevalence through natural infection was insufficient to achieve herd immunity and avert the second wave of the pandemic in Delhi," the study says.

There is another instance when herd immunity can collapse -- that is when the mutation makes the virus more resistant to immunity from an infection with an older variant. A surge in cases despite high sero-positivity was previously reported from Manaus in Brazil, where the Gamma variant (P.1) that can significantly evade immune was identified.

"Rapid Covid-19 vaccination with the highest possible coverage remains the most feasible means of combating and ending the Covid-19 pandemic," even though a previous infection provides higher and longer term immunity," according to the paper.

The researchers also suggest that serial sero-surveys be continued to monitor the waning population levels of antibodies. Genetic sequencing is also needed to keep an eye out for variants that may be more effective in evading immunity, according to the study.

Dr Nandini Sharma, first author of the study and professor of community medicine at Maulana Azad Medical College, said, "In the study we assumed the R0 of the virus to be 2 and showed that



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to prevent a huge surge in infections, hospitalisations, and deaths we need 80 to 90% of the population to be sero-positive either through infection or vaccination. The data is from January when we did not anticipate a second wave due to delta whose R0 is much more.”

She said, “Now, we are unlikely to have an outbreak of delta. But the cases might go up if a new variant emerges that is more infectious and can evade the immunity.”

There is a need to continue following Covid-19 appropriate behaviour and preventing large gatherings for the time being, she said.

Dr Ekta Gupta, professor of virology at the Institute of Liver and Biliary Sciences said, “The number of cases have gone down in Delhi because of the high levels of exposure in April and May along with a good pace of vaccination. This, despite people not following Covid-19 appropriate behaviour – this is clear from the fact that we are seeing other respiratory diseases like flu in Delhi again, which had reduced because of masking.”

<https://www.hindustantimes.com/cities/delhi-news/delta-variant-ups-herd-immunity-threshold-80-need-antibodies-study-101634666874547.html>

