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CONTENT

DRDO News

DRDO Technology News

BHARAT SHAKTI
Self-Reliance in Defence

Fri, 28 Aug 2020

DRDO-Industry collaboration: Leveraging military manufacturing eco-system to next level

By Ravi Shankar

The Defence Research and Development Organisation (DRDO) is ushering into a new phase of reforms aimed at developing futuristic military weapons and supporting the government's initiative to boost domestic defence manufacturing. A high-level committee has been appointed to suggest measures and chart out a roadmap to redefine the charter of the DRDO laboratories on the issues of current and futuristic technologies.

The recommendations will overhaul India's premier defence research establishment DRDO that has a network of over 50 labs across the country engaged in developing defence technologies from nuclear armaments to fighter jets and UAVs, data analytics, laser technology, combat vehicles, engineering systems, missiles, advanced computing and naval systems.

The Committee headed by Prof V Ramagopal Rao, Director of Delhi IIT, and includes Director ISRO S Somnath, Deputy Chief of Air Staff Air Marshal Sandeep Singh and two representatives from within the DRDO.

The Ministry of Defence (MoD) has already outlined its broad roadmap to make India a hub of defence manufacturing and has been taking policy initiatives to promote the domestic industry. On 9th August, Defence Minister Rajnath Singh had announced that India would stop the import of 101 weapons and military platforms like transport aircraft, light combat helicopters, conventional submarines, cruise missiles and sonar systems by 2024.

In response to the government's decision, the DRDO on 24th August identified 108 military systems and subsystems like navigation radars, tank transporters and missile canisters for design and development by the Indian industry only. This initiative was in sync with building an '*AtmaNirbhar Bharat*' in defence manufacturing. The premier organisation said it would provide support to industries for design, development and testing of these systems.

India is one of the largest importers of arms globally. According to estimates, the Indian armed forces projected to spend around $130 billion in capital procurement in the next five years. The government now wants to reduce dependence on imported military platforms and has decided to support the domestic defence manufacturing. The MoD has set a turnover goal of $25 billion (Rs 1.75 lakh crore) in defence manufacturing in the next five years that includes an export target of $5 billion (Rs 35,000 crore) worth of military hardware.

DRDO Support to Indian Industry

Over the years, DRDO has substantially enhanced the technological capabilities of Indian industry through various policy initiatives, sustained engagements and sustained technology transfers. DRDO is taking these efforts to the next level to transform India into a hub of advanced defence technologies, developing state of the art defence equipment and systems.

Government policies, especially concerning 'Make in India', 'Start-up India', 'Stand up India', 'Skill India' and 'Atmanirbhar Bharat' have provided many new opportunities. These are being leveraged to develop defence R&D and manufacturing eco-system in the country.

Details of the major policy initiatives/SOPs/Guidelines of DRDO are listed here for the benefit of the Indian industry to collaborate with the premier agency:

1. **Transfer of Technology (ToT):** DRDO provides the relevant 'know-how' in the form of Technology Transfer Document (TTD) and handholding support to Indian industry. Technology is transferred to Development cum Production Partner (DcPP)/Development Partner (DP)/Production Agency (PA) without any ToT fee and to other industries with a one-time ToT fee at 5 per cent of total project sanction cost. Royalty is not charged on net sales to Indian Armed Forces and other government departments. 2 per cent royalty is applicable for sales in the Indian commercial market and exports. More details are available at website https://drdo.gov.in/transfer-technologies.
2. **Technology Development Fund (TDF):** A corpus fund of Rs. 100 crore earmarked to enable Indian industries, especially MSMEs, for indigenisation of defence products, subsystems and components. The fund could also be utilised for developing new technologies as required by DRDO, Services and DPSUs. The cost of each project under TDF can be up to Rs 10 crore. The industry can get funding up to 90 per cent of the project cost. Details are available at website https://tdf.drdo.gov.in.
3. **DRDO Patents for Indian Industry:** All patents and relevant intellectual publications are available on the DRDO website. Indian industry can use free of cost. Details are available at website https://drdo.gov.in/ipr. For any further support, Director ER&IPR, DRDO HQ may be approached for working out the modalities.
4. **Development and Production Partner:** DRDO engages industry as Development cum Production Partner (DcPP)/Development Partners (DP)/ Production Agency (PA) during the execution of its projects and programmes. The selection of industries is carried out based on procurement rules and procedures. For more details Industry may approach website https://drdo.gov.in/headquarter-directorates/finance-and-materials-management.
5. **Testing Support:** DRDO supports Indian industry during their technology and products development by extending Test Facilities (https://www.drdo.gov.in/test-facilities) and Proof & Field Firing Ranges (http://www.makeinindiadefence.gov.in). It assures the development of high-quality defence products.
6. **Evaluation and Certification Support:** The following certification services are provided by DRDO to industry:
7. CEMILAC provides the certification support to industry for military airworthiness. CEMILAC may be contacted at https://drdo.gov.in/labs-and-establishments/centre-military-airworthiness-certification-cemilac.
8. SAG, Delhi provides testing and certification support for IT and crypto products developed by industries on request of Services. SAG may be contacted at https://drdo.gov.in/labs-and-establishments/scientific-analysis-group-sag.
9. **Export Support:** A Standard Operating Procedure (SOP) promulgated to assist Indian Industry to export products developed with DRDO support. An export compendium, comprising of DRDO products having the potential of export, has also been prepared along with details of manufacturing industries. The industry may obtain details from the website https://drdo.gov.in/transfer-technologies.
10. **Technological and Scientific Support:** Technological and scientific support will be provided to industry by DRDO on a need basis. The interested industry may contact DRDO at https://drdo.gov.in/headquarter-directorates/contact-us/industry-interface-technology-management.

DRDO Test Facilities for Indian Industry

DRDO is developing critical defence technologies and systems to cater to the need of Indian Armed Forces and other security agencies. The laboratories of DRDO have state-of-art infrastructure including 'Test Facilities'. DRDO enables the Indian industry (Private/Govt/DPSUs/PSUs) engaged in defence manufacturing (including under 'Make in India' initiative) to utilise these test facilities in the development of systems and products for Indian Armed Forces.

'Proof & Field Firing Ranges' and 'Test Facilities' of DRDO will be available to Indian industries for the purpose of testing.

The access to 'Test Facilities' and 'Proof & Field Firing Ranges' will be provided to Indian industries as per the SOP/guidelines of DRDO Labs (*https://www.drdo.gov.in/test-facilities)* and the SOP of Department of Defence Production (*https://www.makeinindiadefence.gov.in)* respectively.

List of Test Facilities

The list of test facilities and corresponding DRDO labs are available on the website *https://www.drdo.gov.in/test-facilities*. Industries may approach the concerned lab Director for utilising the same.

Central Agency

Directorate of Industry Interface and Technology Management (DIITM), HQ DRDO will be the central agency at corporate level for industry interface. Industries may approach Director, DIITM for clarification and support, if any.

Registration of Industries for use of Test Facilities

Test facilities are extended to the registered industries only. Those not registered with DRDO may register with the concerned laboratory for the purpose of testing only. Testing support will be given only to developers and manufacturers of indigenous products. DRDO reserves the right of providing test facilities. Verification will be carried out by the concerned DRDO laboratory if required.

Procedures for availing test facilities

Indian industries desirous of utilising the test facilities are required to approach the concerned DRDO laboratory, which will examine the requirement to ascertain whether the test can be undertaken. The tests will be carried out under the supervision of DRDO personnel only. However, industry representatives may witness the tests, however, the results provided by DRDO are final.

https://bharatshakti.in/drdo-industry-collaboration-leveraging-military-manufacturing-eco-system-to-next-level/

onmanorama

Fri, 28 Aug 2020

Gaganyaan Unplugged-5: Tasty space food warming up at DFRL Mysuru for India's manned mission

By Anantha Krishnan M

Bengaluru: 70-member team consisting of scientists and technical officers from the Mysuru-based Defence Food Research Laboratory (DFRL) is locked on to dish out tasty and nutritious-meals-cum-solutions for India's big ticket Human Space Programme — Gaganyaan.

The ready-to-eat (RTE) space food is expected by March 2021. It will undergo trials during the two unmanned missions being planned by Indian Space Research Organisation (ISRO) ahead of the final Gaganyaan manned flight.

Sources in the Defence Research and Development Organisation (DRDO) told Onmanorama the scientists developing space food are mostly in the age group of 40-45 years, with expertise in food technology, microbiology and biotechnology.

Among the technologies that are being developed by DFRL for Gaganyaan mission include waste disposal system (leftover food), liquid dispensing system, food rehydrating system and food heater, to name a few.

Currently, the plan is to make space food sufficient for seven days. The exact days of Gaganyaan mission and the number of astronauts likely on board are not known yet.

DRDO sources said that DFRL, headed by Dr Anil Dutt Semwal, began the work for Gaganyaan mission in September 2019 after signing a memorandum of understanding (MoU) with ISRO.

"The lab has been constantly getting inputs from ISRO on the standards to be maintained while developing space food. ISRO on its part has been consulting India's first and only astronaut Wg Cdr Rakesh Sharma (Retd) for his guidance on several aspects of the manned flight," a DRDO official said.

Interestingly, DFRL initially got the exposure to develop space food in 1984 during Rakesh Sharma's mission. It had then provided RTE mango bar and freeze dried (ready to reconstitute)

pineapple/ mango juice powders. Suitable for space missions, these RTE products always stayed near to fresh, light-weight and would rehydrate instantly.

Challenges Galore

There are several challenges in developing space food meeting very stringent quality standards. The scientists will have to ensure nutritional adequacy that meets macro and micronutrient requirements while developing food meant for space missions.

“The task becomes tougher while meeting quality criteria such as light weight, low volume, quick preparation, easy to consume, low fragmentation, high acceptability, wholesomeness, stability, variety, gastro-intestinal compatibility, minimum residue and appropriate packaging,” says a DRDO official overseeing DFRL’s missions.

The design of suitable liquid delivery systems, reconstitution and rehydration of systems, food heater and food waste restraining bags are all tasks embedded with greater challenges.

“The scientists have been instructed to ensure space worthiness of these products while constantly keeping in mind the physiological changes in astronauts under microgravity conditions,” confirms an official, who is part of this national mission.

While refusing to share any information about the number of products that have been already developed and ground-tested for Gaganyaan mission, the official said: “Development and testing is an integral part of any mission and DFRL will meet the schedule of Gaganyaan mission. The details about the required ground test cannot be revealed at present as it is a part of development and is protected by IP rights.”

On the parameters that go into making of space food menu, he said DFRL pooled in all its expertise in the area of food technology. “There are several parameters that fall into the science and technology of developing space food. Parameters like calorie, nutrition, easy and quick preparation and stability are important criteria to decide the food,” says an official.

The space food is being processed to have long shelf life and stability. Also, the processing parameters were standardized to achieve microbiological targets specified for each category of food.

Quality Key

The space food will have to finally pass a chain of quality processes. The tests are specified in the quality control plan, which is well documented. This includes several tests for the food and packaging material being used.

“Non-inflammability of the packaging material is an important aspect. Even the food warmer/heater is also designed to heat the contents of the pouches,” says an official.

Quality tests will ensure that the menu is adequate to meet the calorific requirements, macro (protein, fat and carbohydrates) and micronutrients (minerals, vitamins and fatty acids).

To evaluate the safety and stability of the products, standard microbiological chemical parameters were tested internally and also were subjected to third party evaluation by National Accreditation Board for Testing and Calibration Laboratories-accredited institutions.

The Menu

For Gagaanyaan mission, sources say DFRL products have been screened for its space worthiness by subjecting them to detailed macro\micro nutrient analysis, sensory evaluation, microbiological safety and acceptability as per NASA standards.

A detailed menu has been formulated taking into account the calorie requirements of the astronauts.

The exhaustive menu based on retort processing technology include: vegetable pulav, vegetable biryani, sooji halwa, shahi paneer, dal makhani, chicken biryani, chicken katti rolls, katti rolls (egg), katti rolls (paneer, sweet corn), potato-stuffed parotha, dal chawal, kadi chawal, rajma chawal, sambar chawal, preserved chapaties along with oral rehydration solution (ORS) and saline water. On the freeze dried segment, the astronauts can choose from pineapple juice powder, carrot/cucumber, chicken shreds. Instant food like idli sambar, khichidi, moong dal halwa, coconut chutney, jiffy upma are also on the menu.

The snack section has fruit and nut bar, Omega-3 rich bar, dates bar, chocolate bar, mango bar, combination tech processed dry fruits (salted almond, cashew and pumpkin seeds), beans in sauce, tomato sauce, pickle (mango/lemon). Beverages like mango nectar, coffee and tea will also likely hit the space.

“The packaging material and its qualification and specification requirements have been formulated and its design, volume and packing size have been standardized. The water dispensing design has been set for potable water in pouches to meet micro gravity conditions,” says an official.

The liquid delivery system has been designed with greater care with the entire assembly being made leak proof.

“This will prevent the liquid from creeping out when not being consumed. The scientists have designed an assembly using a valve type opening and closing system,” says the official.

A food warmer has been designed exclusively for space food, giving a core temperature of 60-70°C within an average time of 8 to 10 minutes. A prototype of an in-pouch rehydration system also has been designed for instant food items. Plans are afoot for proper biological solid waste management inside the crew module.

DFRL scientists have earlier made similar food for Indian Air Force (IAF) pilots in the forms of preflight meals like freeze dried chicken, porridge mix and alertness-inducing coffee paste.

Low glycemic index (GI) chicken khakhra is a product developed as a convenient snack with a lasting shelf-life. All these products have already been sent for trials with the IAF.

Interestingly, a recent NASA feature says that the crewmembers at the International Space Station (ISS) today have the luxury of choosing from 200 different items from their standard menu, including some personal choices.

“We will get there one day as we have the expertise to deliver space food. NASA and ISS have set benchmarks with several manned missions and Gaganyaan will set the ball rolling for us,” says an official.

DFRL is banking on its high success rate of delivering quality RTE food to Indian armed forces over the years. From developing terrain specific food for high altitudes, deserts to energy dense items for light intensity conflict and combat situations, the scientists are confident to take up the challenges thrown at them by the Gaganyaan mission.

https://www.onmanorama.com/news/nation/2020/08/27/gaganyaan-manned-flight-food-warming-dfrl-mysuru.html

NEWS 18

Sun, 30 Aug 2020

The 'Tejas' age begins: As a 3 decade dream comes true for IAF, the sleek aircraft inspires a movie & more

The stationing of these aircraft along the sensitive and tense borders also marks the culmination of LCA Tejas' 37-year-long journey from its conception to active duty

By Rajiv Kumar

The Indian Air Force (IAF) recently deployed its Light Combat Aircraft (LCA) Tejas along the country's western borders. While not heavily reported in the media, the deployment did mark a military milestone for India, which has to stay prepared for a two-front war.

The stationing of these aircraft along the sensitive and tense borders also marks the culmination of LCA Tejas' 37-year-long journey from its conception to active duty.

Spectators take pictures as the Indian Air Force (IAF) light combat aircraft "Tejas" approaches to land during the Indian Air Force Day celebrations at the Hindon Air Force Station on the outskirts of New Delhi, India, October 8, 2019. REUTERS/Anushree Fadnavis

A peep into the past will give a clearer picture of the significance of IAF's move and people's sentiment attached to the aircraft, which is now to be seen in a Bollywood film.

The Kangana Ranaut-starrer 'Tejas' is set to take off in December, months after the fighter reached the frontlines. The film, celebrating the valour of the armed forces, once again brings into focus the long route Tejas took to take wings.

By the 1980s, the country's Soviet-origin MiG-21 fleet had been in service for over two decades. The single engine fighter-interceptors had become the lifeblood of the Indian Air Force, but it had become difficult to source spares for them. Repeated accidents highlighted safety worries.

Concerns were being raised over the post-Mig 21 scenario in the IAF. The 'Long Term Re-Equipment Plan 1981' painted a rather grim scenario by projecting 40% squadron shortage in the force by 1994-95.

It was under these circumstances that in 1983, the DRDO got permission to initiate a programme to design and develop a Light Combat Aircraft. The purpose for developing a homegrown fighter were twin-fold: to fill the deficiency in combat forces as well as the development of a local industry capable of creating state-of-the-art products with commercial spin-offs for a global market.

Many would not know that this was India's second attempt at indigenisation of flying war machines. Earlier, the HAL had made the HF-24 Marut. However, this fighter programme was winded down because of various limitations the aircraft had in modern warfare.

So, what is the LCA Tejas up against? Since the IAF has deployed it along the Pakistan border, it will most likely take on either the China-made JF-17 or the US made F-16s that the Pakistan Air Force has.

All of these – LCA Tejas, JF-17 and F-16 – are multi-role fighter aircraft (MRCA) designed to perform various day/night combat roles. These machines are capable of handling multiple tasks including aerial attacks, air-to-surface attacks, reconnaissance, interception, breaking into the enemy's air defence and providing deterrence. And all three are 4th generation aerial combat

machines, packing more or less the similar class of technology including engines, avionics, among other things.

The LCA Tejas is among the world's lightest multi-role combat aircraft of its category. An empty weight of around 6,560 kg and maximum take-off weight of just 13,300 kg gives it unparalleled maneuvering capabilities. JF-17 on the other hand weighs around 6,411 kg with maximum take-off weight of 12,474 kg.

The F-16 is the heaviest of the lot with an empty weight of 9,207 kg and a maximum take-off weight of 21,772 kilograms. The difference in empty and take-off weight is highest for F-16, meaning it can carry more fuel and weapons as compared to competition.

The 13.2 metre long Tejas with a wing span of 8.2 metres and a height of 4.4 meters is the sleekest of the three. The JF-17 is 14.93 metre long, has a wingspan of 9.48 metres and a height of 4.77 meters. The F-16s on the other hand are relatively bigger with 15 metres of length and a wingspan of 9.4 metres.

Additionally, Tejas' aerodynamically unstable tailless compound delta-wing configuration, optimised primarily for manoeuvrability, makes it unique. In terms of speed, the Lockheed Martin's F-16s have an edge. While the F-16s can fly at a top speed of Mach 2+ or approx. 2,470 km/h, both the LCA Tejas and JF-17 can cruise at a maximum speed of 1.6 Mach or 1975.68 km/ hour. However, the Tejas, can attain supersonic speed at all altitudes.

The JF-17 Thunder can attain a height of little over 54,000 ft while both LCA Tejas and F-16 are enabled with a service ceiling of around 50,000 ft, according to open source data. The service ceiling is the hallmark of an aircraft's efficiency during dogfights and for evading enemy's surface-to-air defence.

As far as operational range is concerned, the F-16 is far superior. Depending on the variant, it can fly up to a spectacular range of 3,900 to 4,220 km. The Tejas and JF-17, according to Airforce-Technology.com, have a maximum range of 3,000 km and 2,037 km, respectively.

On the weaponry front, Tejas is designed to carry a number of air-to-air, air-to-surface, precision-guided and standoff weaponry.

The Tejas carries beyond visual range weapons as well as agile high off-boresight missiles to tackle close combat. The aircraft also boasts of the highly-reliable quadruplex digital fly-by-wire Flight Control System.

To ensure effective Human Machine Interface (HMI) the aircraft's new generation glass cockpit is fitted with Multi Function Displays (MFD), Head Up Display (HUD) and Stand by Instrumentation System.

Tejas' radar system has been jointly developed by India and Israel. Its Doppler Multi Mode model boosts its effectiveness in Air-to-Air and Air-to-Surface combat. The radar can track multiple targets simultaneously while mapping them.

However, despite an early start and the government allocating the first tranche of Rs 575 crore for the LCA programme way back in 1986, it was 15 years later, in January 2001, when the first technology demonstration flight of Tejas took place. Then Prime Minister Atal Bihari Vajpayee named LCA – "Tejas" meaning Radiance in Sanskrit. It took another 14 years before Indian Air Force finally got the aircraft.

Lastly, how much of the machine is Indian? The government informed the Lok Sabha in November 2016 that the indigenous content of LCA Tejas is 59.7% by value and 75.5% by numbers. The government went for the current engine manufactured by General Electric after having spent Rs 2032.22 crore on the Kaveri Engine which eventually failed to give the required thrust.

Despite the fact that it took three decades, it is a matter of pride for the country that now the 'Made in India' LCA has been deployed.

https://www.news18.com/news/opinion/the-tejas-age-begins-as-a-3-decade-dream-comes-true-for-iaf-the-sleek-aircraft-inspires-a-movie-more-2830531.html

THE ECONOMIC TIMES

Sat, 29 Aug 2020

View: Bumpy road to rebuilding air power; IAF likely to remain on tenterhooks

By G Mohan Kumar

Synopsis

The euphoria generated by the arrival of Rafale should not blind us to the long haul that the IAF needs to make in renewing and expanding its fleet to overcome obsolescence and attrition. There is definitely an urgency to replace the large ageing fleet of MiG-21, MiG-23 and MiG-27 by a high-tech single engine aircraft in the next 10-15 years.

Addressing a seminar on 'Atmanirbhar Bharat' (self-reliant India), organised by the Ministry of Defence recently, the PM exhorted the armed forces to embark on the self-reliance mission with full self-confidence. He also dwelt on the need to make India a defence manufacturing hub with the active involvement of the private sector not only in manufacturing but also in research and development. One of the key pathways to realising this vision could be opened if the Indian Air Force (IAF) unleashes a wave of domestic manufacturing to revamp its fleet.

The euphoria generated by the arrival of Rafale should not blind us to the long haul that the IAF needs to make in renewing and expanding its fleet to overcome obsolescence and attrition. The threat of a two-front war currently looms large with an intransigent China least hesitant to mobilise its forces to grab territory or collude with Pakistan. In the current context every effort has to be made to fill in the voids in air power by quickly phasing out the vintage fleet and inducting adequate numbers of new aircraft to reach the target of 42 squadrons. The country will pay a heavy price if these gaps are allowed to continue in the medium term.

The present underdeveloped state of Tejas, the long time required to induct MKII and the HAL's low output will keep the IAF on tenterhooks for many years to come

There is definitely an urgency to replace the large ageing fleet of MiG-21, MiG-23 and MiG-27 by a high-tech single engine aircraft in the next 10-15 years. The MKII version of Tejas, acceptable to the IAF, could replace them and become the mainstay of the fleet, but it is nearly impossible to get the large numbers required to accomplish this. The present underdeveloped state of Tejas, the long time required to induct MKII and the HAL's low output will keep the IAF on tenterhooks for many years to come.So the twin challenges of replacement and net addition to reach the fleet strength required by the IAF necessitate a parallel line of production in the private sector. It is against this background that the IAF, after considerable deliberations, had prepared a plan (2016) for manufacturing 112 single engine fighter aircraft (SEFA) in the private sector simultaneously with HAL's accelerated development and production of the LCAMKII. The SEFA, besides being state-of-the-art in its category, will be cheaper than a twin engine aircraft by at least 30%.

However, the plan to initiate the domestic manufacture of the SEFA seems to have lost steam at a time when we can no longer afford to delay capability building. The IAF had taken some steps to float request for information (RFI) for the SEFA under the strategic partnership policy but the progress has not been satisfactory, leading to speculation that the entire idea is going to be shelved altogether. In the new security scenario, which has opened up opportunities for the US or the EU or Russia to push their products, there is every possibility that some influence will be exerted to get India to import another aircraft. This will be antithetical to the very spirit of Atmanirbhar Bharat. Manufacturing of SEFA is absolutely essential for creating the ecosystem within the country for aerospace manufacturing and if we dither India's aerospace capabilities will remain stunted forever.

It is therefore imperative that along with submarines and naval utility helicopters, the manufacture of SEFA under the strategic partnership policy be accelerated. The Indian private sector company selected to manufacture this also should be made responsible for its performance based logistics (life-cycle product support), subsequent upgradation and indigenisation of parts so that in a span of 10-15 years the full capability could be built in the private sector for aerospace manufacturing. This will also create the manufacturing capability for the new advanced medium combat aircraft (AMCA) that will hopefully be developed by the Defence Research and Development Organisation (DRDO).

Some are sceptical of India's capability to manufacture a fifth generation aircraft like AMCA. They question India's design capabilities, and point to the lack of a credible aerospace ecosystem. The AMCA's development will depend on our success in attaining good design capabilities, setting up a high-tech aerospace ecosystem and developing a high thrust aircraft engine necessary for hypersonic cruise. The Kaveri aero-engine project of the DRDO, which had none of the characteristics of a mission mode project, had failed to take off. French collaboration for upgrading of this engine does not seem to be materialising.

Aero-engine technology is one of the most closely held technologies and to get it through a technical collaboration is next to impossible. It is only hard work utilising home-grown talent or Indian talent scouted from abroad that will lead to a breakthrough. Development of high performance alloys and materials will be key to the development of the "hot" technology that is so very critical for the success of this project. The entire project needs to be restructured to build a dedicated team for this. The DRDO will also have to involve the premier institutions and the private sector as development partners in this effort. Unless they are able to innovate, evolve a new work culture and induct exemplary leadership, success will continue to be elusive.

(The writer is former defence secretary)

https://economictimes.indiatimes.com/news/defence/bumpy-road-to-rebuilding-air-power-iaf-likely-to-remain-on-tenterhooks/articleshow/77812397.cms

DEFENCE AVIATION POST
Your Connect To The World Of Defence And Aviation

Sat, 29 Aug 2020

Will HAL Tejas in future be armed with BrahMos Missile?

Though there are news from DRDO and Brahmos Aerospace Ltd that a lighter varient of Brahmos is under development which can be integrated with LCA Tejas MK1 and MK1A. This varient is known as Brahmos NG. It's weight will be around 1500 kg and warhead of 200 kg. All other flight characteristics will be equivalent like current Brahmos. In 2019's Aero India exhibition a mock up of Tejas with Brahmos NG is being shown. It seems both DRDO and Brahmos Aerospace is marketing for this new missile.

A lighter sleeker variant of the Indo-Russian cruise missile dubbed as Brahmos-NG (Next Generation) will be ready for developmental trials by 2024 said recently a top official of the Brahmos Aerospace. Indo-Russian joint venture company will develop a 1.5-ton Brahmos-NG which is nearly 1 ton lesser in terms of weight when compared to Brahmos-A missiles in service with Indian Air Force (IAF) and 1.5 ton lighter when compared to BrahMos currently in service today with the Indian Army and Indian Navy.

The BrahMos NG assumes significance as it will be capable of being launched from all platforms like air, water and sea. It will be compatible for launches through ground launch vehicles, destroyers and other naval attack vessels, torpedo tubes in submarines and air launch as well. It will be highly versatile and will prove to be a potent weapon that will bolster our strike capabilities as well as improve export offerings. The current version has failed to draw much attention from the market in terms of export demand. This will be a more desirable variant, we believe," a source in the Defence Research and Development Organisation (DRDO) told this newspaper.

Will Tejas we able to carry one Brahmos under its fuselage?

Brahmos cruise missile had to be stripped off its weight considerably(500kg) to make it viable for Sukhoi Su 30 MKI(currently the heaviest multirole fighter in service) to carry it. This is not without compromising the operational parameters of the aircraft which means when this aircraft is loaded with BrahMos.

https://secureservercdn.net/198.71.233.254/bmb.1a0.myftpupload.com/2020/08/will-hal-tejas-in-future-be-armed-with-brahmos-missile/

Defence News

Defence Strategic: National/International

THE ECONOMIC TIMES

Sat, 29 Aug 2020

Defence Ministry to host Aero India in its traditional venue of Bengaluru from Feb 3-5

Synopsis

The sources said Defence Minister Rajnath Singh has already held a number of internal meetings on hosting the mega event. "It was decided that the event will be hosted while taking maximum precaution against the coronavirus pandemic," said a source.

New Delhi: The defence ministry has taken an in-principle decision to host the next edition of Aero India -- considered Asia's largest aerospace exhibition -- in its traditional venue of Bengaluru from February 3-5 next year notwithstanding the coronavirus pandemic, official sources said on Friday. The ministry took the decision to hold the biennial event as scheduled following inputs from the domestic defence industry and global aerospace majors, they said.

The sources said Defence Minister Rajnath Singh has already held a number of internal meetings on hosting the mega event.

"It was decided that the event will be hosted while taking maximum precaution against the coronavirus pandemic," said a source.

Since its inception in 1996, Bengaluru has been hosting the event.

The sources said a significant number of global defence majors and big investors are expected to participate in the event besides official delegations from several countries.

The defence ministry plans to showcase its initiatives in promoting India's defence manufacturing at the event.

The government has unveiled a number of policy initiatives in the last few months with an aim to boost domestic defence production.

On August 9, the defence minister announced that India will stop import of 101 weapons and military platforms like transport aircraft, light combat helicopters, conventional submarines, cruise missiles and sonar systems by 2024.

In a related development, the DRDO on Monday identified 108 military systems and subsystems like navigation radars, tank transporters and missile canisters for the domestic industry to design, develop and manufacture.

The premier organisation said it will also provide support to industries for design, development and testing of these systems on a requirement basis.

It has set a target of next year in developing the 108 systems and subsystems.

India is one the largest importers of arms globally.

According to estimates, the Indian armed forces are projected to spend around USD 130 billion in capital procurement in the next five years. The government now wants to reduce dependence on imported military platforms and decided to support domestic defence manufacturing.

The defence ministry has set a goal of a turnover of USD 25 billion (Rs 1.75 lakh crore) in defence manufacturing in the next five years that included an export target of USD 5 billion (Rs 35,000 crore) worth of military hardware.

https://economictimes.indiatimes.com/news/defence/defence-ministry-to-host-aero-india-in-its-traditional-venue-of-bengaluru-from-feb-3-5/articleshow/77801120.cms

hindustantimes

Sat, 29 Aug 2020

IAF to formally induct Rafale jets on Sept 10

Arrival of the jets coincided with the ongoing India-China border tussle

By Rahul Singh

New Delhi: The Indian Air Force (IAF) will formally induct Rafale fighters at the Ambala air base on September 10 in presence of defence minister Rajnath Singh, officials familiar with the matter said on Friday. India has also invited Singh's French counterpart, Florence Parly, to attend the ceremony, they added.

First five Rafale combat aircraft from France arrive at the Air Force Station, in Ambala. The aircraft will be a part of 17 Squadron, the "Golden Arrows", which was resurrected on Sept 10, 2019. (PTI Photo)

Five Rafale fighters of the 36 ordered arrived at the airbase on July 29, ending IAF's wait for new fighter jets to sharpen its combat potential.

IAF chief Air Chief Marshal RKS Bhadauria and other senior air force officers were present when the jets arrived, but a formal induction ceremony was reserved for another day.

The arrival of the jets coincided with the ongoing India-China border tensions in Ladakh.

Shortly after they landed last month, the defence minister said the fighters would enhance the IAF's capabilities and deter any threat to the country. He said those who want to threaten India's territorial integrity should be worried about the new capability.

Singh, who had travelled to France last year to formally receive the first fighter jet, showered praises on the multi-role aircraft for its capabilities, and Prime Minister Narendra Modi for the decision to buy 36 fighter jets.

The Rafale fighters will significantly enhance IAF's offensive capabilities and be a game changer with their advanced weaponry, high-tech sensors, superior radar for detection and tracking of targets and ability to carry an impressive payload, experts say.

The jet is capable of carrying out a variety of missions — ground and sea attack, air defence and air superiority, reconnaissance and nuclear strike deterrence.

"I would like to add, if it is anyone who should be worried about or critical about this new capability of the Indian Air Force, it should be those who want to threaten our territorial integrity," Rajnath had tweeted and posted in a video of the Rafale jets landing at the Ambala base.

They are part of the IAF's 17 Squadron also known as the Golden Arrows. The aircrew that brought them to India was headed by Group Captain Harkirat Singh, a decorated fighter pilot, who is the commanding officer of the squadron.

The aircraft covered a distance of nearly 8,500 km from France to India. The first stage of the flight covered a distance of 5,800 km from Merignac to Al Dhafra (UAE). The second covered over 2,700 km from Al Dhafra to Ambala.

The new fighters are the first imported jets to be inducted into the IAF in 23 years after the Russian Sukhoi-30 jets entered service in June 1997.

The IAF ordered 36 Rafale jets from France as part of a government-to-government deal worth ~59,000 crore in September 2016. They have been specially tailored for IAF.

The Rafale weaponry includes Meteor beyond visual range air-to-air missiles, Mica multi-mission air-to-air missiles and Scalp deep-strike cruise missiles. The weapons allow fighter pilots to attack air and ground targets from standoff ranges and fill a significant capability gap.

https://www.hindustantimes.com/india-news/iaf-will-induct-rafale-jets-at-ambala-base-on-sept-10/story-pPcemNoAKgsxKVQbfGCt3I.html

Sat, 29 Aug 2020

10 सितंबर को राफेल होगा विधिवत रूप से भारतीय वायुसेना में शामिल, राजनाथ सिंह की मौजूदगी में होगी सेरेमनी

अंबाला एयरबेस पर राफेल लड़ाकू विमानों के वायुसेना में शामिल करने की पूरी तैयारी कर ली गई है। फ्रांस से आए पांचों फाइटर जेट्स अब पूरी तरह से ऑपरेशन्ली तैयार हैं और चीन पाकिस्तान सीमा पर कॉम्बेट पैट्रोलिंग भी कर रहे हैं।

नीरज राजपूत

एलएसी पर चीन से चल रही तनातनी के बीच आखिरकार वो तारीख सामने आ गई है जब राफेल फाइटर जेट विधिवत तौर से भारतीय वायुसेना में शामिल होने जा रहे हैं। 10 सितंबर को रक्षा मंत्री राजनाथ सिंह की मौजूदगी में फ्रांस से आए पांच राफेल लड़ाकू विमानों को अंबाला एयरबेस पर एक सैन्य समारोह में शामिल किया जाएगा। माना जा रहा है कि फ्रांस की रक्षा मंत्री फ्लोरेंस पारले भी इस समारोह में शिरकत करने के लिए भारत आ सकती हैं।

जानकारी के मुताबिक, अंबाला एयरबेस पर राफेल लड़ाकू विमानों के वायुसेना में शामिल करने की पूरी तैयारी कर ली गई है। फ्रांस से आए पांचों फाइटर जेट्स अब पूरी तरह से ऑपरेशन्ली तैयार हैं और चीन पाकिस्तान सीमा पर कॉम्बेट पैट्रोलिंग भी कर रहे हैं। इसीलिए वायुसेना ने कमीशनिंग-सेरेमनी के लिए रक्षा मंत्रालय को 10 सितबंर की तारीख का प्रपोज़ल भेजा है। रक्षा मंत्रालय ने इस समारोह के लिए फ्रांस की रक्षा मंत्री को भी आमंत्रित किया है। फ्रांस से अभी इस समारोह में शामिल होने की स्वीकृति आनी बाकी है।

आपको बता दें कि भारत ने फ्रांस से 36 राफेल लड़ाकू विमानों का सौदा किया था। इनमें से पहली खेप में पांच विमान 29 जुलाई को अंबाला एयरबेस पर पहुंच गए हैं। अगले पांच विमान अक्टूबर में भारत पहुंच जाएंगे। इससे पहले

पिछले साल यानि अक्टूबर 2019 में दशहरा के मौके पर खुद रक्षा मंत्री राजनाथ सिंह ने फ्रांस जाकर पहले राफेल विमान को स्वीकार किया था। इसके बाद से ही भारतीय पायलट इन राफेल विमानों पर फ्रांस में ही ट्रेनिंग ले रहे थे।

राफेल विमानों के वायुसेना में शामिल होने से भारत को चीन और पाकिस्तान पर एयर-पावर में एक बड़ी बढ़त मिलने की उम्मीद है, क्योंकि 4.5 जेनेरेशन वाले राफेल को एक ओमनी-पोटेंट फाइटर जेट माना जाता है। राफेल भारत के लिए दक्षिण एशिया में गेमचेंजर साबित होने वाला है।

इस बीच खबर है कि रक्षा मंत्री राजनाथ सिंह 4-6 सितबंर को रूस की यात्रा पर जाएंगे। वहां पर राजनाथ सिंह एससीओ यानि शंघाई कॉपरेशन ऑर्गेनाइजेशन के रक्षा मंत्रियों की बैठक में हिस्सा लेने जा रहे हैं। चीन और पाकिस्तान भी इस एससीओ के सदस्य हैं और माना जा रहा है कि दोनों देशों के रक्षा मंत्री भी इस सम्मेलन में शिरकत कर सकते हैं।

https://www.abplive.com/news/india/rafale-will-be-formally-inducted-into-the-indian-air-force-on-september-10-will-be-held-in-the-presence-of-rajnath-singh-ann-1542913

अमर उजाला

Sat, 29 Aug 2020

आईएनएस करंज समुद्री परीक्षण में सफल, चार-पांच महीने में नौसेना में होगी शामिल

नई दिल्ली: भारत वायुसेना के साथ-साथ नौसेना को भी मजबूत करने पर जोर डाल रहा है। भारत में बनी कलवरी क्लास की तीसरी पनडुब्बी आईएनएस करंज अब समुद्री परीक्षणों पर भी खरी उतरी है। भारतीय नौसेना इसे चार से पांच महीने में अपने बेड़े में शामिल कर सकती है। इस पनडुब्बी का साल 2018 में समुद्री परीक्षणों के लिए भेजा गया था।

INS Karanj - फोटो: pti

इससे पहले कलवरी औ खंडेरी पहले ही नौसेना में शामिल हो चुकी हैं, ये दोनों पनडुब्बियां भी कलवरी क्लास की बनी हैं। आईएनएस करंज की खासियत यह है कि यह सतह और पानी के अंदर से टॉरपीडो और ट्यूब लॉन्चड एंटी शिप मिसाइल को दागने की क्षमता रखती हैं।

यह सटीक निशान लगाकर दुश्मन को नष्ट कर सकती है। कलवरी क्लास की छह पनडुब्बियों का निर्माण मुंबई के मझगांव डॉकयार्ड लिमिटेड ने फ्रांसीसी कंपनी मेसर्स नेवल ग्रुप के साथ किया है। ये पनडुब्बियां 50 दिनों तक समुद्र में रह सकती हैं और 350 मीटर तक गोता लगा सकती हैं।

ये पनडुब्बी 37 किमी प्रति घंटे की रफ्तार से समुद्र में चल सकती हैं। इस पनडुब्बी में टॉरपीडो लगे हैं, जिसकी मदद से किसी पनडुब्बी या समुद्र की सतह पर किसी जहाज को आसानी से तबाह किया जा सकता है। इसके अलावा ये पनडुब्बी समुद्र में बारूदी तरंगें भी बिछा सकती हैं।

आईएनएस करंज स्टेल्थ और एयर इंडिपेंडेंट प्रॉपल्शन समेत कई तरह की आधुनिक तकनीकियों से लैस है। इस पनडुब्बी में लंबी दूरी वाले मिशन पर जाने के दौरान ऑक्सीजन लेने के लिए सतह पर आने की जरुरत नहीं है।

आईएनएस करंज की अन्य खासियतें

- एंटी-सरफेस वॉरफेयर, एंटी-सबमरीन वॉरफेयर, खुफिया जानकारी जुटाने, माइन लेयिंग और एरिया सर्विलांस जैसे मिशनों को अंजाम देने की क्षमता है
- अकुस्टिक साइलेंसिंग, लो रेडिएटेड नॉइज लेवल, हाइड्रो डायनेमिकली ऑपटिमाइज्ड शेप जैसी अत्याधुनिक तकनीकी का इस्तेमाल

https://www.amarujala.com/india-news/ins-karanj-completed-its-marine-trials-now-indian-navy-will-include-this-submarine-after-4-to-5-months

Sun, 30 Aug 2020

Indian Army gears up at heights of 12,000 feet in Eastern Ladakh

New Delhi: As stand-off with China remains unresolved, the Indian Army gears up for formidable logistical challenges posed by harsh climate at heights exceeding 12,000 feet and temperature as extreme as minus 50 degrees Celsius.

Image Credits: IANS

The force requires special clothing, diet and shelter for around 35,000 extra troops deployed in Eastern Ladakh. Most of the friction points in Ladakh like Pangong Lake and Galwan Valley where the face-offs have happened are 14,000 feet above the sea level.

The force will incur an estimated expenditure of around Rs 400 crore for providing special winter clothing to cater to the enhanced deployment. The cost per soldier for special clothing equipment to brave the harsh winter is around Rs 1 lakh.

"To meet clothing and sheltering requirements for operations in these areas, a Special Clothing and Mountaineering Equipment (SCME) at cost of around Rs 1 lakh per set is provided to each soldier," the officer said.

The SCME set comprises snow clothing and equipment for survival, resuscitation, rescue, mountaineering equipment and tents.

"The equipment is of superlative quality standards offering attributes such as light-weight, thermal, equilibrium, waterproof, breathable and durability," the officer said.

The winter clothing and gear includes special three layered jackets and trousers, boots, snow goggles, facemask, rucksacks and others.

Temperature-controlled special tents and pre-fabricated huts are also provided. These can maintain the optimum temperature at the freezing heights where oxygen levels are also low, as in Ladakh. *(Inputs from IANS)*

https://kalingatv.com/nation/troops-of-indian-army-gears-up-at-heights-above-12000feet-in-eastern-ladakh/

Sun, 30 Aug 2020

What are some drawbacks of India's Sukhoi Su-30MKI fighter aircraft?

Sukhoi 30MKI is a super-maneuverable twin-jet air superiority fighter developed by Russia's Sukhoi and built under licence by India's Hindustan Aeronautics Limited (HAL) for the Indian Air Force (IAF).

The Su-30MKI development was started in 1995 by Sukhoi Corporation and manufactured at Hindustan Aeronautics Limited (HAL), Nasik, Maharashtra production line. It is derived from the Su-27 Flanker, it is a heavy, all-weather, long-range fighter. It has close coupled canards with Thrust Vectoring, gives a deadliest combination.

Currently this fighter is the only most modern and advance fighter jet of IAF (Indian Air-force), this fighter was introduced in Indian Air-force on 27 Sept 2002. Till 2017 total 240 fighter produced in total and one fighter jet in building cost 358 crore rupees. First Su-30mki produced by Russia in 2002 and Air-force accepted that. What about Indian version, first Su-30mki which assembled by HAL in 2004.

Earlier Air-force ordered 240 fighter, but recently due to lack of fighter jet and more trust on su-30mki, Air-force increase its order from 240 to 314 in total number. No new fighter jet (double engine) coming to IAF in near future, so Su-30mki will be the backbone of Air-force until a new Fighter come to IAF.

Every fighter jet has some pros and cons. Even the world's most advanced fighter, F-22, doesn't feature Helmet Mounted Display & Sight (HMDS). So Su-30MKI too feature some flaws. I have some information on flaws of Su-30MKI. Before I start, let me clarify that I am not playing with national security, every info is available in public domain.

Problems with Su-30MKI

01. Lack of Missile Approach Warning System (MAWS)

As the name suggests, MAWS detect the incoming missiles and alerts the pilot about the the threat. Also, it detects the type of missile, which helps in dispensing appropriate countermeasures while performing the defensive manuevers.

Without MAWS, Su-30MKI need to rely on jammers, RWR, Early Warning (EW) control systems for survival against incoming missiles. But MAWS is necessary as it allows detection of missiles and their direction so that appropriate manuevers can be performed and countermeasues can be released in time. MAWS is also most effective heat seeker missiles, that does not use radar for guidance.

Over the years several radar warners and electronic warfare systems such as TEMPEST, TARANG and RWR-118 have been developed and inducted successfully by the IAF. IR based MAWS based on the dual colour concept has been developed by DARE for fighter aircraft and currently is being integrated into Su-30 MKI aircraft.However there is no integral MAWS in Su-30 mki

FYI, PAF F-16 and JF-17 are equipped with MAWS.

02. High Band Jammer issues

Su-30 mki has Made-in-Russia high band jammer called SAP-518, and capable of jamming radar guided missiles and other RF equipments. Su-30MKI is rarely spotted with this jammer and there are some serious problems with it.

https://www.defenceaviationpost.com/2020/08/what-are-some-drawbacks-of-indias-sukhoi-su-30mki-fighter-aircraft/

DefenceNews

Sat, 29 Aug 2020

Govt hikes funds for border road development projects

The Union government has increased funding for border road development projects and raised the allocation for maintenance of border roads -- a development that follows a military standoff with the Chinese People's Liberation Army (PLA) in the Eastern Ladakh sector -- as it attempts to boost infrastructure in frontier areas.

Funding for road development projects in border areas has been raised from Rs 340 crore to Rs 440 core in the current financial year. The budget for maintenance of border roads has gone up from Rs 120 crore to Rs 220 crore. This is the second revision of funding for border roads in the fiscal year; in June, the ministry of road transport and highways raised the allocation for border road maintenance by four times to Rs 120 crore.

The government has been trying to reinforce infrastructure in border areas. The Chinese and Indian armies have been embroiled in a tense standoff along the Line of Actual Control in Eastern Ladakh sector, where a brutal brawl in the Galwan Valley on June 15 led to the deaths of 20 Indian and an unspecified number of Chinese soldiers.

According to documents reviewed by HT, the additional allocation of Rs 100 crore for "general works" to the Border Roads Organization (BRO) is for projects under the Chardham Pariyojana, aimed at improving connectivity o the four pilgrimage centres of Kedarnath, Badrinath, Yamunotri and Gangotri in Uttrakhand.

Works for the Chardham Pariyojna are being implemented by three executing agencies of the transport ministry -- the Uttarakhand State Public Works Department, BRO, and the National Highway and Infrastructure Development Corporation Limited (NHIDCL).

BRO functions under the defence ministry and is tasked with construction and maintenance of roads in the border areas, classified as General Staff (GS) roads in line with defence requirements. GS roads are developed and maintained through funds provided by the Border Roads Development Board through the ministry of road transport and highways.

Strategic affairs analyst Brahma Chellaney said, "This raises two issues—one, given that the construction of any border road takes several years because of the treacherous terrain, why are authorities waking up to the need for increased funding in the midst of China's aggression? And second, even with the increased allocations, the budget seems inadequate to build the kind of border infrastructure India needs to defend itself."

In June, the transport ministry had allocated Rs 1,691 crore for highway development by BRO in Jammu & Kashmir and Uttarakhand for 2020-21. Of this, Rs 1,351 crore was sanctioned for

road works in J&K and Rs 340 crore for Uttarakhand. The transport ministry also allocated an additional Rs 71 crore for highway works in Ladakh, Sikkim and Tamil Nadu.

This time around, the ministry has also increased the allocation for roads in the Northeast under its road development programme from Rs 290 crore to Rs 390 crore.

The allocation to the regional offices of Assam and Arunachal Pradesh has increased from Rs 140 crore and Rs 150 crore, respectively to Rs 190 crore and Rs 200 crore, taking the total funding for incurring expenditure on the Special Accelerated Road Development Programme for North East (SARDP-NE) in the financial year 2020-21 to Rs 390 crore.

https://www.defencenews.in/article/Govt-hikes-funds-for-border-road-development-projects-942098

DefenceNews

Sat, 29 Aug 2020

How Phalcon AWACS will boost the Indian military's capabilities

The Narendra Modi government is all set to clear the acquisition of two PHALCON airborne warning and control systems (AWACS) next week.The matter is before the Cabinet Committee on Security. The last time, the CCS had sent the proposal to National Security Advisor, Ajit Doval and sought some clarifications.

The proposal was cleared earlier by the Defence Acquisition Council and was then sent to the CCS.

This decision is important as Pakistan was able to deploy its SAAB AWACS 24/7 in the north and south sectors during the Balakot air strike. India was able to cover the two theatres only for 12 hours each day due to this. It is also important in the context of the standoff with China.

The Phalcon AWACS will boost the capabilities of the armed forces. This is an air borne radar with a command control system through which the air defence sector can be controlled. India already has an elaborate ground radar system. However these radars find it difficult to penetrate through regions that have a lot of trees. These gaps will be closed by the AWACS.

Moreover the AWACS will also help India keep a close watch on the neighbours. It will keep an eye on all air fields across the borders. Further it will keep a close watch on air-borne aircraft. Once an aircraft is spotted, it will give it an ID and help track its movements. When the same thing is done through the radar, it takes a lot of time.

The AWACS will help India monitor the movement of aircraft and troop build up both during war and hostile situations. It will be able to look at least 200 miles into enemy territory and give advance warnings on the potential enemy threat.

AWACS are a force multiplier, which can pick up movement of an aircraft that are on the ground and also air-borne. The Forces would have immediate information on any kind of aircraft movement across the border. This would in turn given the Air Force and Army more response time.

In another major development, a big push is being given to complete a route to Ladakh that will link Darcha in Himachal Pradesh to Nimu through Padum in Kargil's Zanskar Valley.

This is needed urgently given Pakistan's and China's interest in the Siachen Glacier and Daulat Beg Oldie.

Officials said that the 290 kilometre road will be crucial for the movement of troops and heavy weaponry into the frontier bases of the Ladakh region. This will provide a crucial link to the Kargil region.

This will be the third road link to Ladakh after the other two roads- Manali-Leh road and Srinagar-Leh highway. This road project by the Defence Ministry is being pushed hard by by the highways minister, Nitin Gadkari, following the provocation by China along the line of Actual Control in Eastern Ladakh.

The work on the re-opening of an alternative road to Ladakh from Himachal Pradesh has been expedited due to its strategic importance. The project is expected to be completed by the end of 2022.

The Border Roads Organisation is also working on another crucial road connecting Ladakh with Depsang plains. The road will provide access the Sub-Sector North (SSN) in Ladakh.

The trigger for the standoff in eastern Ladakh was China's stiff opposition to India laying a key road in the Finger area around the Pangong Tso Lake besides construction of another road connecting the Darbuk-Shayok-Daulat Beg Oldie road.

https://www.defencenews.in/article/How-Phalcon-AWACS-will-boost-the-Indian-military%e2%80%99s-capabilities-942110

THE TIMES OF INDIA

Sat, 29 Aug 2020

India buying MIG 29 from Russia – Part 2

By Sadhana Kala

It&'s not the size of the dog in the fight, it's the size of the fight in the dog.'

-Mark Twain

Mig 29 in Actual Air Battles

For a fighter so loved by pilots, and with such formidable close combat capability, Mig 29 has done poorly in actual air battles.

Upgraded Mig 29 UBG in BVR and Close Combat

- Two Syrian MiG-29 were shot down by Israeli F-15s in air combat in 1989; and two more were reportedly shot down in 2001.
- During the Gulf War (1990-91), five Iraqi MiG-29s were shot down by American F-15s.
- During the bombing campaign over Kosov in 1999, sixteen MiG-29s of Serbian Air Force engaged in air battle with F-15s and F-16s. Five Mig 29 were shot down without causing any loss to the adversary.

The Mig 29 losses were not because the fighter was inferior, but because the men manning the machines, the Mig 29 pilots, were inferior, were poorly trained, had low skill.

India's upgraded Mig 29 UPG

Realizing that future air battles will be tilted towards BVR battles where Mig 29 is weak, India decided to upgrade its Mig 29 fleet to UPG fit, to give it better BVR capability and to convert it from an air superiority fighter to a multi role fighter.

In BVR battle, MiG-29 was outclassed by western fighters. But Mig 29 UPG will have radar, IRTS, and BVR and close combat missiles that match the adversary's:

- Phazotron Zhuk-M all-weather multimode airborne radar. In air to air mode, it can detect targets at 120 km, track up to 10 targets and attack four targets simultaneously. In air-to-surface

mode it can detect a tank 25 km, a bridge 120 km, and a naval destroyer 300 km away. Two surface targets can be tracked simultaneously.

- OLS-UEM IRST sensor with laser, thermal-imaging, and television capabilities. Detects airborne targets at 15 to 55 km at +/- 90-degree in azimuth and +60-degree to -15-degree in elevation. It allows 'silent' search for and attack on targets, that is, without the target knowing that it is being tracked.
- Astra all weather BVR air-to-air missile, speed 4.5 Mach, ceiling 20 km. It can engage targets at distance of 10 km to 110 km and can be launched in autonomous or buddy mode, with Lock-On-Before Launch (LOBL) or Lock-On After Launch (LOAL). It has good Electronic Counter-Countermeasure (ECCM) that enable it to function in Electronic Countermeasure (ECM) environment.
- R-77 RVV-AE (AA-12 'Adder') medium range, active radar homing, air-to-air missile. Operating altitude 5m to 25 km, speed 4.5 Mach, maximum turn rate of up to 150° per second, maximum range 80 km, guidance inertial with mid-course update, and within 20 km of its target switch to active radar homing.
- R-74 Close combat IR missile with ±60° off-boresight and improved IRCCM (Infrared Counter-Countermeasures). It will be replaced by the next generation ASRAAM (Advanced Short-Range Air-to-Air Missile) which can be launched in LOBL or LOAL modes. Speed over Mach 3, range 50 km, 50g maneuvrability. ASRAAM outperforms all existing short-range close-combat missiles.
- Kh-35, all-weather, subsonic, anti-ship missile. Range 130 km, speed 0.8 Mach, guidance inertial and from 20 km from target inertial and active radar. Low signature, approach target at extremely low altitude from 20 km.

Other Improvements in Mig 29 UPG

Other major improvements in Mig 29 UPG are:

- Weapons load increased to 4,500 kg on six underwing and one ventral hard points like the MiG-35
- Secure datalink system to enable guidance from AWACS and ground radar.
- New IFF
- New RWR which can identify the type of enemy radar and cue the AESA jammers with high ERP (Emitted Radiated Power) for effective electronic countermeasures (ECM).
- Enhanced HOTAS (hands on throttle and stick) design.
- Glass cockpit with new Head Up Display (HUD).
- Two wide-screen multifunction color displays (MFD). MFD is a small-screen LCD surrounded by multiple buttons that are used to display the desired information to the pilot.
- Increase of 40% in range to 2,100 km on internal fuel
- inflight refuelling by retractable probe
- maintenance cost reduced by about 40%.
- Life increased to another 15 years of use

Why Not More Mig 29 UPG

If Mig 29 UPG is such a great fighter, why not more of them rather than the costlier Western fighters like the Rafale? Because Mig 29 UPG still does not match up with modern jet fighters in BVR air-battle and in attack on surface

targets. Its shortfalls in BVR air-battle role have already been pointed out. In attack role, its weapons load, 4,500 kg, is about half that of Rafale – 9,000 kg, F/A 18 – 8050 kg F 15 E – 10,500 Kg. And its range/radius-of-action is less than that of the western multi role fighters.

If Mig 29 is upgraded to match present day Western fighters like Rafale, it will cost nearly as much as Rafale. Moreover the fifth generation fighters like America's F 22 and F 35, China's J 20,

Russia's Su 57 have stealth, advanced avionics, and integrated computer systems that can network with other systems in the battlespace for situation awareness.

Also, Mig 29 UPG's airframe life and engine life, about 4,000 hours, is less than Western fighters about 6,000 hours. Its airframes deteriorate rapidly later in life and requires extensive and expensive maintenance to keep it flying. And its serviceability and therefore availability is less than that of the Western fighters.

Conclusion

From 1990s-to early 21 st century, Mig 29 was among the most potent air superiority fighters, and better than any fighter in close combat. But its Beyond Visual Range (BVR) battle abilities were much less than the Western fighters. The future air battles are tilted towards BVR battles. Therefore, India has decided to upgrade its Mig 29 fleet to Mig 29 UBG multirole fighter from air superiority fighter. Mig 29 UPG will be a potent attack aircraft while still retaining good capability as air defence fighter, so it can be used for point defence. The main attraction of Mig 29 UBG is its lower cost: about one third the cost of Western fighters like Rafale. Its main shortcomings are in radar, avionics, secure data links, and computer systems integrated with other elements in the battle airspace, like AWACS and ground radars. And in lower airframe and engine life and lower reliability and serviceability/availability.

New Mig 29 airframes are lying unused in Russia. Therefore, Mig 29 UPG will be available in shorter time frame and at lower cost and will help to ameliorate the declining fighter strength of the Indian Air Force (IAF). That will give breathing time to the government and the IAF to select fourth generation fighters to meet its present needs. And to study where and when fifth generation fighters fit in with its future needs.

Our discussion here is bookish. Indian Air Force (IAF) was the first international customer of Mig 29. It has operated these fighters for over thirty years. IAF has twice participated in exercise Red Flag in the US with its Su 30 Mk 1 and Jaguar fighters. We should leave it to the professionals of the IAF to decide, based on the organisation's wide experience, where Mig 29 UBG fits in vis-à-vis the more expensive Western fighters.

'Knowledge gained through experience is far superior and many times more useful than bookish knowledge' – Mahatma Gandhi

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(Disclaimer: Views expressed above are the author's own.)

https://timesofindia.indiatimes.com/blogs/methink/india-buying-mig-29-from-russia/

ThePrint

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China building missile sites near Doklam, Naku La 'clash zones', satellite images show

The Chinese efforts to build air defence positions on the eastern section of the LAC come even as tensions with India continue in the western sector in Ladakh

By Snehesh Alex Philip

New Delhi: China has been developing two air defence positions that will cover the 2017 Doklam stand-off area and also Naku La in Sikkim, which witnessed a clash between Indian and Chinese soldiers this year, new satellite imagery suggested Friday.

The Chinese efforts to build air defence positions on the eastern section of the Line of Actual Control (LAC) come even as tensions with India continue in the western sector in Ladakh.

Information about the Chinese air defence positions came to light as a prominent Twitter handle that regularly posts satellite imagery — @Detresfa_ — made a fresh post Friday.

Putting out the images as part of a joint study with Sim Tack of the geopolitical intelligence platform Stratfor, @Detresfa_ said the location is near the China, Bhutan and India tri-junction at Doklam, where New Delhi and Beijing were locked in an-over-two-month stand-off in 2017.

The People's Liberation Army (PLA) air defence infrastructure, the user added, is being constructed roughly 50 km from the 2017 stand-off site, and the location of the May 2020 scuffles.

The user said the positions, identified by @Detresfa_ and Tack as "surface-to-air missile sites", will close the existing air defence gaps around the clash zones.

It is pertinent to note that India has been regularly flying surveillance missions in this area to keep an eye on Chinese activities, both in Doklam and in the Northeast.

'Pressure tactic'

Even though India and China had disengaged in Doklam in 2017 after a 73-day stand-off, the PLA continues to dominate the areas it had crossed into.

China has been pressuring Bhutan to strike a deal on the Doklam boundary dispute, under which Beijing wants the Chinese holding line in the contentious region to become the working boundary between the two.

The Chinese have also continued with their construction activities on their side of the LAC in the western sector as well even though there has been no forward movement in disengagement talks since July. According to sources in the security and defence establishment, the construction is meant to provide back-up for the thousands of troops China has moved forward near Ladakh, and also into the Indian side, and may also be a possible pressure tactic.

China's withdrawal in July from near the Y Junction in the Galwan Valley, which is on the Indian side, is seen more as a fallout of the Galwan river's rising water level, which made their stay untenable, rather than any sincere effort to disengage, sources had told ThePrint earlier.

https://theprint.in/defence/china-building-missile-sites-near-doklam-naku-la-clash-zones-satellite-images-show/491346/

moderndiplomacy

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India's quest to dominate the South Asian cyberspace

By Basma Khalil

Since the advent of technological innovations in warfare, 'Cyberspace' has considerably emerged as the new battlefield for states. The South Asian region has also been impacted by this complex warfare domain. This is primarily because India aspires to dominate the regional domain of cyberspace. India has a history of cyber-attacks against Pakistan that involves malware attacks and spying operations. In recent years, there has been an intensification of India's cyber-attacks against Pakistan. Consequently, Pakistan has been forced to enter this domain to preserve its cyberspace against Indian cyber-attacks. The prospects of a tit for tat approach towards cyber security might become considerably visible in South Asia. In the wake of India's offensive policies towards Pakistan in which, along with others, cyber security holds great significance.

India has kept its various cyber operations against Pakistan secret and suspicious since the public record in this regard is significantly not available. A recent assessment being carried out by Netscout, a US-based company providing cyber security solutions and digital analytics is quite significant in this regard. As per the assessment; India has a larger cyber operations capability as compared to Pakistan. India has carried out various operations against Pakistan, which were referred to in the assessment. Whereas, Pakistan has not carried out as many cyber operations as India does. In South Asia, cyberspace has become an emerging warfare domain which India aspires to dominate. This equation would likely provoke Pakistan to enhance its cyber warfare capabilities to counter India's cyber threats.

The cyberspace operations of India also include 'cyber harassment' which involves; ransomware attacks, counterfeit pages to log in, spear phishing, website defacements, such as hacking of different official websites of Pakistan. In this regard, the official website of Pakistan's Ministry of Foreign Affairs was hacked in February 2019. Furthermore, the website of the public relations wing of the Pakistan Navy in October 2019 was also seized. Quite recently, on 12th August 2020, Pakistan's intelligence agencies have identified a major cyber-attack, launched by Indian intelligence agencies. This is further evident from the timeline of previous cyber-attacks which India has carried out against Pakistan, for instance on commemoration anniversaries and national days of Pakistan.

Due to the rapid expansion of cyberspace at the regional level, cyber-attacks have become more lethal as these pose a serious threat to the national security of Pakistan. To cope up with such cyber

threats posed by India, Pakistan needs to further enhance its cyber command capabilities. For reference, an Israel based cybersecurity firm NSO Group has developed a spyware namely 'Pegasus'. It has reportedly infected approximately 1400 senior government and military officials' gadgets in twenty countries including Pakistan. The attempt was aimed at gaining access to sensitive information stored on mobile phones of senior officials. Here, it would be significant to highlight that India and Israel have very recently signed a cyber-security cooperation agreement in July 2020to exchange cyber technology. Such an expansion in Indian cyber capability and technology would pose a grieve threat to Pakistan's cyberspace. A Russian based anti-virus and digital security company Kaspersky Lab in one of its reports in 2019 has ranked Pakistan among the vulnerable countries concerning cyber-security. Another US-based firm Symantec had also claimed that Pakistan is among the most spied states, vulnerable to malware. These international reports indicate that India has been actively involved in cyber-attacks against Pakistan because there is no other regional rival of Pakistan.

More dependence on the internet has made states more vulnerable to cyber-attacks. It has become quite vibrant that India has carried out various cyber-attacks against Pakistan including fraudulent fabrications. The growing complexities of cyberspace and the acquisition of offensive cyber capabilities by India have threatened Pakistan's cybersecurity. Pakistan needs to be more conscious of the preparedness of a secure cyber ecosystem. This would further enhance the security of communication networks being used for official as well as domestic purposes. Though relevant ministries and departments such as the Ministry of Information Technology and Pakistan Telecommunication Authority have considerably increased their capacity, fake IPs (Internet Protocol addresses) have been frequently used to target the networks in cyberspace. These activities can be damaging to the overall cybersecurity and have severe consequences. In the cyber-security domain, Pakistan needs to further invest in offensive cyber technologies that can paralyze any communication network working against the cyber interests of Pakistan. These offensive cyber technologies include the complex technologies that can disrupt and damage a system by using advanced techniques such as spear-phishing and denial of service attack. Furthermore, in the longer term, it would be more beneficial for Pakistan to entirely adopt the indigenously developed technology vis-à-vis its cybersecurity to ensure a safe and secure cyberspace.In this regard, Pakistan must further equip its specialized cyber workforce to cope up with the cyber threat posed by India. This would likely reduce the prospects of escalation dominance by India in the regional cyberspace. As India has already acquired offensive cyber weapons, certain boundaries are needed to be further integrated with the overall security calculus of national security.

https://moderndiplomacy.eu/2020/08/29/indias-quest-to-dominate-the-south-asian-cyberspace/

Outlook

Sun, 30 Aug 2020

India not to participate in multilateral war game in Russia next month

New Delhi: India has decided to withdraw from a multilateral war game in Russia next month, government sources said on Saturday, a week after New Delhi had confirmed its participation in the exercise that is also expected to be attended by the Chinese and Pakistani troops.

Last week India had conveyed to Russia that it will participate in the strategic command-post exercise to be held in the Astrakhan region in southern Russia from September 15 to 26.

Though no reason has been cited officially about India reversing its decision, people familiar with the development said that China"s participation in the exercise was a major factor behind the review.

"A decision has been taken to not participate in the exercise," said a source.

It is learnt that the decision was taken following deliberations between the top brass of the military and the ministry of external affairs.

Indian and Chinese troops have been engaged in a bitter standoff in several areas along the Line of Actual Control in eastern Ladakh for over three-and-half months. Both the countries are holding talks at military and diplomatic levels to resolve the dispute.

Around 20 countries including all member-nations of the Shanghai Cooperation Organisation (SCO) including China and Pakistan are expected to participate in the Kavkaz exercise.

India"s reconsideration on its participation in the military drill comes ahead of Defence Minister Rajnath Singh"s scheduled visit to Russia next week to attend a crucial meeting of the SCO.

The SCO defence ministers" meeting is expected to deliberate on regional security scenario and geo-strategic developments.

India had earlier planned to send around 150 Indian Army troops, 45 Indian Air Force personnel and a number of Navy officers to the multilateral military exercise.

Russia has been a major partner of India in the defence sector and the cooperation has been steadily growing further.

In June, a tri-services contingent from India participated at the Victory Day Parade at the iconic Red Square in Moscow to commemorate the 75th anniversary of the Soviet victory over Nazi Germany in the Second World War. A contingent from China had also attended it.

Both India and China are members of the SCO, an influential regional grouping.

The SCO, seen as a counterweight to NATO, has emerged as one of the largest transregional international organisations which accounts for almost 44 per cent of the world population stretching from the Arctic Ocean to the Indian Ocean and from the Pacific Ocean to the Baltic Sea.

(Disclaimer: This story has not been edited by Outlook staff and is auto-generated from news agency feeds. Source: PTI)

https://www.outlookindia.com/newsscroll/india-not-to-participate-in-multilateral-war-game-in-russia-next-month/1925448

THE TIMES OF INDIA

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US to hold high-level talks with Australia, Japan and India

The United States plans high-level talks with "Quad" security partners from India, Australia and Japan in September and October, President Donald Trump's national security adviser said on Friday, while criticizing "very aggressive" behavior by China.

Robert O'Brien told the Atlantic Council think tank he would likely meet his opposite numbers from those countries in Hawaii in October, while secretary of state Mike Pompeo would meet his counterparts from the so-called Quad in September and October.

O'Brien said the United States had an "amazing amount of stake" in the India-Pacific region.

"It's really the engine of the world economy going forward and America's gonna play a big role there. One of the ways that we can do that is providing for a safe and secure Indo-Pacific through our defense partnerships and our diplomatic partnerships with our allies," he said.

O'Brien said the Quad relationship, which has been denounced by China, was coming into its own and likely to pay huge dividends.

"We're seeing a very assertive, a very aggressive China and the United States is not going to back down from its long-held principles that the world's ocean ways and international waters should be free for navigation, and the same with space and with air rights and international airspace," he said.

US-China tension has risen in the run-up to the US election in November and the countries' military forces have stepped up activities in the Indo-Pacific region.

On Thursday, the Pentagon expressed concern about China's recent military exercises, including the firing of medium-range ballistic missiles in the South China Sea.

China criticized a U.S. warship operation near the Paracel Islands, which China claims, along with most of the sea.

The Quad engagement was revived in 2017 to deepen security cooperation and coordinate alternatives for regional infrastructure financing offered by China.

https://timesofindia.indiatimes.com/world/us/us-to-hold-high-level-talks-with-australia-japan-and-india/articleshow/77810139.cms

Sat, 29 Aug 2020

इसरो चंद्रयान-3 मिशन के लिए बना रहा है चांद की कृत्रिम सतह, टेस्ट होंगे लैंडर और रोवर

इसरो ने चंद्रयान-3 मिशन पर काम करना शुरू कर दिया था। चंद्रयान 3 मिशन में भी चंद्रयान 2 मिशन की ही तरह लैंडर और रोवर मौजूद रहेंगे।

पिंकी राजपुरोहित

दिल्ली: चंद्रयान 2 मिशन के बाद इसरो में चंद्रयान-3 के लिए तैयारियां जारी है। आपकों याद होगा कि चंद्रयान 2 मिशन के लैंडर विक्रम की रफ लैंडिंग हुई थी जिसके बाद मिशन से संपर्क टूट गया था। हालांकि ऑर्बिटर चंद्रमा की कक्षा में परिक्रमा कर रहा है। लगातार वहां से तस्वीरें भेज रहा है। इसके तुरंत बाद से ही इसरो ने चंद्रयान-3 मिशन पर काम करना शुरू कर दिया था। चंद्रयान 3 मिशन में भी चंद्रयान 2 मिशन की ही तरह लैंडर और रोवर मौजूद रहेंगे।

दरअसल कोरोना महामारी के कारण इसरो को अपने 10 से ज्यादा मिशन को आगे धकेलना पड़ा है। जिनमें से चंद्रयान-3 मिशन भी एक है। चंद्रया-3 मिशन को अगले साल प्रक्षेपित किया जाना है और इसके लिए इसरो ने कमर कस ली है। इसरो चंद्रमा की सतह पर मौजूद उसी तरह की कृत्रिम जमीन कर्नाटका में बनाने जा रहा है। बेंगलुरु से 215 किलोमीटर दूर चलकेरे में चंद्रमा की सतह पर मौजूद उसी तरह की जमीन यानी वहां जैसे गड्ढे और उसी तरह की मिट्टी के जरिए चंद्रयान-3 की टेस्टिंग की जाएगी।

सफलतापूर्वक चांद पर उतारने के लिए चंद्रमा का कृत्रिम माहौल धरती पर तैयार किया गया था

आपकों याद होगा इससे पहले चंद्रयान-2 मिशन के लिए भी इसरो ने कर्नाटक के चलकेरे में ही एक ऐसी जमीन तैयार की थी जो कि बिल्कुल चंद्रमा की सतह जैसी थी। Chandrayaan-2 को सफल बनाने के लिए भारतीय वैज्ञानिकों ने कोई कसर नहीं छोड़ी थी। लेकिन इसमें कोई दो राय नहीं कि लैंडिंग सबसे चुनौतीपूर्ण भरा रहा, जब लैंडर को चांद की सतह पर लैंड करना था। इसरो ने लैंडर विक्रम और रोवर प्रज्ञान को सफलतापूर्वक चांद पर उतारने के लिए चंद्रमा का कृत्रिम माहौल धरती पर तैयार किया था। एक ऐसी सतह का निर्माण किया गया था जो कि बिल्कुल चांद जैसी ही थी।

चांद जितना ही प्रकाश और उस पर पड़ने वाली सूर्य की रोशनी के लिए कई स्टूडियो से बात की गई थी। कर्नाटक के चित्रदुर्गा जिले के चलकेरे में इस सतह का निर्माण किया गया था। जहां लैंडर और रोवर को टेस्ट किया गया। प्रक्षेपण से पहले लैंडर और रोवर का टेस्ट इसलिए भी काफी महत्वपूर्ण था क्योंकि चांद की सतह पर गड्ढे मिट्टी और पत्थर मौजूद है। ऐसे में क्या लैंडर के पैर उस झटके को सहन कर पाएंगे साथ ही रोवर के पहिए क्या उस सतह है पर चल पाएंगे? इन तमाम एक्सपेरिमेंट का करना काफी महत्वपूर्ण था।

इसके लिए इसरो को जरूरत थी कुछ ऐसे ही पत्थर और मिट्टी की जो कि चांद की सतह से मिलते जुलते हो। ठीक चांद की सतह जैसी मिट्टी और चट्टान के लिए इसरो ने अमेरिका के नासा से संपर्क भी किया और इस का सौदा काफी

महंगा पड़ रहा था। जिसका मूल्य $150 प्रति किलो था, यानी करीब 10000 प्रति किलो। इसरो को जरूरत थी करीब 60 टन मिट्टी चट्टान की। यानी साफ तौर पर बजट करोड़ों का किया जा रहा था।

25 करोड़ के बजट को 10 से 12 लाख में पूरा किया गया

जिसके बाद इसरो ने एक स्थानीय समाधान की तलाश की। कई भूवैज्ञानिकों ने इसरो को बताया कि तमिलनाडु में सलेम के पास नामक्कल जिले के दो गांवों में एनॉर्थोसाइट चट्टानें हैं, जो चंद्रमा की मिट्टी से 90 फ़ीसदी मिलती-जुलती है। इसरो ने चांद की मिट्टी के लिए तमिलनाडु के सीतमपोंडी और कुन्नामलाई गांवों से एनॉर्थोसाइट चट्टानों को लेने का निर्णय लिया।

चट्टानों को आवश्यक आकार में तब्दील किया गया और ज्यादातर इसके नेनोपार्टिकल्स बनाए गए। इसके बाद बेंगलुरु स्थित परीक्षण केंद्र भेज दिया गया। इस काम के लिए शुरुआती बजट 25 करोड़ रुपये था, लेकिन सेवा प्रदाता ने कुछ ना लेने के लिए यह सौदा काफी सस्ता पड़ गया। आपको बता दें कि जिस काम के लिए इसरो ने 25 करोड़ का बजट रखा था आप ये जानकर हैरान होंगे कि वह काम महज़ 10 से 12 लाख में पूरा हो गया। साथ ही कई एक्सपर्ट्स ऐसे भी थे जिन्होंने बिना सैलरी इस पर काम किया।

चंद्रमा पर सूर्य का प्रकाश जिस वेग से पड़ता है और उसकी प्रदीप्ति जितनी होती है, उसी अनुपात में परीक्षण स्थल पर रौशनी की व्यवस्था की गई। जिसके बाद इसका परीक्षण शुरू हुआ। शुरुआत में रोवर प्रज्ञान में चार पहिये लगे थे। लेकिन परीक्षण के बाद इसरो के वैज्ञानिकों ने इसे और अधिक स्थिरता देने के लिए इस में छह पहिये लगाए। कुछ बदलाव पहियों के आकार के साथ भी किए गए।

आपकों बता दें कि धरती से चांद पर गुरुत्वाकर्षण कम है यानी अगर कोई वस्तु धरती पर 100 किलो की है तो वह वस्तु चांद पर महज 17 किलो की ही होगी। यही कारण है कि जब धरती पर चंद्रमा की सतह का निर्माण किया गया तब रोवर के भार को कम करने और धरती से कम होने वाले चांद के गुरुत्व बल से तारतम्य बैठाने के लिए उसके साथ हीलियम के गुब्बारे लगाए गए।

चंद्रयान-3 मिशन की तैयारियां शुरू हुई

रोवर और लैंडर के बीच संचार क्षमताओं का परीक्षण हिंदुस्तान एयरोनॉटिक्स लिमिटेड में किया गया। इसका परीक्षण कर्नाटक के चित्रदुर्गा जिले के चल्लकेरे में किया गया। लैंडर विक्रम का परीक्षण भी कुछ इसी तरह हुआ। चांद की सतह पर सॉफ्ट लैंडिंग के दौरान इंजन शुरू होते ही चांद की सतह पर मौजूद मिट्टी और बाकी पार्टिकल उड़ेंगे और लैंडर में लगे सेंसर या सोलर पैनल पर जम सकते हैं। ऐसे में सॉफ्ट लैंडिंग के दौरान यह चुनौती सबसे बड़ी होती है।

सॉफ्ट-लैंडिंग से पहले लैंडर विक्रम के सेंसर यह जांचेंगे कि क्या उतरने वाला भूभाग सुरक्षित है या नहीं। लैंडिंग के बाद भी अगर इलाक़ा उपयुक्त नहीं है तो लैंडर वापस ऊपर उठकर पास के किसी स्थिर जगह पर लैंड कर सकता है या नहीं। इसरो टीम ने एनआरएससी (नेशनल रिमोट सेंसिंग सेंटर) के बनाए गए सेंसर को छोटे प्लेन में लगाया और सेंसर की जांच करने के लिए इसे दो बार कृत्रिम सतह के ऊपर उड़ाया।

जिससे कि यह पता लगाया जा सके कि जब सॉफ्ट लैंडिंग होगी तो उससे पहले लेंडर के सेंसर चांद की सतह को सही से पढ़ पाते हैं या नहीं। जिससे वास्तविक रूप से उतरने में लैंडर को कोई दिक्कत न आए। लैंडर के एक्युटेटर्स महेंद्रगिरि के इसरो सेंटर में जांचे गए। यहीं इसके थ्रस्टर्स की भी जांच की गई। लैंडर के पैर की दो परिस्थितियों में जांच की गई। एक उतरते समय इंजन बंद करके और दूसरा इंजन चालू रहते।

जिस तरह से चंद्रयान 2 मिशन के लिए यह तमाम तैयारियां की गई कुछ उसी तर्ज पर अब चंद्रयान-3 मिशन के लिए भी तैयारियां की जा रही है। हर एक पेलोड को उसी तरह से जाना और परखा जाएगा जो कि चंद्रयान-2 मिशन में किया गया था।

https://www.abplive.com/news/india/isro-is-preparing-artificial-lunar-surface-for-chandrayaan-3-mission-lander-and-rover-to-be-tested-ann-1542492

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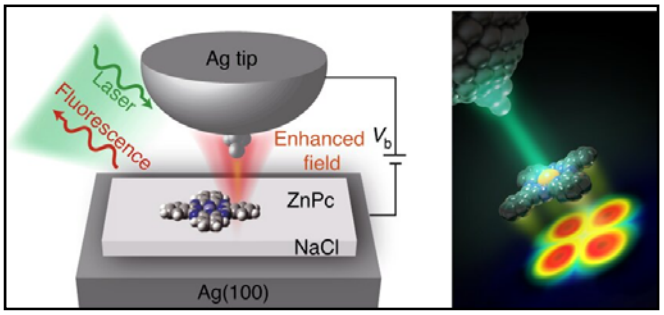
Sat, 29 Aug 2020

Optical imaging enters sub-nanometer era

Prof. Dong Zhenchao and Prof. Hou Jianguo from the University of Science and Technology of China (USTC) of the Chinese Academy of Sciences (CAS) have improved the spatial resolution from 8 nm to ~8 Å of photoluminescence imaging. This has realized sub-molecular resolution with single molecule photofluorescence imaging for the first time.

This study was published in *Nature Photonics* on August 10.

To reach atomic resolution with light has always been one of the ultimate goals in nano-optics, and the advent of scanning near-field optical microscopy (SNOM) kindled hopes for thus goal.



chematic of the experimental set-up for single-molecule photoluminescence imaging with sub-nanometer resolution. Credit: Yang Ben, Huang Wen et al.

Prof. Dong and his colleagues successfully demonstrated sub-nanometer scale spatial resolution in single-molecule Raman spectroscopy imaging with local enhancement effect of a nanocavity plasmon field in a study in 2013.

However, unlike the Raman scattering process, fluorescence will be quenched in the very immediate vicinity of metals which stop the resolution development of SNOM at around 10 nm.

The radiation properties (fluorescence) of molecules in the metal nanocavity are directly affected by the photon density of the nanocavity, and the photon density of the nanocavity is closely related to the structure of the probe tip. Therefore, it is key to modify the structure of the probe and the electronic state of the molecules in the nanocavity to avoid the fluorescence quenching and achieve high-resolution photofluorescence imaging.

Dong's team further fine-tuned the plasmon nanocavity, especially in the fabrication and control of the atomic-level structure of the probe tip. They constructed an Ag tip apex with an atomistic protrusion and matched the nanocavity plasmon resonance with the effective energy of the incident laser and molecular luminescence.

Then, the researchers used an ultra-thin dielectric layer (three-atom-thick NaCl) to isolate the charge transfer between the nanocavity molecules and the metal substrate, achieving sub-nanometer resolution of the single-molecule photoluminescence imaging.

They found that with the probe approaching the molecule, even if their distance is less than 1 nm, the intensity of photoluminescence continues increasing monotonously. And the fluorescence quenching disappears completely.

Theoretical simulations showed that when the atomistic protrusion tip and the metal substrate form a plasmon nanocavity, the resonance response of the nanocavity plasmon and the lightning rod effect of the atomistic protrusion structure would have a synergistic effect. The synergistic effect generates a strong and highly localized electromagnetic field compressing the cavity mode volume to below 1 nm^3, which greatly increases the localized photon density of states and the molecular radiation decay rate. These effects not only inhibit the fluorescence quenching, but also realize sub-nanometer-resolution photoluminescence imaging.

To achieve sub-nanometer spatial resolution, the size of the tip and the distance between the tip and the sample must be on the sub-nanometer scale.

The researchers further realized sub-molecular-resolved photoluminescence hyperspectral imaging with spectral information, and demonstrated the effects of local plasmon-exciton interaction on fluorescence intensity, peak position and peak width on the sub-nanometer scale.

This research achieved the long-awaited goal of using light to analyze the internal structure of molecules in SNOM, and provided a new technical method for detecting and modulating the localized environment of molecules and light-matter interactions on the sub-nanometer scale.

The reviewers of *Nature Photonics* say that this paper will be an important article in its field, which has guiding significance for carrying out ultra-sensitive spectroscopic microscopy research with atomic-scale light.

More information: Ben Yang et al, Sub-nanometre resolution in single-molecule photoluminescence imaging, *Nature Photonics* (2020). DOI: 10.1038/s41566-020-0677-y

Journal information: *Nature Photonics*

https://phys.org/news/2020-08-optical-imaging-sub-nanometer-era.html

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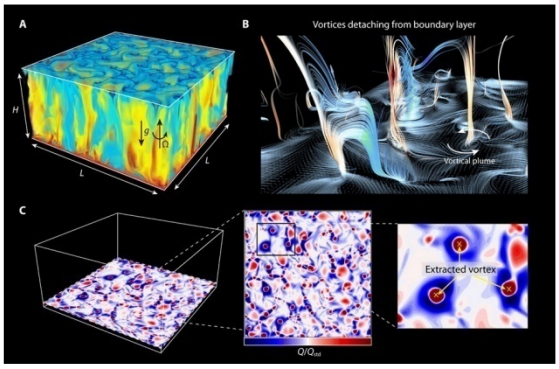
Sat, 29 Aug 2020

Demonstrating vortices as Brownian particles in turbulent flows

By Thamarasee Jeewandara

Brownian motion of particles in fluid is a common collective behavior in biological and physical systems. In a new report on *Science Advances*, Kai Leong Chong, and a team of researchers in physics, engineering, and aerospace engineering in China, conducted experiments and numerical simulations to show how the movement of vortices resembled inertial Brownian particles. During the experiments, the rotating turbulent convective vortical flow allowed the particles to move ballistically at first and diffusively after a critical time in a direct behavioral transition—without going through a hydrodynamic memory regime. The work implies that convective vortices have inertia-induced memory, so their short-term movement was well-defined in the framework of Brownian motion here for the first time.

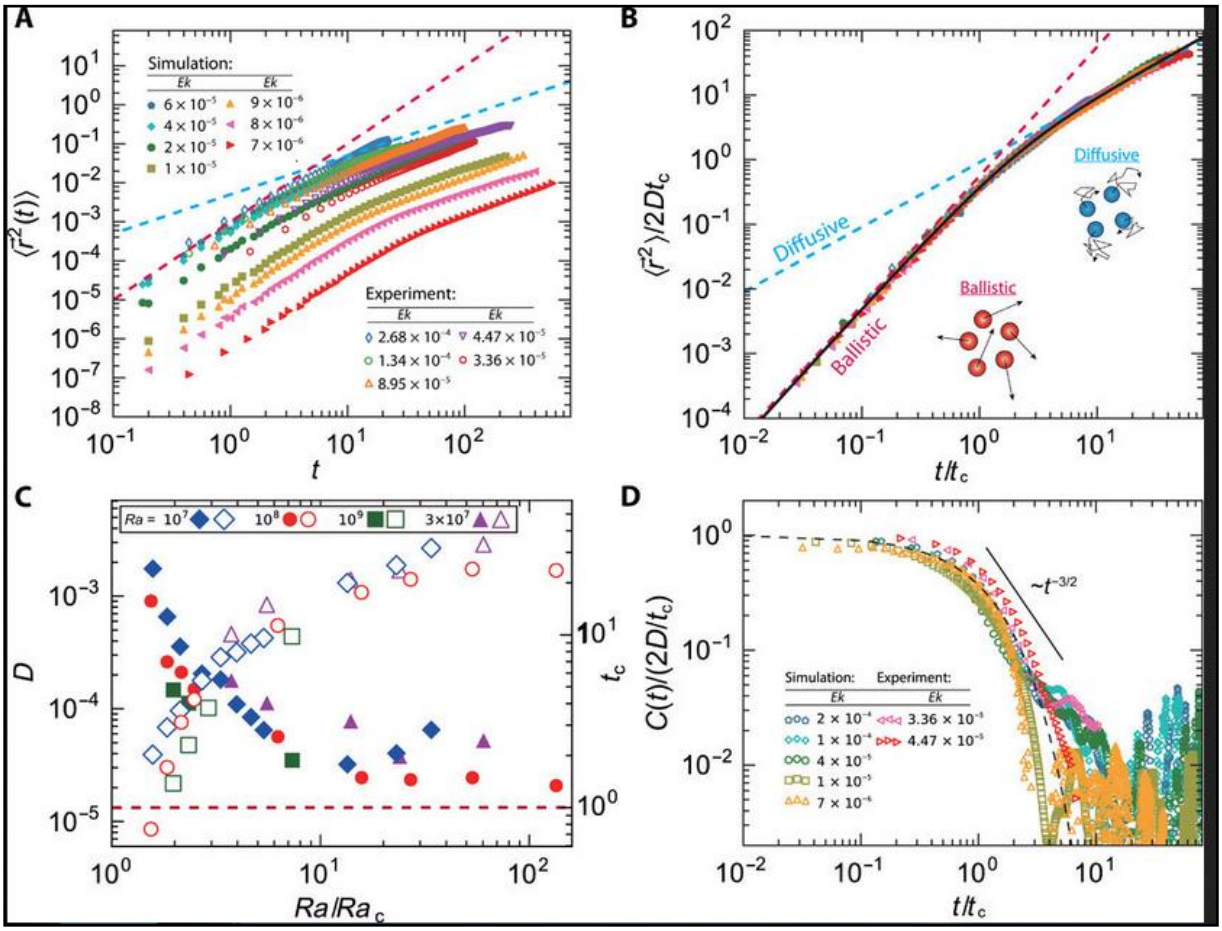


Flow structures with rotation. Snapshots of (A) the temperature θ and (B) streamlines originating from the lower thermal boundary layer. (C) Snapshots of Q/Qstd (Q-criterion) taken horizontally at the edge of thermal boundary layer for Ekman number (Ek) = 4 × 10−5 and Ra = 108 and a demonstration of the extracted vortex. The locations of vortex center are marked as yellow crosses. Credit: Science Advances, doi: 10.1126/sciadv.aaz1110

Brownian motion

Albert Einstein first provided a theoretical explanation to Brownian motion in 1905 with the movement of pollen particles in a thermal bath, the phenomenon is now a common example of stochastic processes that widely occur in nature. Later in 1908, Paul Langevin noted the inertia of particles and predicted that their motion would be ballistic within a short period of time, changing to diffuse motion after a specific timeline. However, due to the rapidity of this transition, it took more than a century for researchers to be able to directly observe the phenomenon. Nevertheless, the "pure" Brownian motion predicted by Langevin was not observed in liquid systems and the transition spanned a broad range of time scales. The slow and smooth transition occurred due to the hydrodynamic memory effect, to ultimately generate long-range correlations. Scientists had previously observed the hydrodynamic memory effect in multiple systems including colloidal suspensions, particles suspended in air and particles trapped in optical tweezers. In this work, Chong et al. showed how vortices in highly connective flows behaved as inertial particles to perform pure Brownian motion, for the first time, without being influenced by the hydrodynamic effect. They identified and extracted the vortices using the Q-criterion (a method for vortex

identification). The work will help them predict the vortex motion during a specific period of time in astrophysical and geophysical systems.



Ballistic to diffusive motion of convective vortices. (A) The MSD of the vortices as a function of time. (B) Normalized MSD as a function of t/tc. The solid line represents a fit of Eq. 4 to the data. In both (A) and (B), solid symbols denote numerical results at Ra = 1 × 108, and open symbols denote experimental results at Ra = 3 × 107. (C) Diffusion coefficient D of vortices (open symbols) and the characteristic time scale tc for motion transition (solid symbols) as a function Ra/Rac. (D) Velocity autocorrelation function (VACF) versus t/tc for different Ek. The dashed line represents C(t)=2Dtcexp(−t/tc). The solid line indicates a power law decay for the VACF (data for t ≳ 5tc have some scatter owing to insufficient statistics). Note that all the physical quantities are made dimensionless as described in the main text. Credit: Science Advances, doi: 10.1126/sciadv.aaz1110

Rotating Raleigh Bernard convection and horizontal motion of the vortices

An existing challenge in astrophysical and geophysical research is to predict the movement of vortices within a specific period of time. Chong et al. used a model system to study vortices in convective flows known as the Rayleigh Benard (RB) convection, which includes a fluid layer of fixed height, heated from below and cooled from above, while being rotated about the vertical axis at an angular velocity. The temperature difference in the system destabilized the flow for convection to occur when the thermal drive was sufficiently strong. The scientists used three dimensionless parameters to characterize the flow dynamics, including the Rayleigh number (Ra), Prandtl number (Pr) and the Ekman number (Ek). In the presence of rotation, vortical structures emerged as fluid parcels spiralling up or down. Researchers continue to investigate such vortical plumes due to their importance in momentum and heat transport.

Chong et al. first studied the motion of vortices by tracking their positional change via a series of snapshots. They characterized the statistical behavior of the vortices using their mean squared displacement (MSD). The MSD values for different Ek and Ra exhibited similar behavior indicating that in a short time frame the vortex motion transferred from ballistic motion to diffusive motion. This transition resembled Brownian motion in a thermal bath. The scientists therefore treated the vortices as Brownian particles and described their motion by solving the Langevin equation to obtain their MSD. The results implied similar dynamics of vortex motion for Ra and

Ek, suggesting that the vortices exhibited "pure Brownian" behavior. In the convection system, vortices carried fluid parcels that were hotter and colder than the surrounding fluid; this relatively small density difference caused by temperature variations in the experiment gave rise to the notable ballistic behavior.

Vortex distribution

Despite Brownian-like motion, the spatial distribution of the vortices was not random, and exhibited patterned structures, which the scientists obtained using snapshots of several rotation rates. As the Ekman number (Ek) varied, several changes occurred in vortex distribution. At first, the number of vortices increased with the rate of rotation, so that the initially dilute and randomly distributed vortices became highly concentrated and clustered. The increasing vortex number density with the rotation rate also agreed with previous investigations. Next, when the rotation rate became sufficiently high, they formed a vortex-grid structure. When Chong et al. zoomed into a local region to observe the highest rotation rate, they observed a regular pattern for such vortex-grid structures. The reddish regions of the vortices formed a square lattice and the in-between bluish localized regions showed high strain behavior. The team credited the square patterns observed in the work to different boundary settings and control parameters.

Despite random motion in the temporal domain, the vortices showed a specific spatial order, which resulted in an apparent contradiction. Chong et al. observed the trajectories of vortices during slow and fast rotation. However, the vortices did not travel far enough to "see" or interact with other vortices. They credited the spatial order of the vortices to the competition between the two dynamic processes characterized by the vortex's relaxation time scale and Brownian time scale, respectively.

In this way, Kai Leong Chong and colleagues showed how the motion of vortices in rotating thermal convection resembled inertial particles performing Brownian motion. The motion underwent a sharp transition from ballistic to diffusive regions without experiencing an intermediate hydrodynamic memory region. The observation of pure Brownian motion was first predicted by Paul Langevin, although it was not previously observed in practice for inertial particles in liquid systems. The work highlighted existing classical theoretical work that showed how passive traces exhibited a transition from ballistic to diffusive behavior, similar to the experimental observations of this study. The observed pure Brownian motion also indicated the insignificance of the hydrodynamic memory effect. Chong et al. considered the Coriolis force during the study due to its relevance in vortex formation in natural phenomena, including tropical cyclones in the atmosphere, ocean vortices and the long-lived giant red spot in Jupiter. The findings will influence many situations in astrophysics, geophysics and meteorology.

More information: Kai Leong Chong et al. Vortices as Brownian particles in turbulent flows, *Science Advances* (2020). DOI: 10.1126/sciadv.aaz1110

Einstein, A. Investigations on the theory of the brownian movement. *Annalen der Physik*, www.maths.usyd.edu.au/u/UG/SM/ … /r/Einstein_1905.pdf

Rongxin Huang et al. Direct observation of the full transition from ballistic to diffusive Brownian motion in a liquid, *Nature Physics* (2011). DOI: 10.1038/nphys1953

Journal information: *Science Advances* , *Nature Physics*

https://phys.org/news/2020-08-vortices-brownian-particles-turbulent.html

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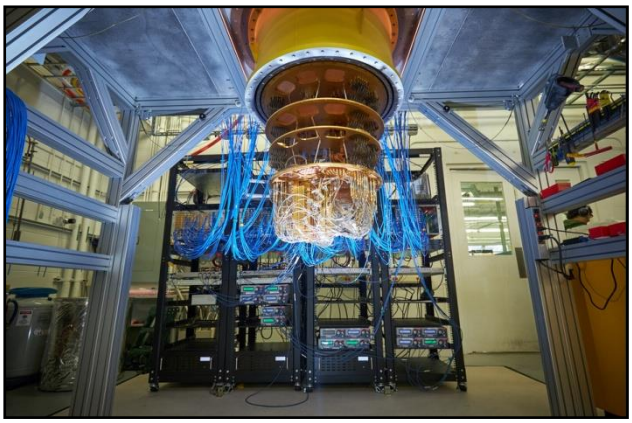
Sat, 29 Aug 2020

Google conducts largest chemical simulation on a quantum computer to date

By Bob Yirka

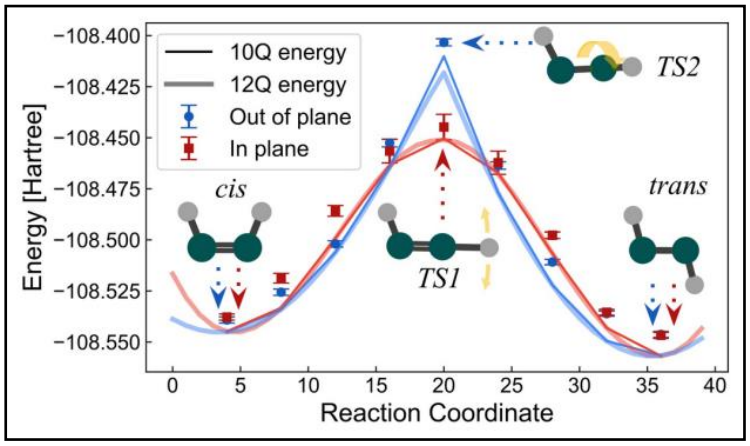
A team of researchers with Google's AI Quantum team (working with unspecified collaborators) has conducted the largest chemical simulation on a quantum computer to date. In their paper published in the journal *Science*, the group describes their work and why they believe it was a step forward in quantum computing. Xiao Yuan of Stanford University has written a Perspective piece outlining the potential benefits of quantum computer use to conduct chemical simulations and the work by the team at AI Quantum, published in the same journal issue.

Developing an ability to predict chemical processes by simulating them on computers would be of great benefit to chemists—currently, they do most of it through trial and error. Prediction would open up the door to the development of a wide range of new materials with still unknown properties. Sadly, current computers lack the exponential scaling that would be required for such work. Because of that, chemists have been hoping quantum computers will one day step in to take on the role.



Google's Sycamore processor mounted in a cryostat, recently used to demonstrate quantum supremacy and the largest quantum chemistry simulation on a quantum computer. Credit: Rocco Ceselin

Current quantum computer technology is not yet ready to take on such a challenge, of course, but computer scientists are hoping to get them there sometime in the near future. In the meantime, big companies like Google are investing in research geared toward using quantum computers once they mature. In this new effort, the team at AI Quantum focused their efforts on simulating a simple chemical process—the Hartree-Fock approximation of a real chemical system—in this particular case, a diazene molecule undergoing a reaction with hydrogen atoms, resulting in an altered configuration.



Energy predictions of molecular geometries by the Hartree-Fock model simulated on 10 qubits of the Sycamore processor. Credit: Google

Figuring out how to program Google's Sycamore quantum system was not difficult—the hard part was figuring out how to ensure the results were accurate—quantum computers are notoriously prone to errors. Validation was the real achievement of the AI Quantum team. They did it by pairing the quantum system with a classical computer. It was used to analyze the results given by the Sycamore machine and then to provide new parameters. This process was repeated until the quantum computer worked its way to a minimum value. The team also used two other checking systems, both geared toward calculating results to spot and fix errors.

More information: Hartree-Fock on a superconducting qubit quantum computer, *Science* 28 Aug 2020: Vol. 369, Issue 6507, pp. 1084-1089, DOI: 10.1126/science.abb9811, science.sciencemag.org/content/369/6507/1084

Google blog: ai.googleblog.com/2020/08/scal … amental-quantum.html

Journal information: *Science*

https://phys.org/news/2020-08-google-largest-chemical-simulation-quantum.html

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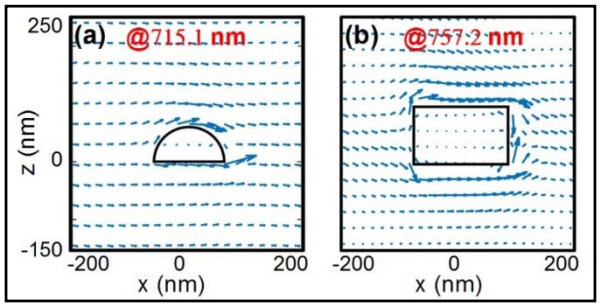
Sat, 29 Aug 2020

Round nanoparticles improve quality factors of surface lattice resonances

Plasmonic surface lattice resonances (SLRs) supported by metal nanoparticle arrays have many merits such as strong field enhancements extended over large volumes, as well as long lifetimes, narrow linewidths, angle-dependent dispersion, and a wide range of wavelength tunability.

In order to improve the performance of SLR-based nanophotonic devices such as nanolasers, nonlinear optical devices, and optical sensors, much effort has been put into improving SLR quality factors.

A research group led by Dr. Li Guangyuan from the Shenzhen Institutes of Advanced Technology (SIAT) of the Chinese Academy of Sciences has found that nanohemisphere arrays can significantly improve the quality factors of SLRs.



An energy flux propagates along a surface and bypasses the nanoparticle at SLR. The hemisphere shape introduces weaker perturbations than the rod shape, resulting in much lower loss and a much higher quality factor. Credit: SIAT

The group's study, entitled "Exceptionally narrow plasmonic surface lattice resonances in gold nanohemisphere array," was published in the *Journal of Physics D: Applied Physics* on August 24.

In previous studies, SLRs were supported mainly by periodic metal nanorods. According to a recent review, the quality factors of such SLRs are ~150 for visible light, ~300 for telecom wavelengths, and ~500 for the midinfrared regime, respectively.

Although the lattice shape is vital for quality factors, studies involving various geometries did not lead to an anticipated remarkable narrowing of localized surface plasmon resonances (LSPRs) associated with these particles.

In this study, the researchers investigated SLRs supported by a 2-D periodic nanohemisphere array embedded in a symmetric dielectric environment. Their simulation results showed that out-of-plane SLRs can have an ultra-narrow resonant linewidth (~0.9 nm) at visible wavelengths around 715 nm.

This result corresponded to an exceptionally high quality factor of 794, which was an order of magnitude larger than that of widely adopted nanorods.

In addition, the team also showed how to achieve high quality factors based on detuning between the Rayleigh anomaly and the LSPR of an isolated nanoparticle.

"The energy flux propagates along the surface and bypasses the nanoparticle, which mimics a stream bypassing a stone," said Dr. Li Guangyuan. "We all know that a round stone introduces weaker perturbations. This inspired us to replace nanorods with nanohemispheres."

The researchers are now continuing to fabricate 2-D nanohemisphere array patterns with controlled feature size and shape, which is challenging but feasible.

They believe that SLRs supported by a 2-D nanohemisphere array, featuring much higher quality factors than nanorods, will be attractive in diverse applications, including nanolasers, nonlinear optics, and ultrasensitive sensing.

More information: Xiuhua Yang et al, Exceptionally narrow plasmonic surface lattice resonances in gold nanohemisphere array, *Journal of Physics D: Applied Physics* (2020). DOI: 10.1088/1361-6463/aba1ae

Journal information: *Journal of Physics D: Applied Physics*

https://phys.org/news/2020-08-nanoparticles-quality-factors-surface-lattice.html

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Sat, 29 Aug 2020

Scientists find direct evidence of thickening organic film at soil-water micro-interfaces

By Li Yuan

Soil organic matter is essential for the maintenance of soil fertility, absorption of pollutants and mitigation of global climate change. In the past few decades, the long-term protection mechanism of organic matter in soil and sediment has been extensively studied.

Revealing the intrinsic relationship and nature between microorganisms, organic matter and minerals in the soil microenvironment may be the key to understanding the biogeochemical cycle of soil organic matter.

Credit: CC0 Public Domain

Soil aggregates are the basic skeleton of soil, and their surface is considered to be the hot spot of microbial-organic matter-mineral interaction.

Prof. Wu Jinshui from the Institute of Subtropical Agriculture (ISA) of the Chinese Academy of Sciences and Prof. Liu Bifeng from Huazhong University of Science and Technology applied soilchip technology that overcomes soil micro-heterogeneity at a certain scale. It achieved dynamic continuous monitoring of soil-water micro-interface processes for the first time.

On this basis, they further systematically studied the transformation of organic matter in the typical mollisol soil-water micro-interface and the dynamic coupling process of the solution microenvironment.

Combining X-ray photoelectron spectroscopy and ion sputtering on soil microarrays incubated with a predefined solution (SoilChips), they provided the first direct evidence that a nanoscale organic film with a distinct composition and thickness gradually formed at the soil-water interface (SWI) within 21 days of cultivation.

Although the organic coatings on the soil-water micro-interfaces quickly reached equilibrium within four days, the formation of thicker mineral-organic association (MOA, 20-130 nm) and microbial biomass (>130 nm) continued, partially at the cost of the thin MOA (<20 nm).

Consistent with the thickening organic film, the bioavailability of nutrients (dissolved organic carbon and ammonium) decreased gradually over 21 days, which restrained the microbial activities.

Thickening SWIs acted as a biogeochemical gate to regulate the bioavailability of specific organic compounds and determine their preservation or microbial mineralization.

Further, thickening SWIs in the z-axis direction provided direct structural insight to increase carbon sequestration in soil and sediment.

The research was published in *Environmental Science: Nano*.

More information: Xizhi Huang et al. Direct evidence for thickening nanoscale organic films at soil biogeochemical interfaces and its relevance to organic matter preservation, *Environmental Science: Nano* (2020). DOI: 10.1039/D0EN00489H

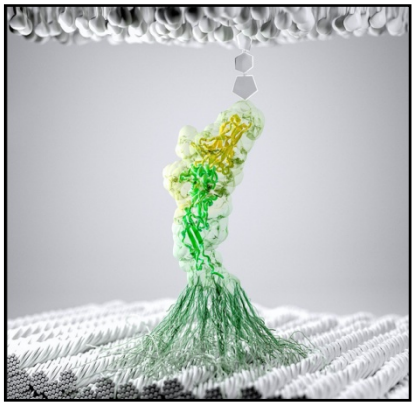
https://phys.org/news/2020-08-scientists-evidence-thickening-soil-water-micro-interfaces.html

PHYS.ORG

Sat, 29 Aug 2020

How bacteria adhere to fiber in the gut

Researchers have revealed a new molecular mechanism by which bacteria adhere to cellulose fibers in the human gut. Thanks to two different binding modes, they can withstand the shear forces in the body. Scientists of the University of Basel and ETH Zurich published their results in the journal *Nature Communications*.



Depiction of a gut bacteria attached to cellulose fibers through adhesion proteins on the bacterial surface. Cohesin (yellow) and Dockerin (green) assemble into a protein complex in two possible configurations, referred to as dual binding modes. The complex is activated by mechanical tension, which strengthens it and facilitates bacterial adhesion to fibers under shear flow. Credit: University of Basel, Department of Chemistry

Cellulose is a major building block of plant cell walls, consisting of molecules linked together into solid fibers. For humans, cellulose is indigestible, and the majority of gut bacteria lack the enzymes required to break down cellulose.

However, recently genetic material from the cellulose-degrading bacterium R. champanellensis was detected in human gut samples. Bacterial colonization of the intestine is essential for human physiology, and understanding how gut bacteria adhere to cellulose broadens our knowledge of the microbiome and its relationship to human health.

The bacterium under investigation uses an intricate network of scaffold proteins and enzymes on the outer cell wall, referred to as a cellulosome network, to attach to and degrade cellulose fibers. These cellulosome networks are held together by families of interacting proteins.

Of particular interest is the cohesin-dockerin interaction responsible for anchoring the cellulosome network to the cell wall. This interaction needs to withstand shear forces in the body to adhere to fiber. This vital feature motivated the researchers to investigate in more detail how the anchoring complex responds to mechanical forces.

By using a combination of single-molecule atomic force microscopy, single-molecule fluorescence and molecular dynamics simulations, Professor Michael Nash from the University of Basel and ETH Zurich along with collaborators from LMU Munich and Auburn University studied how the complex resists external force.

Two binding modes allow bacteria to stick to surfaces under flow

They were able to show that the complex exhibits a rare behavior called dual binding mode, where the proteins form a complex in two distinct ways. The researchers found that the two binding modes have very different mechanical properties, with one breaking at low forces of around 200 piconewtons and the other exhibiting a much higher stability breaking only at 600 piconewtons of force.

Further analysis showed that the protein complex displays a behavior called a "catch bond," meaning that the protein interaction becomes stronger as force is ramped up. The dynamics of this interaction are believed to allow the bacteria to adhere to cellulose under shear stress and release the complex in response to new substrates or to explore new environments.

"We clearly observe the dual binding modes, but can only speculate on their biological significance. We think the bacteria might control the binding mode preference by modifying the proteins. This would allow switching from a low to high adhesion state depending on the environment," Professor Nash explains.

By shedding light on this natural adhesion mechanism, these findings set the stage for the development of artificial molecular mechanisms that exhibit similar behavior but bind to disease targets. Such materials could have applications in bio-based medical superglues or shear-enhanced binding of therapeutic nanoparticles inside the body. "For now, we are excited to return to the laboratory and see what sticks," says Nash.

More information: Zhaowei Liu et al. High force catch bond mechanism of bacterial adhesion in the human gut, *Nature Communications* (2020). DOI: 10.1038/s41467-020-18063-x

Journal information: *Nature Communications*

https://phys.org/news/2020-08-bacteria-adhere-fiber-gut.html

COVID-19 Research News

ScienceDaily

Sat, 29 Aug 2020

Study explains multipronged SARS-CoV-2 attack and widepread COVID-19 infection

Summary:
A study of a gateway receptor for SARS-CoV-2 may help explain the wide variety of symptoms and organs involved with SARS-CoV-2 infection and COVID-19. The results suggest that a multi-organ infection with SARS-CoV-2 may be via the angiotensin-converting enzyme 2 (ACE2) receptor, which is found almost everywhere throughout the body.

A study of a gateway receptor for SARS-CoV-2 led by Walter Lukiw, PhD, Professor of Neuroscience, Neurology and Ophthalmology at LSU Health New Orleans' Neuroscience Center of Excellence and School of Medicine, may help explain the wide variety of symptoms and organs involved with SARS-CoV-2 infection and COVID-19. The results suggest that a multi-organ infection with SARS-CoV-2 may be via the angiotensin-converting enzyme 2 (ACE2) receptor, which is found almost everywhere throughout the body. The findings are published in the journal *Cellular and Molecular Neurobiology*.

To better understand the mechanism and pathways of SARS-CoV-2 infection and susceptibility to specific cell and tissue types as well as organ systems, the research team analyzed 85 human tissues for the presence of ACE2 receptors. ACE2 is a protein that is found on the surface of many immune and nonimmune cell types. An enzyme, it is part of the system that regulates blood pressure and fluid and electrolyte balance. It may also help regulate cardiovascular, neurovascular and renal function, as well as fertility. ACE2 receptors act like locks on cells, and the SARS-CoV-2 spike proteins act like keys that open the locks letting the virus enter cells to rapidly multiply. As well as controls, tissues tested included lung, digestive, renal-excretory, reproductive, eye tissues, and 21 different regions of the brain.

"Besides strong ACE2 expression in respiratory, digestive, renal-excretory and reproductive cells, high ACE2 expression was also found in the amygdala, cerebral cortex and brainstem," reports Dr. Lukiw. "This may help explain cognitive deficits associated with SARS-CoV-2 infection. Some of the highest ACE2 expression levels were found in the pons and medulla

oblongata in the human brainstem, an anatomical region of the brain containing the medullary respiratory centers, and this may in part explain the susceptibility of many CoV-19 patients to severe respiratory distress."

The team further noted that ACE2 receptor activity was also easily detected in the eye, suggesting that the visual system may provide an additional entry point for SARS-CoV-2 invasion and that under certain conditions, eyeglasses or face shields may be as important as face masks in reducing SARS-CoV-2 transmission and infection.

"Several important research gaps remain," Lukiw concludes. "A real danger of SARS-CoV-2 infection is not only its highly transmissible and contagious nature and lethality, but also its simultaneous and multipronged attack on many human cell and tissue types involving vital and critical respiratory, immunological, vascular, renal-excretory and neural systems as well as an unprecedented coordinated disruption of the complex neurophysiology, neurochemistry, neurobiology and neurology of the cells of the brain and central nervous system (CNS) that normally regulate these multiple physiological systems."

The authors credit the late Dr. James M. Hill (formerly a Professor in the Departments of Microbiology, Ophthalmology and Pharmacology at LSU Health New Orleans School of Medicine) with whom they had a longstanding research collaboration on the expression of the ACE2 receptors, including those found in the Alzheimer's disease brain. Aileen Pogue, from Alchem Biotech Research in Toronto, also participated in the research data tabulation, bioinformatics and statistical analysis.

The research was supported by grants from Research to Prevent Blindness (RPB); the Louisiana Biotechnology Research Network (LBRN); and NIH grants NEI EY006311, NIA AG18031 and NIA AG038834.

Story Source:

Materials provided by **Louisiana State University Health Sciences Center**. *Note: Content may be edited for style and length.*

Journal Reference:

1. Walter J. Lukiw, Aileen Pogue, James M. Hill. **SARS-CoV-2 Infectivity and Neurological Targets in the Brain**. *Cellular and Molecular Neurobiology*, 2020; DOI: 10.1007/s10571-020-00947-7

https://www.sciencedaily.com/releases/2020/08/200828115353.htm

NEWS CLICK

Sat, 29 Aug 2020

COVID-19: New research may improve plasma therapy significantly

Aside from finding a new antibody named EY6A, the study, published in Nature, also revealed how the novel coronavirus could be cornered

By Sandipan Talukdar

Some countries in the world have been using convalescent blood plasma therapy to treat critically ill COVID-19 patients. The process entails blood plasma, collected from patients recovering from the disease, being injected into those who are critical. The antibodies in the blood plasma of the recovering or convalescent patients can neutralise the virus in those who are suffering.

However, this form of therapy is facing apprehensions. Firstly, it lacks evidence of wide-scale benefit from large randomised studies. Moreover, placebo control studies are also lacking.

A new finding, which has been published in the science journal *Nature*, however, has brought forth some encouragement. A team of researchers have isolated an antibody named EY6A from

recovering patients. They also found a new and highly conserved site of the SARS-CoV-2 virus, one which that causes COVID-19. The isolated antibody can bind at this conserved site and neutralise the virus.

This finding has two-fold values. It has found new targets which antibodies can bind to and neutralise the virus. When we have limited sites of the virus that can be latched onto by an antibody, then there might be a situation where some antibodies may not bind to those specific targets, lessening chances of the neutralisation of the virus. Secondly, finding new antibodies is also encouraging. The greater variety of the neutralising antibodies there are, the more chances we have of restricting the novel coronavirus.

The benefits also have implications for viral mutations. Mutations may give the virus the ability to change its structure and evade some of the antibodies that previously could neutralise it, as a result. A greater variety of virus sites and antibodies could prove to be effective in overpowering the mutational changes of the virus.

In convalescent blood plasma therapy, antibodies are collected from recovering patients. In this context, convalescence means the period between the patient testing negative and the time to taken to recover fully. Within the period, the amount of antibody in the blood is at a maximum.

“This finding is valuable because it comes from a real patient who had the virus. And the discovery of this new target means that more effective combination therapies which attack the virus at different points are now possible,” Professor Dave Stuart, Professor of Structural Biology at the University of Oxford, was quoted saying. “Increasing the number of target sites that can be blocked on SARS-CoV-2 also means there is a lower probability that mutations preventing the antibody binding will compromise treatments. Even if one binding site mutates and can no longer be neutralized, the second binding site can still prevent infection,” he added.

One of the major concerns about the antibody therapy is that if it is used more rigorously, it might lead to a mutation of the virus, thus rendering the therapy useless. The new research found that the target site of the virus is highly conserved. It means that the amino acid sequence of the proteins present in the target site are same for almost all the viruses sequenced as of now. The highly conserved site means that different mutated forms of the virus do not want a change in it and it is highly possible that a change in this site would negatively impact the virus. The EY6A antibody can bind to this site and neutralise it, thus becoming a very suitable and safe candidate for antibody therapy. The antibody therapy needs more randomised control trials to decide on its efficacy and the research might prove to be significant.

https://www.newsclick.in/COVID-19-New-Research-May-Improve-Plasma-Therapy-Significantly

livemint

Sun, 30 Aug 2020

Covid-19 vaccine trials in India: Govt reviews status. 10 things to know

Edited By Aparna Banerjea

- ***An approved vaccine is likely to hit the Indian market by the first quarter of 2021, Bernstein said in a report***
- ***The Oxford vaccine candidate developed by Serum Institute of India is already in Phase III trial in Maharashtra and some other states, the government says in a statement***

The government of India today reviewed the status of Covid-19 vaccine trials going on in the country. There are currently three vaccines in different phases including Covaxin by Bharat Biotech Vaccine, which is India's first indigenous vaccine against the novel coronavirus. It is being developed in collaboration with Indian Council of Medical Research (ICMR).

India's first Covid-19 vaccine, Covaxin, is currently in the second phase of clinical trials, the government stated. Through partnerships, India has access to two other vaccine candidates in the country – AZ/Oxford's viral vector vaccine and Novavax's protein subunit vaccine.

Here are the 10 major updates on the status of the Covid-19 vaccines development and trials:

1. Niti Aayog's Dr Vinod K Paul, who is the Chairperson of the Empowered Group-1 on Medical Emergency management plan apprised government of the process of COVID vaccine development in India and around the world.
2. Dr Paul stated that globally, 29 candidates, including two Indian ones, are in clinical trials. Out of these, six such vaccines are in phase 3.
3. In India, Bharat Biotech's vaccine candidate based on inactivated virus procured by ICMR is in Phase II trial along with ZydusCadila's candidate which is based on viral DNA.
4. ICMR, which is collaborating with the pharma company for development of the vaccine, has chosen 12 medical institutes in the country where the trial would be conducted.
5. The Oxford Covid-19 vaccine candidate developed by Serum Institute of India is already in Phase III trial in Maharashtra and some other states. The ICMR had earlier stated that Oxford's 'Covidshield' vaccine is in phase 2 (b) and phase 3 trials.
6. Pune-based drug maker has selected 17 sites in India to conduct the trial. A total of 1,600 candidates will take part in the study, out of which at least five volunteers have already been inoculated with "Covishield" vaccine in the past two days.
7. The government was also briefed about the National Expert Group on Vaccine Administration for COVID-19. The group is tasked with facilitation of vaccine development including issues of trial and stockpiling, sorting out issues of financing, risk-management, selection of potential beneficiaries and their order of reference, envisioning logistics, scale up, digital system, defining principles for selecting beneficiary categories, and defining scientific basis for selecting vaccine. Three meetings of the Expert Group have been held so far.
8. In the meantime, an approved vaccine is likely to hit the Indian market by the first quarter of 2021, Bernstein said in a report.
9. "Phase I/II data looks promising for both in terms of safety and the vaccine's ability to elicit an immune response," it said. "We are optimistic that there will be an approved vaccine in the market by 1Q calendar year 2021 in India," the report stated.
10. Meanwhile, India's COVID-19 tally raced past 34 lakh with a single-day spike of 76,472 cases, while the number of recoveries surged to 26,48,998, pushing the recovery rate to 76.47% on Saturday, according to the Union health ministry. However, the case fatality rate has further declined to 1.81% in the country. "India has one of the lowest global COVID-19 fatality rates," states Union Health Minister Dr Harsh Vardhan during the meeting.

https://www.livemint.com/news/india/covid-19-vaccine-trials-in-india-govt-reviews-status-10-things-to-know-11598698086218.html