

# समाचार पत्रों से चयित अंश Newspapers Clippings

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Sat, 09 Nov 2019

## **New DRDO's center to focus on critical ignition technology**

The new complex of DRDO was inaugurated by MoS (defense) Mr. Shripad Naik at the High Energy Materials Research Laboratory (HEMRL) in Pune.

The facility is situated in the ignition complex at the laboratory and is of crucial importance to the DRDO's ignition research that it has been doing for various missiles, and its pet project, the Kaveri Engine.

Ignition is a highly critical aspect in the ignition chain of rocket motors, and to develop advanced missile systems, the organization needs to build on the advances made in the past to count for the future.

The collaboration with HEMRL is of superior importance to the DRDO as the lab has previously as well developed composite fuels and oxidizers to compliment the ignition process of rocket motors and advanced missile delivery systems.

The lab has also pioneered research in the usage of organic binders in the production of several ignition technologies to produce reliable ignition points and making sure that the motor delivers rather than failing.

The binder structure used by the lab to produce the oxidizers has been highly relevant from the point of understanding the structural integrity of these organic compounds to support the process involved in advanced delivery mechanisms and how innovatively a better alternative to synthetic additives can be used in such applications.

The inauguration also has come for a crucial time for DRDO as the organization is struggling to get its project the Kaveri Engine of the ground. The project has had undergone a lot of development but the premier institute in the country hasn't been able to deliver on the promises it made before the start of the project, French aviation giants Dassault have agreed to partner the project in lieu of the offset obligations that have been applied on them for the purchase of the Rafale jets that India have bought directly in flyaway conditions from the French manufacturer.

<https://www.industryglobalnews24.com/new-drdo-center-to-focus-on-critical-ignition-technology>



Sun, 10 Nov 2019

## IAF to sign contract this fiscal to procure 83 LCAs

The Light Combat Aircraft Tejas (LCA) Mark-1A and Mark-2 and 114 new fighter jets to be procured will be the mainstay of the Indian Air Force (IAF) in the next decade as other jets are phased out, and before the indigenous fifth-generation Advanced Medium Combat Aircraft (AMCA) is ready, IAF sources said.

The IAF is looking at speeding up the production of the LCA by Hindustan Aeronautics Limited (HAL).

“We are taking delivery of the last four aircraft in the Initial Operational Configuration (IOC). We are expecting to receive 5-6 LCAs in the Final Operational Configuration (FOC) by March this financial year,” a senior IAF source said. “The contract for 83 LCA Mark-1A will be signed this financial year.” the source added.



The AMCA, being designed and developed by the Aeronautical Development Agency (ADA) with the IAF's support, is expected to make the first flight in 2032.

<http://www.defencenews.in/article/IAF-to-sign-contract-this-fiscal-to-procure-83-LCAs-757912>

## THE ECONOMIC TIMES

Sat, 09 Nov 2019

## IIT Roorkee working with ISRO, DRDO for cutting edge space, defence tech

*Researchers at the premier institute are working with ISRO and DRDO on "thin membrane-based technology" to develop parachutes for fighter aircraft*

Noida: IIT Roorkee is working with the Indian Space Research Organisation (ISRO) and the Defence Research and Development Organisation (DRDO) to design and develop cutting edge technology for space and defence projects, officials said.

Researchers at the premier institute are working on "thin membrane-based technology" to develop parachutes for fighter aircraft and could be crucial in boosting indigenous production in the country, the officials said.

The information was shared during a seminar on “Inflatable Structures and Materials for Space Applications” held on Thursday at the IIT Roorkee's Greater Noida campus.

"If you look at foreign countries, they have excelled in defence technology and with permission of their government they are exporting their products, leading to the growth of their own economy," Director of DRDO's Armament Research & Development Establishment (ARDE) Arun Kumar Saxena.

All fighter aircraft in the country have DRDO-made parachutes in them which help them reduce their landing run when brakes are applied and reduces pressure on tyres during landing, he said.

Retired Group Director of ISRO Ahmedabad A C Mathur said inflatable technology can be a solution for complications faced when sending large structure projects in space, where the conditions are very different.

"A lot of private companies are working on this technology but if we succeed in it, we can supply the products to foreign countries also but for all this we need advanced industries and technology," he added.

A lot of work is underway at IIT Roorkee, its Deputy Director M Parida said.

"Several researchers are working on thin membrane-based technology and it's a continuing process. We have developed some technology and working on it further," Parida said, but did not divulge any details.

<https://economictimes.indiatimes.com/news/defence/iit-roorkee-working-with-isro-drdo-for-cutting-edge-space-defence-tech/articleshow/71967047.cms>

## **STAR OF MYSORE**

*Sun, 10 Nov 2019*

### **ICFOST national conference curtain raiser event held at DFRL**

Mysuru: Association of Food Scientists and Technologists-India (AFST-I) had organised World Food Day, Prof. J.V. Bhat Memorial Lecture and Curtain Raiser of 27th Indian Convention of Food Scientists and Technologists (ICFOST) in association with DRDO-DFRL and CSIR-CFTRI at Defence Food Research Laboratory (DFRL), Siddhartha Nagar, recently.

Dr. K.S.M.S. Raghava Rao, Director, CSIR-CFTRI, who delivered World Food Day lecture, briefed about the progress of CSIR-CFTRI and need of our action for future for ensuring zero hunger through techno-innovative ways.

Dr. Neerja Hajela, Head – Science and Regulatory Affairs, Yakult Danone India Pvt. Ltd., New Delhi, delivered Prof. J.V. Bhat Memorial lecture on the topic “The Growing Burden of Antibiotic Resistance — Can Probiotics be one of the Solution to combat the crisis?”



Dr. D.D. Wadikar, Hon. Secretary, briefed about the 27th ICFOST National Conference of AFST(I) to be held at Tezpur University, Assam, from Dec.18 to 20 on the theme ‘Raising Agro-processing and Integrating Novel Technologies for Boosting Organic Wellness’ [RAINBOW-2019].

Dr. G.K. Sharma, Scientist G and Additional Director, DFRL, Mysuru, clicked the Curtain Raiser for ICFOST and wished the conference a grand success. He appreciated the AFST(I) for reaching to North East to conduct ICFOST to spread the knowledge on Food Technology.

All the dignitaries joined to unveil the selfie point of ICFOST on the occasion.

Dr. Anil Dutt Semwal, Director, DFRL, who presided over the event, said both lectures were full of novel information and assured full support to AFST(I) for its 27th ICFOST.

Dr. A.S. Bawa, former Director, DRDO-DFRL, was also present on the occasion. Dr. D.D. Wadikar welcomed. Umapati Hirewodeyar, Hon. Treasurer, proposed a vote of thanks.

<https://starofmysore.com/icfost-national-conference-curtain-raiser-event-held-at-dftrl/>

## **DRDO bets big on indigenous capabilities**

*India should focus more on indigenous defence production to reduce import in the defence sector, and to become self-reliant in technology*

*By Manish Kumar Jha*

The Government aims to take the Indian economy to \$10 trillion by 2030, and it believes, defence is one of the sectors that can help in contributing towards this. Echoing the same views, the Defence Research and Development Organisation (DRDO) is working towards the same to make this a reality. With a network of 52 laboratories across the country and over 30,000 employees, it is one of India's largest and most diverse research organisations.

Controlled directly by the Ministry of Defence, DRDO feels the country should focus on more indigenous defence production to reduce import in the sector and should become self-reliant in technology. But the approach towards indigenisation since independence has yielded limited results. It has largely resulted in policy capture by public sector undertakings in the name of indigenisation. The net result is that the domestic industry is incapable of meeting India's defence requirements and is embroiled in license production as far as the key technology is concerned.

### **The Breakthrough**

It would be unfair to deride the institution without talking about their breakthroughs, and in fact, the best in the world of science and technology, in some of complex technological challenges of the 21st century. Especially in Defence, the assimilation of such breakthrough in forming into the workable application is another crucial thread that scientists have to grapple with. For such breakthroughs, it is also a fact that the DRDO has not received the emphatic applause from the various corners that it actually deserves.

DRDO Chairman and Secretary Department of Defence R&D G. Satheesh Reddy proudly points out: "A-SAT, Ballistic Missiles, Ballistic Missiles defence Systems, Radars, Sonars, EW systems, Torpedoes are state-of-the-art systems and not World War II systems. DRDO has always and will continue to engage on cutting-edge technologies. All the stakeholders have always appreciated the efforts of DRDO. Incidentally, in all of the above systems, we are one of the six countries in the world to develop such capability."

DRDO has developed several ballistic missiles under its Integrated Guided Missile Development Programme (IGMDP), includes missiles like Prithvi, Trishul, Agni, Akash and Nag. The latest in this series is the successful testing of nuclear capable the Agni V missile. Earlier this year, DRDO successfully tested new generation anti-radiation missile (NGARM), which is capable of destroying enemy radars that can be launched from various altitudes. The DRDO is testing Hypersonic Technology Demonstrator Vehicle (HSTDV), which will have speed at in excess of Mach 6, while using atmospheric oxygen as oxidiser. The DRDO's role in developing multiple weapon platforms and systems for INS Arihant, India's first nuclear ballistic missile submarine, is commendable.

### **The Fallout**

Even after 60 years of the DRDO formation, India still imports a large share of its defence equipments. In the year 2018-19, India is the world's second-largest importer of defence equipment, accounting for 13 per cent of the global total, according to the Stockholm International Peace Research Institute. The DRDO's list of successes is short -- primarily the Agni and Prithvi missiles. Its list of failures is much longer. The Kaveri Engine is indeed on top of that. It would cost indigenous fighter aircraft a great deal. The Indian Air Force (IAF) itself is looking for some 400 next generation fighter aircrafts. Navy has its own good number -- some 200 combat aircrafts and in the context of Indian



Ocean, along the greater shift of the naval supremacy, it is more than needed. Building the required thrust for the engine that could indeed be at the heart of 5th generation fighter aircraft should have been taken off. Delays in AMCA and dumping of joint collaboration programme with Russia turned clumsy and messy. That cost the IAF a lot as it had to start from scratch. The CAG report also revealed that not all technologies developed by the DRDO were suitable for the armed forces. The three services have rejected 70 per cent of the products developed at the Armament Research and Development Establishment (ARDE), Pune, in the last 15 years, costing Rs 320 crore because the products did not meet their standards and requirements.

### **Costly Affair**

The DRDO's capital allocation is mere 6 per cent of the total defence budget and that also includes the cost of maintenance and other administrative expenditure. This is grossly inadequate, especially when the need should be for financial commitment to the Technology Perspective and Capability Roadmap (TPCR) after deliberations between the scientists and the defence services. Fact that no nation gives away its cutting-edge technology, the Centre should treat the DRDO as its No. 1 priority. It is tricky situation. One side, the government has to spent \$42 billion in procuring technology from overseas and a few domestically assemble, on the other, it harp on the assimilation of indigenisation up to 70-75 per cent by 2025. But the defence puts the total sum for the DRDO far less than desired. At 6 per cent of the total budget (Rs 18,000 crore), it halts many futuristic programme.

As DRDO Scientist & Former Chief Controller R&D W. Selvamurthy points out: "A minimum 12-15 per cent is what is required for India in its quest for indigenisation." Under the head, it goes into maintaining the entire infrastructural empire of the DRDO spread across India. That is a huge cost which takes way substantial chunk. Reddy said: "The cutting-edge technologies are not available at any cost. They are acquired hard way through the persistent efforts of the scientific community of the country, and the government is well aware of this."

It may be recalled that the government had set up a committee on 08 February 2007 chaired by Former Secretary, Department of Science and Technology P. Rama Rao to review and suggest measures to improve the functioning of the DRDO. The committee was mandated through its terms of reference to review the present organisational structure and to recommend necessary changes in the institutional, managerial, administrative and financial structures for improving the functioning of the DRDO. The Committee submitted its report to the government on 07 February 2008. The structural part of the DRDO is indeed the problem. Even the official agrees on the breadth and a scope of the functioning of the DRDO. But so far the committee's recommendations have been implemented abysmally, gerrymandering the core of the problem. The DRDO is far from reaching the operational efficiency of similar organisations from across the world given the size and scope of work. But it does not have the same scope of budget as mentioned above.

Selvamurthy has served four decades in the institution and has been a deft hand in some of the key technological breakthroughs of the DRDO. Talking about such issues, he pointed out that the DRDO should be put on track like the ISRO as Commission and be place director under the Prime Minister Office. The ISRO's model is often brought back under discussion whenever the obvious comparison takes place. And, truly, what is the most pertinent thing for an emerging nation like India which is to bring the thrust on the R&D in defence - a number one priority. Pointing the same question, Reddy said: "Yes, I am aware of such debates. But first, give me some time to set my house right." Some change is visible and the DRDO is definitely gearing up for the further challenges. The DRDO has taken some steps in the direction as it is considering long-term contracts with the Indian information technology vendors such as Tata Consultancy Services to build software solutions for defence projects, shifting its strategy of awarding deals to the lowest bidders on short-term projects. The doors for the private industry or individual are opening fast.

<http://www.businessworld.in/article/DRDO-Bets-Big-On-Indigenous-Capabilities/08-11-2019-178679/>

## DRDO stall at science festival draws huge crowd

Kolkata: Night sight device used in Army tanks, exhibited at a DRDO stall, is drawing a huge crowd. Environment-friendly explosives and models of missiles on display as part of the India International Festival here is also a big attraction among the people.

The advanced night sight device enables the Army personnel in the tank to locate an object in pitch darkness before launching an attack, a DRDO official said on Thursday. Speaking on the device that uses thermal imaging technology, the official said, "We keep adding new features to every device in our lab.

It is then requisitioned by the Army after due tests and demonstration." The Defence Research and Development Organisation (DRDO) pavilion at Science City here has been

a big hit with visitors, largely school students and their guardians, he said. Environment-friendly 'benign green primary explosives', bulletproof jackets, specially made snake repellants and battle fatigues for high altitude were also on display at the stall. Harshad Motwani, a school student, seemed excited after donning a bulletproof jacket.

Another student Archisman Banerjee was equally enthused on getting an opportunity to look at the various objects. "We have also exhibited Capsi-grenade which is used against insurgents," the official manning the counter said. Capsi-grenade, made from 'Bhut Jolokia' (also known as "Nag Jolokia" - one of the world's hottest chilly peppers), is a handy weapon in crowd control and low-intensity conflicts. Inquisitive students and visitors were also having a look at the models of missiles. Nodal officer DRDO, Dr Sukhomoy Hazra, said that different devices, designed in 22 labs of the DRDO have been put up on display to inform the younger generation about the activities of the premier organisation.

<https://www.thehansindia.com/hans/young-hans/drdo-stall-at-science-festival-draws-huge-crowd-579752>



## Indian Defence Minister supports blockchains use in contemporary warfare

Blockchain tech could be the next step in contemporary warfare according to the Indian defence minister, who is a big supporter of the technology.

Making a speech at an 80-nation plus envoy roundtable on Monday prior to the country's DefExpo 2020 conference in February next year, the defence minister, Rajnath Singh said blockchain, artificial intelligence (AI) and big data are what is needed for next iteration of combat.

Singh said countries need to develop these technologies and as warfare changes from the air to the sea and of course land, this is becoming more apparent.

The challenge now, he said, is “not just to prepare for contingencies but also to repel threats from multiple sources, and at the same time possess the ability to respond proactively if needed.”

The rise in the price of cryptocurrencies has been often accompanied by an increase of general interest by big institutional investors. Of course, in this case, it is the technology behind the cryptocurrency that is so appealing to the defence minister.

India has expressed its interest for blockchain in other areas too. The nations central bank indicated as far back as 2017 that it was looking into the development of a digital rupee. But the bank later was said to have developed a dedicated blockchain unit. At the time this was just a rumour that was shot down by the country.

It will be interesting to see how this situation plays out with blockchain and contemporary warfare. For more news on this and other crypto updates, keep it with CryptoDaily!

<http://www.defencenews.in/article/Indian-Defence-Minister-Supports-Blockchains-Use-In-Contemporary-Warfare-757885>



*Sat, 09 Nov 2019*

## **Air Chief Marshal RKS Bhadauria to fly HAL's HTT-40 next week**

In his maiden visit as a Chief of Air Staff to Bangalore from November 13-15, Air Chief Marshal RKS Bhadauria will be flying Hindustan Aeronautics Limited's (HAL), HTT-40 (Basic trainer aircraft). Confirming this, top HAL officer told Financial Express Online that, “The Air Chief will fly one of the HTT-40 aircraft which is going through various tests on November 14 afternoon.”

As stated in the Defence Procurement Procedure (2016), the indigenous HTT-40 comes under the category of “Indian designed, developed and manufactured” (IDDM) equipment and has till date cleared all Air Staff Qualitative Requirements (ASQR) as per the requirements.

Bhadauria who became the Chief of Air Staff on October 1, is not only a certified flying instructor, an attack instructor of CAT ‘A’ category, he is also an experimental test pilot. One of the finest pilots in Indian Air Force (IAF) has flown more than 27 types of fighter and transport aircraft so far, including the French Rafale.

According to the HAL spokesperson, “With critical spin a test being successful, HAL now is concentrating on completing the certification process of HTT40 as early as it can. The aim is to induct the aircraft by meeting the expectations of the customer.”

The project design has started in 2013 and in a matter of five years with Rs 350 crore the HTT-40 has completed several spin tests successfully. These have proved that the state-owned company has the capability of not only designing a fixed-wing but can also build spin worthy aircraft.

The basic trainer has completed all the Preliminary Services Qualitative Requirements (PSQR) test points including the spin tests. This means that the aircraft is ready to be put in service.

After successfully completing spin tests in 2018, the Defence Acquisition Council had given approval for 70 aircraft for the IAF.

<http://www.defencenews.in/article/Air-Chief-Marshal-RKS-Bhadauria-to-fly-HAL%e2%80%99s-HTT-40-next-week-757887>



## **Navy mulls scrapping Rs 20k-cr tender for building four amphibious warships**

*The Navy has communicated to the Ministry of Defence about its plans and requested it to withdraw the Request for Proposal in the tender, they said*

Delayed by more than five years, the Indian Navy wants to scrap a more than Rs 20,000 crore tender for building four big-size amphibious warships indigenously in private shipyards.

The tender is for building four Landing Platform Docks (LPDs) for the Indian Navy which were meant for carrying both helicopters and amphibious land warfare assets such as tanks and personnel carriers.

"The specifications for the LPD was issued in 2006 and it has been almost 14 years. Now, we want to withdraw the tender and look around for the advancements in the technology for LPDs world over and then issue a fresh tender," Navy sources told ANI.

The Navy has communicated to the Ministry of Defence about its plans and requested it to withdraw the Request for Proposal in the tender, they said.

Once the Navy has identified the latest developments in technologies in the field of amphibious warships, the Navy would issue a new tender for acquiring these warships, the sources said.

As part of the tender, four warships were to be built for which two Indian firms were in the race including the Anil Ambani-led Reliance Defence and Larsen and Toubro.

Reliance had partnered with the French Naval Group and L & T was in partnership with the Spanish firm Navantia.

The tender had been hanging fire for many years now due to one controversy or the other including the financial health of the participating companies in the contract.

The commercial bids of the tender were planned to be opened earlier this year but the process was stopped at that time.

As per Navy plans, the warships were to be around 30,000 tonnes with ability to operate helicopters and ability to carry an army battalion, including tanks and armoured carriers.

[https://www.business-standard.com/article/news-ani/navy-wants-to-scrap-rs-20-000-cr-lpd-tender-119110801371\\_1.html](https://www.business-standard.com/article/news-ani/navy-wants-to-scrap-rs-20-000-cr-lpd-tender-119110801371_1.html)

## GRSE lays keel of the first large survey vessel

*These vessels are 110m long with deep displacement of 3300 tonne and can accommodate 231 personnel. The vessel will have a cruising speed of 16 knots. The hull form of these new generations Survey Vessel also meets the stringent seakeeping and man...*

*By Anuradha Himatsingka*

Kolkata: Garden Reach Shipbuilders & Engineers (GRSE) laid the keel of the first Survey Vessel (Large) in Kolkata.

This first ship is part of the four large Survey Vessels order won by GRSE in competitive bidding process in October 2018. The contract for four Survey Vessel Large was signed between GRSE and Government of India, Ministry of Defence. The total value of the order is Rs 2435.15 crore.

The first ship is to be delivered within 36 months from contract signing date with a project completion time of 54 months.

These vessels are 110m long with deep displacement of 3300 tonne and can accommodate 231 personnel. The vessel will have a cruising speed of 16 knots. The hull form of these new generations Survey Vessel also meets the stringent seakeeping and manoeuvring requirements including helicopter operations at high sea states.

With their state-of-the-art "Survey Payload" comprising of Autonomous Underwater Vehicles, Remote Operated Vehicles, Multi Beam Echo Sounders etc, these Survey Ships will prove to be a game changer in the Indian Navy's capabilities for coastal and deepwater hydrographic surveys aiding maritime operations. In their secondary role, they will be capable of performing limited search and rescue, limited ocean research and operate as hospital ship or casualty holding ships.

The warship builder posted a more than four-fold jump in net profit to Rs 59.02 crore in the second-quarter (Q2) of the current fiscal, on the back of higher revenue. The company had posted a net profit of Rs 12.78 crore in the corresponding period of 2018-19.

Revenue from operations for the quarter ended September 30, 2019, stood at Rs 439.02 crore compared to Rs 217.70 crore clocked in the same period of previous year. As many as 22 projects are in various stages of construction, with an order book of Rs 27,400 crore, the company said.

<https://economictimes.indiatimes.com/industry/transportation/shipping/-/transport/grse-lays-keel-of-the-first-large-survey-vessel/articleshow/71984356.cms>

## Indian newspaper casts doubt on S-400's capabilities owing to its 'untested' status

Russia and India penned a \$5.43 billion deal for the delivery of five regiments of the S-400 air defence system in October 2018, with Delhi recently reportedly asking Moscow for deliveries to be expedited, notwithstanding the threat of US sanctions.

Russia's S-400 air defence system is "as or more effective than any other anti-aircraft system in the market today," but remains "largely untested" in conflict, Indian news outlet TimesNowNews writes.

According to the outlet, "although respected as a formidable weapon that provides numerous tactical advantages, the S-400 is still largely untested in a real war situation." The outlet points out that while Russia "had the opportunity to show off the capabilities of the S-400 systems it had stationed in Syria in April 2018, against US Tomahawk missiles," it "refrained from doing so."



On April 14, 2018, in response to what was later revealed to have been a false flag 'chemical attack' in Douma, Syria, the US, UK and France launched a major surprise missile attack against the Arab Republic, using a combination of warship-launched Tomahawk missiles and air-launched long-range missiles. Despite its armament of mostly outdated air defences, including the S-200, which was first introduced into the Soviet military in the late 1960s, Syria managed to repel the attack, with the Russian defence ministry confirming the destruction of 71 of 103 missiles before impact, (just shy of 70 percent).

The S-400s, meanwhile, remained stationed at the Russian air base in Khmeimim, northwest Syria, and were not used, with the Russian military previously making clear that it would only use the system to defend Russian military personnel operating in Syria.

Despite its "untested" status, TimesNowNews pointed to several of the S-400's important advantages, including its modular construction, which makes it possible to fit a variety of short-, medium- and long-range missiles (with a range of between 40 and 400 km), its high mobility and quick deployment time. The system's price tag, said to be "significantly less than French or US-made alternatives" is another of its attractive qualities, according to the outlet.

Finally, the outlet notes that it is "the long-range 40N6 missile that the the S-400 is capable of firing" that "truly separates it from competitor systems like the US Patriot PAC-3 MS, that can only engage targets at distances of 100 km or less."

The S-400 is currently the most advanced mobile air defence system in Russia's arsenal. Along with Russia, the system is fielded by Belarus, China, and, most recently, Turkey. India expects to receive its S-400s sometime in the next three to four years, with Delhi reportedly requesting recently for deliveries to be expedited.

The US has threatened to impose sanctions against India over its S-400 purchase, citing 2017 legislation known as the Countering America's Adversaries Through Sanctions Act (CAATSA). However, Indian officials have resisted US pressure, emphasising that the decision to buy Russian arms was Delhi's "sovereign right."

<http://www.defencenews.in/article/Indian-Newspaper-Casts-Doubt-on-S-400%e2%80%99s-Capabilities-Owing-to-Its-%e2%80%98Untested%e2%80%99-Status-757899>

## **Rajasthan: Military exercise of Indian Army to commence near Pak border in Barmer**

*The Indian Army will undertake a massive military exercise starting November 13 to November 18 near Pakistan border in Barmer district of Rajasthan*

*By Manjeet Singh Negi*

New Delhi: The Indian Army will undertake a massive military exercise starting November 13 to November 18 near Pakistan border in Barmer district of Rajasthan.

The military exercise will be undertaken by the Sudarshan Chakra Corps of the Southern Army.

According to sources, more than 40,000 troops will be participating in the exercise to hone their combat skills and validate their deep-strike capabilities in the deserted area.

The exercise aims to validate the battle readiness and operational effectiveness of Sudarshan Chakra Corps in an integrated air, land battle scenario.

The exercise will showcase tanks and other armoured vehicles duly supported by overwhelming land and air-based firepower.

The exercise is being conducted under simulated battlefield conditions aimed at implementing surveillance and the mechanisms to validate the operational plans.

With an emphasis on joint operations, the exercise would test sensor to shooter grids by employing surveillance and air assets networked with land-based operational and tactical vectors, in addition, to manoeuvre by mechanised formations.

The exercise will showcase the seamless integration between armoured, mechanised infantry, infantry, artillery, air force resources as well as the special forces.

The combined arms cohesion will be on display with the integrated employment of mechanised forces with the newly inducted K-9 Vajra (Self Propelled Artillery Gun System) and indigenous Advanced Light Helicopter (Weapon Systems Integrated) 'Rudra' with innovative tech skills and prowess of IA as a Network Centric Force.

<https://www.indiatoday.in/india/story/rajasthan-military-exercise-indian-army-commence-pak-border-barmer-1617427-2019-11-09>

Sun, 10 Nov 2019

## India's first mark : Zeroing for native Sniper Rifles

SSS Defence – Bangalore based arms manufacturing firm, is the first company to develop a prototype of the country's first native Sniper rifles. The entity has managed to develop two distinctive variants of the rifles, as reported.

Endeavor made by the firm, can easily be anticipated to be a major milestone for nations', 'Make in India' campaign. It's speculated to give a major boost in turning India to be an arms manufacturing and export hub.

Whilst, expressing his views Satish R Machani, MD – SSS Defense, said, "We started designing and developing these rifles after the launch of 'Make in India' in the defence sector"



SSS Defence, is 61 years old and is one of the few manufacturing companies allowed to manufacture weapons in the national periphery. In its initial years, the company used to manufacture components for the automotive industry.

"We have supplied components for our defence sector. Our idea is to develop a complete arms system for our security and armed forces and intends to become an arms exporter. We need to do more and build weapons of global stature" further added, Machani.

Explaining the indigenous technology, the company plans to build a sprawling factory in Jigani in Karnataka – 80,000 square feet for its manufacturing unit.

<http://www.defencenews.in/article/India%e2%80%99s-First-Mark--Zeroing-for-Native-Sniper-Rifles-757903>

Mon, 11 Nov 2019

## India needs foreign talent to indigenize defence equipment

At a recent discussion in one of our defence institutions, defence analyst Bharat Karnad made a striking point: that indigenization of defence equipment will remain an elusive goal if India's procurement policy relies on offsets, and while requiring a foreign manufacturer to invest a certain fraction of the purchase value in an Indian firm might generate some employment, it will not result in the transfer of cutting-edge technology. If we want to leapfrog up the value chain, Karnad argued, we must insist that the foreign manufacturer bring in top talent into the country. In other words, what we really ought to be buying is human capital even if what we are ordering is fighter aircraft, missiles or combat rifles.

Indeed, the issue of human capital is almost completely absent from the debate on defence policy. This, despite one of the most remarkable success stories of indigenous defence production being the result of the kind of approach Karnad advocates. India was among the few countries—outside the



Western powers—to develop a supersonic fighter plane in the late 1950s. The HF-24 Marut project started in 1955, started test flights in 1961, and was inducted into the Indian Air Force in 1967. That's a mere 12 years to go from drawing board to production in a country that was still struggling with mass poverty and had only a handful of good engineering colleges, producing perhaps a couple of thousand engineers every year.

India managed to achieve this feat because Jawaharlal Nehru's government imported Kurt Tank, a German engineer who had designed fighter aircraft for Nazi Germany and was at a loose end in Juan Peron's Argentina, where he had moved after the war. After a short stint at Madras Institute of Technology, Tank was employed by Hindustan Aeronautics Ltd (HAL) in Bengaluru, where he set about building the supersonic Marut. His team consisted of 18 German designers and over 800 Indian engineers and technicians. For unfathomable but not unfamiliar bureaucratic reasons, the Indian government decided against investing in a British company that produced the appropriate engines, resulting in an underpowered aircraft that the Indian Air Force couldn't use as a frontline fighter. Even so, the Marut played an important role in the 1971 war as a ground attack aircraft. Oh, and by the way, one of the promising students Tank taught at Madras was a young man named APJ Abdul Kalam.

The Marut story highlights the importance of talent acquisition as a vital ingredient in the development of indigenous defence technological capacity. China's leaders figured this out in the late 1980s, and after the fall of the Soviet Union, employed a number of Russian experts in its defence industries. While China's blatant violation of Western intellectual property gets a lot of credit for its rapid military modernization, the role of foreign advisors and engineers is less known.

To succeed in the indigenization game, it is necessary to play the talent game well. In an important study of global talent flows published in 2016, Sari Pekkala Kerr, William Kerr, Caglar Ozden and Christopher Parsons showed how a few countries disproportionately benefit from skilled migration, none more so than the US. It alone accounts for more than a third of the world's high-skilled migrants. In 2013, over half the science, technology, engineering and mathematics workers and 70% of software engineers in Silicon Valley were foreign-born. US institutions dominate the Nobel prizes for chemistry, physics, medicine and economics, but more than half the American winners in roughly the past four decades were foreign-born.

It gets even starker when it comes to inventors; the US gained almost 200,000 inventors from abroad between 2000 to 2010, of whom 60,000 came from China and 40,000 from India. Even European Union countries lost tens of thousands of inventors on a net basis to the US.

Now, it is hard for any other country to match the US as a talent magnet, but the world's richest countries are trying hard. So is China. In recent years, it has not only relaxed residency rules for high-skilled professionals, but is actively courting foreign researchers, university professors and students. Humanities and social science professors might find the political atmosphere in China stifling, but engineers and scientists are more easily attracted by professional opportunities and lavish research funding.

<http://www.defencenews.in/article/India-needs-foreign-talent-to-indigenize-defence-equipment-757910>

## **BECA : India and US may sign third military pact soon**

India and the United States are likely to sign the pending third foundational military pact—Basic Exchange and Cooperation Agreement (BECA)—during the 2+2 Ministerial Dialogue likely to be held soon in the US. This is expected to give a boost to the country's defence system and counter the Russia-China-Pakistan axis.

The first ever 2+2 Ministerial Dialogue between the two countries took place in New Delhi in September last year. This year, the dialogue will be held in the US. However, the meeting dates are yet to be finalised because of scheduling issues. However, the dates would be finalised very soon, sources said. “When the dialogue takes place, BECA, which is the third foundational military pact, and also the Industrial Security Annex, are ready to be signed. In fact, the Industrial Security Annex is already vetted and has just to be signed,” a source said.

The sources said that the US had shared the draft agreement of BECA with India. “However, India had certain reservations because of its own national security. This was conveyed to the US establishment, which held up the agreement for quite some time. However, now that all the gaps have been ironed out, the agreement will be signed during the 2+2 Ministerial Dialogue,” the source said.

India has already signed the Logistics Exchange Memorandum of Agreement (LEMOA) with the US and the Communications Compatibility and Security Agreement (COMCASA). However, it is yet to sign the third, BECA. A country needs to sign these three pacts to obtain cutting-edge weapons and communications systems from the US. BECA will allow India to use US expertise on geospatial intelligence and enhance military accuracy of automated hardware systems and weapons like cruise, ballistic missiles and drones.

Under the Industrial Security Annex, transfer of defence technology will be permissible. The US has such an agreement with other countries. But this will be the first time ever for India. The US, through this agreement, seeks guarantee for the protection of both classified technology and information. This will be needed to allow the transfer of technology if production lines for US fighter jets are set up in India or other defence joint ventures.

The two countries held a round of the bilateral 2+2 intersessional meeting on 22 August in Monterey, California, ahead of the 2+2 Ministerial. The two sides reviewed the progress and development of bilateral relations in cross-cutting defence, security, and foreign policy areas ever since the inaugural 2+2 Ministerial meeting of September last year and explored further possibilities of cooperation in these fields, based on common interest.

Sources said the Basic Exchange and Cooperation Agreement (BECA) is likely to be signed during the 2+2 Ministerial. The issue was discussed at the bilateral Defence Planning Group (DPG) dialogue in Washington in August. The Indian delegation was led by Defence Secretary Sanjay Mitra, who had a meeting with US Undersecretary of Defence for Policy John Rood. The DPG has been revived after a gap of four years. The decision to revive it was taken at the last 2+2 dialogue between India and the US last year, which was attended by the defence and foreign ministers of both countries.

COMCASA was signed last year and the two countries agreed on working together on India's entry into the Nuclear Suppliers' Group (NSG). The agreement, which was pending for almost 10 years, was aimed at opening the way for the sale of more sensitive US military equipment to India. It is to be noted that India was designated as a “major defence partner” by the United States in 2016.

<http://www.defencenews.in/article/BECA--India-and-US-may-sign-third-military-pact-soon-757891>

## India's nuclear arsenal keeps growing, and that's bad news for Pakistan and China

“India is estimated to have produced enough military plutonium for 150 to 200 nuclear warheads, but has likely produced only 130 to 140,” according to Hans Kristensen and Matt Korda of the Nuclear Information Project at the Federation of American Scientists. “Nonetheless, additional plutonium will be required to produce warheads for missiles now under development, and India is reportedly building several new plutonium production facilities.”

In addition, “India continues to modernize its nuclear arsenal, with at least five new weapon systems now under development to complement or replace existing nuclear-capable aircraft, land-based delivery systems, and sea-based systems.”

Unlike the missile-centric U.S. and Russian nuclear forces, India still heavily relies on bombers, perhaps not unexpected for a nation that fielded its first nuclear-capable ballistic missile in 2003. Kristensen and Korda estimate India maintains three or four nuclear strike squadrons of Cold War-vintage, French-made Mirage 2000H and Jaguar IS/IB aircraft targeted at Pakistan and China.

“Despite the upgrades, the original nuclear bombers are getting old and India is probably searching for a modern fighter-bomber that could potentially take over the air-based nuclear strike role in the future,” the report notes. India is buying thirty-six French Rafale fighters that carry nuclear weapons in French service, and presumably could do for India.

India’s nuclear missile force is only fifteen years old, but it already has four types of land-based ballistic missiles: the short-range Prithvi-II and Agni-I, the medium-range Agni-II and the intermediate-range Agni-III. “At least two other longer-range Agni missiles are under development: the Agni-IV and Agni-V,” says the report. “It remains to be seen how many of these missile types India plans to fully develop and keep in its arsenal. Some may serve as technology development programs toward longer-range missiles.”

“Although the Indian government has made no statements about the future size or composition of its land-based missile force, short-range and redundant missile types could potentially be discontinued, with only medium- and long-range missiles deployed in the future to provide a mix of strike options against near and distant targets,” the report noted.

India is also developing the Nirbhay ground-launched cruise missile, similar to the U.S. Tomahawk. In addition, there is Dhanush sea-based, short-range ballistic missile, which is fired from two specially-configured patrol vessels. The report estimates that India is building three or four nuclear-powered ballistic missile submarines, which will be equipped with a short-range missile, or a bigger missile with a range of 2,000 miles.

It’s an ambitious program. “The government appears to be planning to field a diverse missile force that will be expensive to maintain and operate,” the report points out.

What remains to be seen is what will be the command and control system to make sure these missiles are fired when—and only when—they should be. And, of course, since Pakistan and China also have nuclear weapons, Indian leaders may find that more nukes only lead to an arms race that paradoxically leaves their nation less secure.

<http://www.defencenews.in/article/Indias-Nuclear-Arsenal-Keeps-Growing,-And-Thats-Bad-News-For-Pakistan-and-China-757913>

## China's type 99 tank is here (and it can wage war against anyone)

China has finally fielded a first-class main battle tank. China has a lot of tanks. Like, eight to nine thousand of them. The United States. And Russia. (Note that such counts include vehicles in storage and reserve. The numbers for tanks in operational units are lower in every case).

However, the majority of Beijing's tanks are old designs, particularly Type 59 and 69 tanks more or less directly copied from the 50s-era Soviet T-54 tank. Such is their profligacy that I once had the pleasure of bumping into one in a children's playground in Tianjin serving the needs of the (young) people.

However, China's top of the line tank, the Type 99, has commanded healthy respect from international observers, even though it has never been exported, nor used in combat. The reason is simple: the reported performance parameters are equal to many top Western designs, and the Type 99 also packs a few unique tricks of its own.

Today we'll look at how the Type 99 stacks up to two important contemporaries, the American M1A2 Abrams and the Russian T-90A tank.

Before we get our hands greasy with the technical details, we should consider: does China even need tanks?

It's a reasonable question to ask. China's major military efforts have been directed towards the Pacific.

Some might ask, how likely are the U.S. Army's M1 Abrams tanks ever to clash with the Type 99?

To which one should consider: can either vehicle swim across the Pacific Ocean and exchange shots over Scarborough Shoal?

Kidding aside, it seems a pretty unlikely except in amphibious invasions scenarios fit for Operation Flashpoint computer games. On the other hand, Taiwan has expressed interest in purchasing Abrams tanks, and Australia operates 60 as well, so never say never.

However, the question is more relevant when we consider the Russian T-90. Moscow currently maintains good relations with Beijing, with which it shares a border, but the two powers are not close allies, having nearly come to war during the late 1960s.

Most importantly, Russia is selling its weapons to India and Vietnam—including systems which are quite clearly earmarked to oppose the Chinese military, such as the Brahmos cruise missile, and, well...over 1,000 T-90 tanks, many of which are deployed along its Himalayan border.

China fought a war with India in 1962 over that border, and another with Vietnam in 1979 to punish the nation for opposing the Beijing-backed Khmer Rouge regime in Cambodia. (Vietnam would like to order T-90s as well.)

Today, the Chinese military persists in seeing India—a potential future superpower—as a threat, and has extensively militarized their shared border and built roads allowing heavy military vehicles to pass through the steep mountains. China is also allied with Pakistan, which has repeatedly warred with India, and occasionally transfers military technology to it.

Lastly, one should consider the scenario of a potential civil war or government collapse in North Korea. What Beijing's policy would actually be in such an event is the trillion dollar question, but one scenario would involve Chinese ground forces intervening to restore order in North Korea—leading to potential clashes with Korean troops.

So, even though an actual armed conflict would be unnecessary and vastly counterproductive for everyone involved—like most wars!—there are some contexts in which tank combat could occur on China’s borders, particularly verses Russian-made tanks.

Enough politics, onto the lumbering death machines!

First, to introduce the contenders...

The Abrams, of course, is the classic American design which devastated Soviet-made Iraqi armor in the 1991 Gulf War without losing a single tank to enemy fire. The Abrams isn’t exactly new, but the Army has continuously tweaked the ammunition, armor package, and sensors to keep it up to date.

The T-90 is Russia’s first post-Cold War tank. Though not quite a peer of the Abrams, it still boasts significant improvements in accuracy and protection, particularly in models equipped with later-generation explosive reactive armor. While Russia is introducing its revolutionary new T-14 tank, for now its 550 T-90As remain its frontline armored vehicle.

Moscow has developed the more advanced T-90AM but did not place it into full production. However, 354 of the similar T-90MS export variant have been sold to India for deployment on its border with China. In total, India has over 1200 T-90s, while Algeria eventually intends to operate over 800.

China’s Type-99 combines a hull that closely resembles an elongated T-72 with a Western-style turret inspired in part by the German Leopard 2. First appearing as the Type 98 prototype tank in a National Day parade in a 1999, the vehicle was re-designated the Type 99 and entered service in 2001. At 57 tons, it comes in between the 70-ton Abrams and the 48-ton T-90 in terms of weight. Several upgrades, including the new Type 99A2 variant, boast advanced new technologies. Beijing fields nearly 500 Type 99s in sixteen armored battalions, and has produced 124 of the newer 99As so far. The type is not offered for export, though some of its technology is used in China’s VT4 export tank.

#### **Firepower:**

The Type 99 and the T-90 rely on a 125 millimeter cannons using carousel autoloaders descended from Soviet-era designs. This weapon proved underpowered verses Abrams and Challenger tanks in the Gulf War, but new improved tungsten ammunition leaves it capable of piercing the frontal armor of an Abrams at shorter combat ranges.

The new Type 99A2 comes with a longer barrel main gun, which in theory should impart higher muzzle velocity to sabot shells and improve their armor penetration and accuracy. It also boasts fancy new stabilizer technology.

Reportedly, China intends to eventually install a larger 140 millimeter gun on the Type 99, but early tests have cracked up the weapon. This, incidentally, mirrors Russia’s plans to up-gun its new T-14 Armata tank to a similar caliber weapon.

The Abram’s Rheinmetal 120 millimeter gun, equipped with politically-controversial M829 depleted-uranium rounds, can penetrate around 15-25% more armor. The U.S. now produces new generations of M829 rounds capable of piercing the advanced Kontakt and Relikt reactive armor systems developed by Russia (more on those below).

China has developed its own depleted uranium ammunition for its 125 millimeter gun, which it claims can penetrate the M1 up to ranges of 1.4 kilometers.

The Abrams uses a fourth crewmember to load the gun, which American tankers argue is more reliable, offers a higher rate of fire, and gives the tank a spare hand if one of the other crew members is incapacitated. However, the space needed to accommodate a fourth crew member makes the M1 larger and heavier.

The Type 99 and T-90 both can fire anti-tank missiles from the gun tube, while the Abrams cannot. (The Type 99 uses AT-11 Refleks missiles licensed from Russia). This could theoretically be useful for combat at very long ranges, or against low-flying helicopters. However, tank-launched missiles have existed for fifty years without seeing much use.



Effective sensors for spotting and aiming are arguably as decisive in tank engagements as firepower. Russia has made some strides in tank sights and thermal imagers in recent years, though the general sentiment is that Western sights and sensors remain superior. The T-90A does not carry Russia's best hardware (some have been upgraded with French Catherine thermal sights), while the T-90MS has an improved Kalina targeting system.

China is known for its excellent electronics, and the Type 99A2 supposedly carries a new infrared tracking system that enables it hunt enemy tanks efficiently and is believed to be superior to the systems on the T-90A.

### **Protection:**

The Type 99 benefits both from composite armor, and Explosive Reactive Armor (ERA), bricks of explosives onto the tank that prematurely detonate incoming shells. The new Type 99A2 variant uses a multi-layered system thought to be similar to the Relikt ERA developed by Russia, which uses a radar to detonate the ERA before hostile shells impact. It is intended to defeat tandem-charge missiles capable of overcoming older-generation ERA.

The T-90A uses the older Kontakt-5 ERA, while the new T-90MS tanks serving in India sport the Relikt system. Though most effective against anti-tank missiles, both systems also diminish the penetrating power of tank shells.

The Type 99 also comes with a Laser Warning Receiver which warns the tank commander if his vehicle is being painted with hostile targeting lasers, affording the driver a chance to back away out of danger. Given all the videos from Syria and Yemen of tanks sitting obliviously as anti-tank missiles meander towards them (often taking 20 seconds or more to impact), this could significantly improve survivability.

The Type 99 also is believed to come with its own unique high-powered 'dazzler' laser designed to jam laser- and infrared-guided missiles, damage enemy sights, and blind the eyes of hostile gunners, possibly with a permanent effect. Fortunately, high-power tank-mounted dazzlers have never been used in combat before, so we have no idea how well they would work.

The new A2 is also thought to have a laser-based communication system which can be used to identify friendly vehicles and transmit encrypted data.

The T-90 tank, on the other hand, relies on the Shtora "soft kill" Active Protection System, which not only jams lasers with its own emitters, but also deploys aerosol grenades to create a laser-obscuring cloud around the vehicle.

The M1 Abrams lacks its own Laser Warning Receiver, Active Protection Systems or Explosive Reactive Armor, though it is conceivable future upgrades will incorporate some of these features.

For now, the M1A2 relies on its excellent Chobham composite armor, which has been tweaked over the years and believed to be equivalent to 800 millimeters or more of rolled hardened armor (RHA) verses tank sabot shells, or 1300 millimeters versus the shaped charges used in rockets and missiles. For comparison, the T-90 is believed to have a maximum armor of around 650 RHA. The Abrams also benefit from having separately stowed ammunition, making its less likely to catastrophically detonate when hit by enemy fire.

The Type 99's combination of composite and modular space armor is believed to offer armor protection close or equivalent to the Abrams. One sources claims it offers protection equivalent to around 1100 RHA, though the actual effectiveness is classified.

### **Mobility:**

The Type 99 is by far the most nimble of the bunch, able to sprint up to 50 miles per hour on roads. The M1 Abrams and the T-90MS used by India follow behind at 42 and 45 miles per hour respectively, while the T-90A trails at 35. However, the gas-guzzling turbine-powered M1A2 can only travel 240 miles before requiring refueling, while both the Type 99 and T-90 have ranges over 300 miles. Furthermore, the M1's greater weight makes it the hardest to transport and deploy.

A last note is the Type 99 features new digital maintenance systems similar to those entering into use in the latest upgrade of the M1 Abrams.

So all in all, while the Abrams arguably retains the best firepower of the three, the Type 99 seems likely to be better protected thanks to its multi-layered defensive systems. And it's faster and has longer range.

The T-90A is generally outclassed by the other two, but the T-90MS, with its Relikt armor, improved sights and more powerful engines, can hold its own.

However, one should keep in mind the actual performance of the Type 99's armor, gun and electronic systems is not certain, particularly as the vehicle has not been exported, whereas both the M1 and T-90 have been used in action by multiple operators. Beijing likes to keep the details of its technology close, and also has an incentive to talk up the capabilities of its hardware.

Nonetheless, the majority of the evidence available suggests that, despite its hordes of Type 59s, China is capable of designing and fielding a first-class main battle tank. This fits in well with President Xi Jinping's recent push to downsize in quantity, and improve in quality, its armed forces.

[http://www.defencenews.in/article/Chinas-Type-99-Tank-Is-Here-\(And-It-Can-Wage-War-Against-Anyone\)-757898](http://www.defencenews.in/article/Chinas-Type-99-Tank-Is-Here-(And-It-Can-Wage-War-Against-Anyone)-757898)



*Sun, 10 Nov 2019*

## **Bangladesh wants to buy combat fighters, Apache helicopters, missile systems from US**

Bangladesh has proposed to the United States to purchase advanced military equipment including multi-role combat fighters, Apache attack helicopters and surface-to-air missile systems, according to US government officials.

Both countries are currently negotiating two agreements that are required by the US law for the purchase to go ahead that will expand the military cooperation between the countries, said the two officials, preferring anonymity, while talking to a select group of reporters at the US Embassy in Dhaka yesterday.

However, when contacted by Dhaka Tribune, Foreign Secretary Shahidul Haque declined to comment on the matter.

The foundational agreements are Acquisition and Cross-Servicing Agreement (ACSA) and General Security of Military Information Agreement (GSOMIA). Both are bilateral in nature.

ACSA refers to an agreement between the US coalition partners that allow US forces to exchange most common types of support, including food, fuel, transportation, ammunition, and equipment. The agreement does not, in any way, commit a country to any military action.

GSOMIA is a legally binding deal that will ensure that the US advanced equipment and its knowhow will be protected from others.

The officials, however, did not say how much it would cost Bangladesh to make the proposed purchase.

They said it was not possible to talk about the prices as long discussions regarding the agreements were pending.

The initial request from Bangladesh for more advanced equipment include attack helicopters, multi-role combat fighters aircraft, surface-to-air missile system and few other things that were made back in 2018, said one of the officials.

For instance, the official said that they offered Bangladesh Air Force (BAF) two types of attack helicopters and BAF opted for the AH-64 Apache helicopters. “Now, the air force is waiting for the approval of the civilian leadership.”

“We are supportive of it [Bangladesh’s proposal],” said the other official, expressing optimism to ink the deals soon to pave the way for the purchases.

But neither of the officials elaborated on the types of other advanced equipment Bangladesh wants to buy from the US.

Since these are high-end equipment from the US defence industry, the conclusion of the agreements was required to transfer the machinery, they said, and added that there were certain non-advanced equipments that can be purchased without such agreements.

All purchased advanced equipment from the US will come with a number of facilities that include servicing, maintenance, training and supply of spare parts.

One of the officials said that Bangladesh military has now come to a point to feel that it can now have advanced US equipment, and Washington is positive about it as cooperation between the militaries of two countries has been on the rise.

“Bangladesh has known about these agreements for quite some time,” the official said, but declined to comment on the status of the negotiations regarding the two agreements.

Both officials also noted that Bangladesh military has been using the US equipment sensibly, leading Washington to consider selling advanced equipment — which will help Dhaka achieve Forces Goal 2030, a long-term modernization program for Bangladesh’s armed forces.

About the timeframe to conclude the agreements, one official said that it takes one year to sign an ACSA while it takes as long as four years to ink a GSOMIA.

To a question on possible objection from China, the main supplier of arms to Bangladesh military, about the proposed purchases from the US, the official said that it was for Bangladesh to decide from where it would buy the arms.

<http://www.defencenews.in/article/Bangladesh-wants-to-buy-Combat-Fighters,-Apache-Helicopters,-Missile-systems-from-US-757893>

## IISc: Natural shield protects certain DNA regions from radiation damage

*When exposed to radiation, there were fewer breaks in G-quadruplexes present in the telomeres*

*By R. Prasad*

It is well known that ionizing radiation can break the double-stranded DNA in one or both the strands. Now a study by researchers at the Indian Institute of Science (IISc) Bengaluru have shown that regions of the genome rich in four-stranded DNA made of guanine nucleotide base — G-quadruplexes (G4-DNA) — are more resistant to irradiation. As a result, there are fewer DNA breaks seen in G-quadruplexes when exposed to radiation. The lower sensitivity to radiation was seen in studies carried out *in vitro* and inside cells.

The team led by Sathees Raghavan from the Department of Biochemistry at IISc found that contrary to the general notion that radiation-induced DNA breaks are random in nature and can occur throughout the genome, the breaks are sequence-dependent. Certain regions of the genome were found to be resistant to radiation with fewer strand breaks in the DNA, and these regions are rich in G-quadruplexes.

G-quadruplexes typically consist of three-guanine nucleotide base found together and repeated four times. When a guanine nucleotide gets repeated it tends to fold itself into a four-stranded DNA. There are 3.5 to 7 lakh G-quadruplexes in the human genome, and these are found in certain regions of the genome such as the telomeres that act as caps on either end of the chromosomes.

“When we exposed double-stranded DNA to radiation, the DNA was getting cut randomly. But those regions of the DNA containing G-quadruplexes had fewer breaks and so were protected from radiation,” says Prof. Raghavan. The results were published in the journal *iScience*.

### **Resilience of guanine**

To test the resistance of guanine to radiation, the researchers started with single DNA strands. When single DNA strands made entirely of one of the four nucleotides — adenine, cytosine, guanine, or thymine — were exposed to gamma radiation, all except the strand made of guanine were sensitive to radiation.

In the case of a single DNA strand containing only thymine in one half and guanine in the other half, the guanine half alone showed better resistance to radiation.

But guanine loses its resistance when paired into double-strands and exposed to radiation. “We found guanine was resistant to radiation when present in a single strand but becoming sensitive to radiation when present in a double-strand form,” he says.

When the team made three double-stranded DNAs containing AT-rich, GC-rich and scrambled sequence and exposed to gamma radiation, all the three were equally susceptible to radiation. “When DNA is in normal double-helical form then guanine is equally susceptible to radiation unlike when it is in the G-quadruplex structure,” says Prof. Raghavan.

While dimethyl sulphate is able to cause DNA breaks when guanine is present in a double-strand, its ability to break DNA strands is compromised when guanine is present as G-quadruplex. “The position required for methylation [addition of methyl groups to the DNA] is occupied due to bonding, and so the G-quadruplex is resistant to dimethyl sulphate and no breaks are seen,” he says.

“Potassium chloride is essential for G-quadruplex formation. And in the presence of potassium chloride, the ability of dimethyl sulphate to induce cleavage in guanine is less, suggesting that guanine forms a G-quadruplex structure,” says Nitu Kumari from IISc and one of the first authors of the paper.

### **Inside the cells**

The researchers tested the radiation resistance of G-quadruplex inside cells. The cells were exposed to 10 Gray gamma radiation and then stained with a fluorescent-labelled antibody to study if the telomere remains protected.

“There were fewer DNA breaks in the G-quadruplex present in telomeres compared with centromere [another part of the chromosome]. This suggests that G-quadruplex offers radioprotection inside the cell,” says Sumedha Dahal from IISc and another first author of the paper.

To reconfirm the protection offered by G-quadruplex, the researchers used an antibody that binds to the G-quadruplex structure and then irradiated the cell using 5, 10 and 20 Gray. “We examined the entire genome and found wherever G-quadruplex was present there was less DNA damage. Even at 20 gray gamma radiation no breaks were seen in the G-quadruplex structure unlike the rest of the genome,” says Susmita Kumari from IISc and another first author of the paper.

### **Public database**

Data available in public database of whole genome sequencing of two cell lines post-irradiation were analysed for radioprotection offered by G-quadruplex by collaborators from Institute of Bioinformatics and Applied Biotechnology (IBAB). “There were fewer DNA breaks in the regions where G-quadruplex is present unlike the other regions of the genome,” says Bibha Choudhary.

To confirm the analysis of publicly available data, the researchers irradiated the genome and amplified the DNA sequences using a PCR. “All the genes that contained G-quadruplex structure showed less DNA breaks unlike other genes,” says Nitu Kumari.

Several other studies carried out too confirmed that G-quadruplex structure offered better protection to the DNA against radiation.

“Our study provides a new dimension to the role of altered DNA structures within the human genome, and helps study potential evolution of these structures. We also anticipate that our study will aid in exploring differential radiosensitivity across living organisms in correlation with the GC content of the genome,” says Prof. Raghavan.

<https://www.thehindu.com/sci-tech/science/iisc-natural-shield-protects-certain-dna-regions-from-radiation-damage/article29931809.ece>



## Researchers develop desi solar tech for indoor

New Delhi: As the conventional solar technologies may not be a suitable choice for indoor environments in near future owing to the high costs involved, researchers from a Central lab, based in Kerala, have developed an indigenous semi-automatic fabrication unit for manufacturing dye-sensitized solar cell (DSC) based modules.

DSCs contain synthetic dyes and harvests light by mimicking photosynthesis and are an efficient third generation indoor light harvesting technology, said researchers from the National Institute of Interdisciplinary Science and Technology (NIIST) which has developed the equipment. NIIST is one of the labs of the Council of Scientific and Industrial Research under the Union Science and Technology Ministry.

By developing indoor light harvesting photovoltaic cells, self-powered sensors can be realised and the battery life can be extended, pointed out an official from the Ministry.

Their advantage lies in their ability to generate power from low levels of exposure to light including indoor lights like CFL, LED etc. Installed at CSIR-NIIST lab, the equipment has been selected on the Prime Minister Office's high priority implementation category, he said.

The indigenous unit has been developed with the support of the Department of Science and Technology (DST) under the Ministry.

The entire equipment which was developed by the CSIR-NIIST partnering with Elixir Technologies, Bangalore has helped reduce cost of fabrication equipments to more than 60 per cent leading to true import substitution, said the researchers.

They said the fabrication process, molecules and materials were optimised keeping in mind end user requirements and applications thereby developing international competency in this photovoltaic sector.

The cell can be used in powering internet of things (IoT) smart devices, smart meters, water and energy management, smart parking, self-powered sensors, portable devices like those integrated in phones, tablets, mobile charging stations, backpack, in clothes and also solar power windows or aesthetically beautiful power producing glass windows.

According to experts, by 2020, there will be around 50 billion connected smart devices in the IoT domain which will be powered by batteries.

Appreciating the development, a scientist from the DST said India needs to develop expertise in manufacturing production equipment for photovoltaic technologies. "The country had been depending on technologies elsewhere and was importing them at a high cost. The NIIST fabrication unit has addressed this gap to a great extent and at a much lower cost," he added.

<https://www.dailypioneer.com/2019/india/researchers-develop-desi-solar-tech-for-indoor.html>