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

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Army yet to approve upgraded Arjun Mark-1A: All you need to know about India's most powerful desi tank

The upgraded Arjun Mark-1A MBT has been hailed by many as India's answer to the Russian-origin T-90S 'Bhishma' tanks that currently make up the majority of India's armoured vehicle regiments

Key Highlights

- *Weighing 68 tonnes, the Mark 1-A features a 120mm main gun and is an upgraded version of the original Arjun version*
- *The Mark 1-A is also equipped with thermobaric and penetration-cum-blast ammunition, apart from the conventional fin stabilised armour-piercing discarding sabot and high explosive squash head ammunition*
- *Apart from remaining in the testing phases for over 30 years before the first two tanks regiments were inducted into the Army, the basic Arjun MBT has been criticised for its weight, low serviceability and logistical issues*

The Indian Army continues to stall on approving the indigenously-developed Arjun Mark-1A main-battle tank. Last week, the latest capabilities of the tank were put on display for senior Army officials including Director-General Armoured Corps Lt Gen MJS Kahlon Bakshi, where the tanks' remote-controlled weapon system was demonstrated among other upgrades.

As per some reports, the Indian Army is preparing to raise two regiments of the tank to be inducted into the Army in the coming months. Currently, there are 124 Arjun tanks commissioned by the Army all of which are, reportedly, deployed along the western sector.

The upgraded Arjun Mark-1A MBT has been hailed by many as India's answer to the Russian-origin T-90S 'Bhishma' tanks that currently make up the majority of India's armoured vehicle regiments. However, with an order worth Rs 20,000 crore placed by the Indian Army in November 2019 for the production of 464 T-90S tanks. to add the existing 1,193 tanks already in operation, it does appear that the Army is not fully prepared to go 'aatmanirbhar' with the Arjun Mark-1A just yet.

Features of the Arjun Mark 1-A

Weighing 68 tonnes, the Mark 1-A features a 120mm main gun and is an upgraded version of the original Arjun version. The improvements made to the tank based on the Army recommendations are expected to have turned it into the nation's most potent indigenously-developed, self-protective tank.



The Arjun MK-1A Main Battle Tank. | Photo Credit: Twitter

Compared to its predecessor, the Mark 1-A includes an improved gunner sight, fitted with automated target tracking capabilities. This enables the tank's crew to identify and track moving targets automatically and attack them even when the MBT is mobile.

The Arjun MK-1A's gun is also, reportedly, operated using a computerised integrated fire control allowing high first-round kill capability. It also integrates day-and-night stabilised sights. The Mark 1-A is also equipped with thermobaric and penetration-cum-blast ammunition, apart from the conventional fin stabilised armour-piercing discarding sabot and high explosive squash head ammunition.

Controversy over the Arjun project

The Arjun MBT tank has been the subject of significant criticism since the DRDO first initiated the project in the mid-1970s. Apart from remaining in the testing phases for over 30 years before the first two tanks regiments were inducted into the Army, the basic Arjun MBT has been criticised for its weight, low serviceability and logistical issues. What's more, a 2016 report from the Comptroller and Auditor General noted that the Arjun tanks have not been operational since 2013 owing to a lack of spare parts. However, in 2017, the DRDO announced that it had imported spare parts to repair the faults that had, reportedly, sidelined 75 per cent of country's Arjun tanks.

Since 2017, the DRDO has been making concerted efforts to address the deficiencies of the tank and build it up to the Indian Army specifications. The latest statement from the DRDO noted that “all maintenance, spares and other issues” have been resolved for the first 124 tanks inducted into the Indian Army with 14 major and 58 improvements carried out on the Mark-1A tanks. However, the Indian Army has maintained that the tank remains a work in progress despite admitting that “substantive issues have been addressed.”

<https://www.timesnownews.com/india/article/army-yet-to-approve-upgraded-arjun-mark-1a-all-you-need-to-know-about-indias-most-powerful-desi-tank/694232>



Tue, 15 Dec 2020

What is the difference between DRDO and ISRO?

Defence Research and Development Organization, DRDO works to establish globally competitive science and technology base for India and Indian Space Research Organization, ISRO works for space programmes of India- Know the complete difference between the two here
By Tulika Tandon

Defence Research Development Organization and Indian Space Research Organization, ISRO are the two spearheads of Indian Research and Development. On one hand, DRDO is responsible for artillery and arms of Indian Armed forces, ISRO has the responsibility to make its mark in the world in the field of space and technology. Both departments use extensive research to make the best products available for national benefit. Take a look at the differences between DRDO and ISRO here.

What is DRDO?

Defence Research and Development Organization, DRDO is the organization that works to establish globally competitive science and technology base for India and equip the armed forces with state of art weapon systems and equipment as per the requirements laid in front of it.



DRDO's establishment happened in 1958 when Technical Development Establishment (TDEs) of the Indian Army and the Directorate of Technical Development & Production (DTDP) were combined with the Defence Science Organisation (DSO).

Now the organization is being run by more than 5000 scientists and various personnel. The work of DRDO involves various projects from the development of missiles and arms to electronic warfare systems.

DRDO: Significance

DRDO's pursuit of self-reliance and successful indigenous development and production of strategic systems and platforms such as

1. **Agni and Prithvi** series of missiles
2. Light combat aircraft, **Tejas**
3. Multi-barrel rocket launcher, **Pinaka**
4. Air Defence System, **Akash**
5. A wide range of radars and electronic warfare systems

These have provided a quantum jump to India's military might, generating effective deterrence and providing crucial leverage.

DRDO: Mission

1. It designs, develops and produces state-of-the-art sensors, weapon systems and other required equipment for Indian Defence Services.
2. It provides all technological solutions to the Defence Services and optimises the combat effectiveness.
3. It aims to promote the well-being of the defence troops of India
4. It develops the infrastructure and quality manpower for India and builds strong indigenous technology base

What is ISRO?

ISRO stands for Indian Space Research Organization. The Indian Space Agency works under the Department of Space of Government of India and is headquartered in Bengaluru, Karnataka.

ISRO: History

The space activities began in the 1960s in India and Dr Vikram Sarabhai, the founding father of Indian space programme brought up the idea of launching space missions from India. INCOSPAR, Indian National Committee for Space Research was initiated then by Dr Sarabhai and Dr Ramanathan.

It was then between 1975-76 when the Satellite Instructional Television Experiment (SITE) was launched and was hailed as the largest sociological experiment in the world. Kheda Communications Project followed next. It worked as a field laboratory for need-based and locale-specific programme transmission in Gujarat. Later in the 1980s the first Indian spacecraft named Aryabhata was developed and launched using a Soviet Launcher. This was followed by Bhaskara-I & II missions, INSAT, PSLV, GSLV and more.

ISRO: Significance

1. ISRO aims to design and develop launch vehicles and related technologies for providing access to space for India
2. It also designs and develops satellites and related technologies for earth's observation, communication, navigation, meteorology and space science
3. Indian National Satellite (INSAT) programme was developed by ISRO to meet the need for telecommunication, television broadcasting and developmental applications.
4. ISRO's Indian Remote Sensing Satellite (IRS) programme is used for management of natural resources and observing environment through space-based imagery
5. It develops space-based applications for societal development and conducts research and development in space science and planetary exploration

ISRO: Achievements

1. ISRO has launched various communication satellites like GSAT 7A, GSAT-31 etc and is also the launcher of various operational remote sensing satellites beginning with IRS-1A in 1988. These satellites aim to provide information on agriculture, water resources, urban planning, rural development, mineral prospecting, environment, forestry, ocean resources and disaster management.
2. ISRO also has some navigation satellites to its hat. These help the civil aviation department to function.
3. ISRO is working jointly with Airport Authority of India (AAI) to launch the GPS Aided Geo Augmented Navigation (GAGAN) system.
4. ISRO also works on Indian Regional Navigation Satellite System (IRNSS).
5. ISRO's Mission to Mars: Mars Orbiter Mission (MOM) or Mangalyaan was the maiden interplanetary mission of ISRO. It was launched on November 5, 2013, and was successfully inserted into Martian orbit on September 24, 2014, in its first attempt. This achievement of ISRO shook the world
6. ISRO in 2016 also successfully conducted the Scramjet (Supersonic Combusting Ramjet) engine test. This uses Hydrogen as fuel and the Oxygen from the atmospheric air as the oxidiser.
7. Apart from these ISRO has PSLV (Polar Satellite Launch Vehicle) and GSLV (Geosynchronous Satellite Launch Vehicle) which are used as satellite-launch vehicles.

Difference between ISRO and DRDO: Summarised

In the table below one can find the major differences between the two organizations discussed in detail above.

Category	DRDO	ISRO
Ministry	Ministry of Defence	Department of Space, Govt of India
Origination	1958	The 1960s
Founder	Govt of India	Dr Vikram Sarabhai
Functions	Develops defence weapons, artillery, missiles etc for Indian Armed forces	Develops and builds Space projects, satellites and launch vehicles
Products	BrahMos, Prithvi, Agni, Trishul, Akash	PSLV, GSLV, INSAT, MOM, Chandrayaan
Purpose	The organization works only for defence purpose, to save the integrity of the Indian Boundaries	Works for domestic purposes too like agriculture, communication system, weather assessment, green area measurement etc to help the general population

However, ISRO has made significant improvement and contributions towards the Space Research and has carved a niche for itself.

<https://www.jagranjosh.com/general-knowledge/what-is-the-difference-between-drdo-and-isro-1607942895-1>

View from India: Business is booming, with even the railways up for privatisation

We look forward to interesting times, led by successes in aerospace and transport. Electric mobility will gain momentum and passenger vehicles will be more sought after than before. As Asia's third-largest economy, India is preparing for a new growth story

By Kavitha Srinivasa

Global think-tank Stockholm International Peace Research Institute (SIPRI) noted this year that India is now the world's third largest military-defence spender, having moved up from fourth in ranking because of expenditure incurred to procure warships, submarines, aircraft and helicopters over a period of time.

Apart from defence investments, there have been many success stories of indigenous defence technologies. The Defence Research and Development Organization (DRDO), which is responsible for developing technology for the military, has declared the test flight of HSTDV as successful. An acronym for hypersonic technology demonstrator vehicle, HSTDV has catapulted India into the elite league of countries like US, Russia and China. India has several such victorious test flights. Yet HSTDV stands out for its diverse applications. Its potency lies in its speed. HSTDV missiles can serve purposes in air defence, surveillance and reconnaissance, apart from facilitating energy-efficient, low cost and reusable satellite launch vehicles. In its statement, the DRDO described the achievement as historic.



View from India: Business is booming, with even the railways up for privatisation

Another DRDO-developed Pinaka missile has also undergone a successful flight test. This enhanced version of the Pinaka Mk-1 is a multi-barrel rocket-launcher (MBRL) system. Pinaka, named after Lord Shiva's bow, can fire a salvo of 12 rockets in 44 seconds. It has a longer range performance compared to the previous variants.

Indian Space Research Organization (ISRO), the primary space agency of the Indian government, is all set to launch the country's third Moon mission in 2021. So Chandrayaan-3 will include a lander and rover like Chandrayaan-2. However the difference lies in the fact that the upcoming Moon mission will not have an orbiter. This decision is supported by the logic that the orbiter of Chandrayaan-2 is functional and has served the purpose of capturing several images of the lunar surface and craters.

Hindustan Aeronautics Limited (HAL) is producing 73 Advanced Light Helicopter (ALHs). A contracted effort, the production is expected to be completed by 2022 and will add to the existing fleet in the Army, Navy and Coast Guard. A world-class helicopter, ALH began production in 1992 and its design and performance has evolved since then.

A consortium of global agencies have come together to build the world's largest radio telescope in a scientific endeavour that is among the largest of its kind. The Square Kilometre Array (SKA) is so-called as it will be spread over a square kilometre or one million square metres of collecting area. Upon completion astronomers will monitor the sky in greater detail than ever before and at much higher speed.

India has a key role to play in this prestigious project. Tata Consultancy Services is designing and building the control systems of the mega project. The telescope manage is being stewarded by National Centre for Radio Astrophysics of the Tata Institute of Fundamental Research. Scientific research comes from other organizations like Raman Research Institute, Indian Institute of

Astrophysics, Inter-University Centre for Astronomy and Astrophysics, along with several Indian Institutes of Technology.

Space is all set to be a level playing field. IN-SPACe, an acronym for Indian National Space Promotion and Authorization Centre, is the new entity that will pave the way for unexplored opportunities in space. With the approval of the Union Cabinet, IN-SPACe will open up the skies for private participation. Regulatory measures and supportive policies will help private companies tap Indian space infrastructure. This extends to space activities like building rockets and satellites, apart from providing launch services. The inter-planetary missions of the Indian Space Research Organization (ISRO) will also be thrown open to private players. Prime Minister (PM) Narendra Modi tweeted, “The Union Cabinet’s approval to reforms in the space sector is yet another step towards making our nation self-reliant and technologically advanced. The reforms will boost private sector participation as well. This will not only result in an accelerated growth of this sector but will enable Indian Industry to be an important player in global space economy. With this, there is an opportunity for large-scale employment in the technology sector and India becoming a Global technology powerhouse.”

Boeing India has announced that its largest presence outside America, its home turf, will be India. It’s destination India for the American major. Over the next two years, Boeing India will strengthen its workforce as well as component sourcing. Investments will go towards enhancing production, supply chain management and innovations in aerospace technology. It is anticipated that Boeing India’s decision will encourage the growth of MSME’s in aerospace and avionics.

Rolls-Royce, a leading aerospace and defence technology company, and Infosys, a global leader in next-generation digital services and consulting have entered into a partnership. The partnership is to source engineering and R&D services for Rolls-Royce’s Civil Aerospace business. As part of the overall partnership, Rolls-Royce will transition a significant part of its engineering centre capabilities for Civil Aerospace in Bangalore to Infosys. Leveraging its expertise in core engineering services, digital transformation capabilities, and Rolls-Royce product knowledge acquired through the partnership, Infosys will provide a full range of high-end engineering and R&D services integrated with advanced digital service to Rolls-Royce.

When we look at the overall aviation industry in India, investments from and collaborations with global players have accelerated the growth of aerospace engineering, aviation technology, accelerator programmes as well as aerospace start-ups.

Awais Ahmed and Kshitij Khandelwal who started Pixxel, an Indian start-up have made news as the business has managed to raise seed funding to the tune of \$5 million. The capital will be utilised for sending Earth-imaging satellites into space from India. Venture capital firms Lightspeed India and Blume Ventures have come forward to make this investment, which is the largest of its kind in the space sector. Agriculture and oil and gas firms in India and the US have an agreement to use Pixxel’s image data. Let’s hope more such tech start-ups come up with path-breaking technologies.

Belagavi in Karnataka is preparing to usher India’s first miniature airport. Modelled along the lines of Miniatur Wunderland in Hamburg, Germany, the airport is positioned as a tourist attraction. It will showcase operations such as check-in, boarding, aircraft take-off, landing and parking. As part of the Smart City programme, Belagavi Smart City Ltd has tentatively identified land for the upcoming project.

Railways open for privatisation

In another significant development, the government has announced that the Indian Railways (IR) is open for privatisation. The first batch of 12 private trains is expected to chug along the railway tracks by 2023. The fact that IR will be privatised makes it interesting. This will unfold channels for investments. As per media reports, around 23 companies have shown interest in privatisation. It would be nice if some of the unexplored routes are mapped out as investments pick up.

This year, rail connectivity has reached a milestone with historic achievements. PM Modi has announced various projects undertaken to improve rail connectivity as well as electrification in Bihar. Worth around Rs 3,000 crore, the projects are dedicated to the nation. Some of the positive outcomes of the inauguration of Kosi Mahasetu and Kiul Bridge would include the promotion of Make in India solutions for railways along with the creation of new jobs.

The railway journey continues with a multipurpose transport project planned in the state of Haryana. The Haryana Orbital Rail Corridor project is expected to facilitate affordable and faster commuter travel, as well as long-distance travel to different locations. Manipur in North-East India is gearing up to welcome a pier bridge which is supposed to be the tallest of its kind in the world. Being constructed across the River Ijai near Noney, the pier height will stand tall at 141 metres, while the length of the bridge will be 703 metres. The pier bridge will surpass the existing record of 139 metres of Mala-Rijeka viaduct, Montenegro in Europe. Hydraulic augers have been used for the piers of the bridge. Being tall, the piers required a slip-form technique to ensure efficient and continual construction. As a safety measure, 'self-erecting' electric lifts are being used at each pier.

Fresh revenue opportunities will arise from new routes of rail connectivity. Besides seamless connectivity, it will also de-congest the existing routes as well help in the development of multi-modal logistics hubs.

Road transport

The Atal Tunnel at Rohtang is another engineering marvel. Rohtang, the world's highest-altitude tunnel, is a horseshoe-shaped, single tube double lane road tunnel. It has a roadway of eight metres with a fireproof emergency egress tunnel built into the main tunnel itself.

The tunnel has been designed to accommodate 3,000 cars a day and 1,500 trucks with maximum speed of 80km/h. It has an electromechanical system with a semi-transverse ventilation system. Rohtang is one of the highest passes in the Himalayas. So it's natural that the tunnel has factored in geological, terrain and weather challenges. The tunnel is in honour of the contribution made by late PM Atal Bihari Vajpayee.

Electric vehicles (EVs) are replacing the existing fleet of petrol-diesel vehicles used by the central and state governments. Automakers like Tata Motors and Hyundai Motor India are in the process of manufacturing 250 EVs for Energy Efficiency Services Limited (EESL). This is a joint venture of public sector undertaking companies under the administrative control of the Ministry of Power.

A growing concern for EV adoption has urged the industry and academia to come together. The outcome is an electric (e-bus) project. Hitachi ABB Power Grids in India (listed as ABB Power Products and Systems India Ltd), Ashok Leyland and the Indian Institute of Technology, Madras (IIT-M) have all signed an agreement for an e-bus. A collaborative effort, Ashok Leyland will provide the e-bus, Hitachi ABB Power Grids will localise the flash charging technology for India and the infrastructure required for the flash-charging system will come from IIT-M. But an e-bus has its own challenges. The charging infrastructure and running time need to be figured out.

Besides that, auto companies have rolled out many clean and green variants in the form of EVs. To that extent, investments continue in the auto segment. No doubt, EVs navigate the roads, yet their sales can ramp up when the charging infrastructure falls into place. Seen futuristically, the domestic production of battery cells is also expected to drive in volume sales.

Taxi aggregator Ola is preparing to be a vehicle manufacturer. Its founders Bhavish Aggarwal and Ankit Bhati have shared their plans with the media. Ola is in talks with state governments. The company plans to build an e-scooter facility across 100 acres of land.

The personal mobility space has wooed potential buyers during Covid. Second-hand cars and two-wheelers are a thriving market. Showroom models of two-wheelers and passenger vehicles (PVs) have generated sales as consumers prefer their own vehicle to commuting in public transport. Leading automaker Tata Motors has achieved a milestone. The company has completed the production of four million passenger vehicles (PV).

Meanwhile Royal Enfield has launched a personalisation service titled Make-It-Yours (MIY) for its motorcycles. This application and website-based configurator enables bikers to personalise their motorcycles when they make the purchase. Imagination knows no bounds as options come in the form of colourways, trims and graphics, along with motorcycle accessories. Royal Enfield has been making motorcycles since 1901 and is now owned by the Eicher Group.

Pandemic-driven innovations will continue and many existing solutions and operations will undergo a disruption. Things will change.

<https://eandt.theiet.org/content/articles/2020/12/view-from-india-business-is-booming-with-even-the-railways-up-for-privatisation/>



Tue, 15 Dec 2020

India to tap ‘Lithium Triangle’ for Lithium-ION batteries onboard Indian Navy subs

While India and Bolivia are in talks about having a joint manufacturing base for the batteries, both Chile and Argentina are in talks about exploration and exports of Lithium

By Huma Siddiqui

Following in the footsteps of the Japanese and South Korean navies, the Indian Navy has issued a RFI seeking details of Li-ion batteries. These batteries will be fitted in all the future submarines in the Indian Navy which are being designed to use this technology.

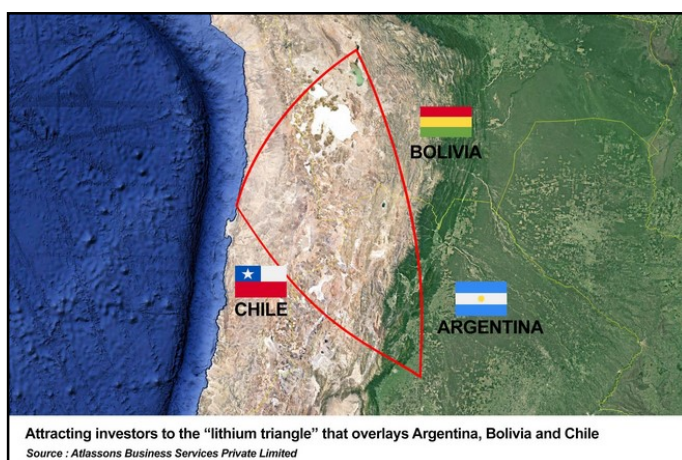
Lithium-ion battery development is at an advanced stage with all leading global submarine manufacturers and one could guesstimate that by the end of this decade, all modern SSKs will be powered by Li-ion batteries.

“Indian submarines still do not have Air-independent Propulsion (AIP) even on the latest Kalvari class submarines. India’s DRDO is developing an indigenous fuel cell AIP system but fitment on a submarine is yet some distance away,” Indian Navy veteran Commodore Anil Jai Singh tells Financial Express Online.

Financial Express Online has been reporting on India’s exploratory visits to the ‘Lithium Triangle’ nations (Argentina, Bolivia & Chile) to meet its target of having Electric Vehicles by 2030. And it was for this reason in 2019, the government has formed ‘KABIL’ consortium which has three state-owned companies: National Aluminum Company (NALCO), Hindustan Copper (HCL) and Mineral Exploration Corp Ltd., (MECL).

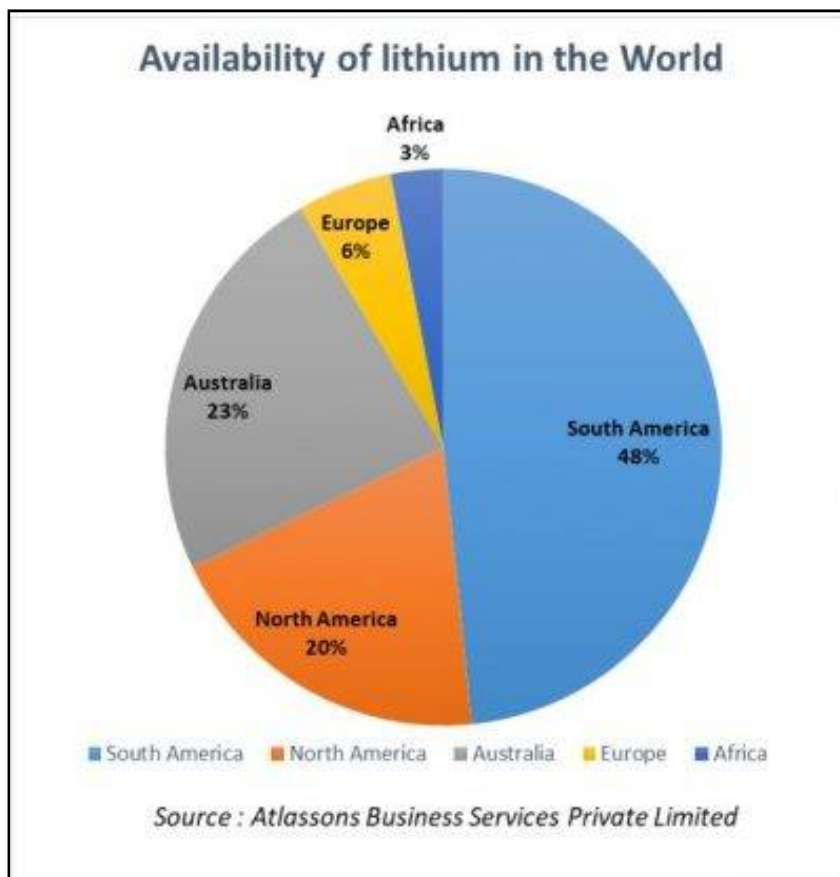
The Purpose of this consortium

It has been set up to help in the process of acquiring this most strategic mineral globally. This mineral is required not only for the EVs but is used in other sectors including space launchers, solar panels, mobile phones and laptops and hi-tech military platforms including submarines for the Indian Navy. KABIL will help in processing the mineral once acquired from any of the three countries in South America.



Last year, President Ram Nath Kovind had visited two out of the three 'Lithium Triangle' nations.

Last year, President Ram Nath Kovind had visited two out of the three ‘Lithium Triangle’ nations and the focus of talks was also on joint manufacturing and facilitating the process of acquiring the rare metal. And, the former President of Argentina Mauricio Marci, had also visited India.



Today, since there is a huge demand for the Li-on batteries and cells due to their high energy density, these are imported 100 per cent. With the ongoing standoff between India and China, the focus has now shifted on setting up R&D and Technology Development Facilities, as the government plans to manufacture the batteries and cells here locally.

While India and Bolivia are in talks about having a joint manufacturing base for the batteries, both Chile and Argentina are in talks about exploration and exports of Lithium.

Submarines of Japan & South Korea

“In March 2020, the JMSDF (Japanese Maritime Self Defence Force) became the first navy in the world to operationalise lithium-ion battery technology on submarines onboard its newest submarine, JS Ouryo, the 11th of the Soryu class submarines commissioned in March 2020. Lithium-ion batteries will also power the 12th and last of the Soryu class and the forthcoming Tiagei class, the first of which was launched in November 2020. Many more navies are expected to follow suit with the South Korean Navy’s new KSS-III submarines, currently under construction also being fitted with this technology,” says Indian Navy veteran Commodore Anil Jai Singh.

According to the former submariner, “The South Koreans are planning to go a step further than the Japanese. While the Japanese have done away with their Stirling engine based Air-independent Propulsion (AIP) system onboard the Ouryo and its successor, the South Koreans are planning to reconfigure their fuel cell AIP system to operate in conjunction with the lithium-ion batteries on board. This will greatly enhance both, the speed and the endurance of diesel-electric submarines (SSK). Most other submarine manufacturers are expected to follow suit with each of them in various stages of developing Li-ion battery systems for their respective designs.”

Use of Lithium Batteries & how will it help

According to Commodore Singh, “Li-ion batteries are already being used to power practice torpedoes and unmanned underwater vehicles but there had been a hesitation to incorporate these onboard submarines because of lingering safety concerns. The exploding Samsung -7 Note mobile telephones and the frequent fires on board the Boeing 787 aircraft were both attributed to lithium-ion batteries.”

This breakthrough technology which has begun replacing the traditional lead-acid batteries in use for over one hundred years on submarines greatly reduces the constraints on underwater speed and endurance that limits the options available for their deployment. Lead-acid batteries, because of their high discharge rates required to be charged frequently and even the most conservative operational profile underwater would still require them to be charged at least once in 48-72 hours.

“Doing top speed underwater would discharge them in about a couple of hours. Charging of batteries requires a submarine to operate its diesel generators which then charge the batteries. The diesel generators need fresh air for their operation. Hence the submarine has to expose its ‘snorkel’ mast to take in fresh air and risks detection by the enemy. This complicates the Commanding Officer’s options to attack or evade the enemy in hostile waters. Improvements in lead-acid battery technology over the years has mitigated this to some extent with the endeavour being to minimise the ‘indiscretion rate’ which is the percentage of the time a submarine is exposed in a 24-hour cycle,” he explains to Financial Express Online.

“The introduction of AIP systems which allows a submarine at economical speed to remain underwater for up to a fortnight without charging batteries has reduced indiscretion rates to a negligible value but has not appreciably enhanced the operational profile at higher speeds. Lithium-ion batteries, with their higher energy and longer lifecycle are set to change this by improving the endurance at higher speeds thus providing the submarine commander with a wider range of tactical options and will also facilitate the integration of the submarine into a network-centric force deployment over a larger area of the ocean,” he adds.

In conclusion, he says, “One of the main concerns which inhibited their deployment of submarines was the hazards of thermal runaway, fire and explosion but as development has progressed these have been addressed and the operational deployment of these on submarines is reassuring.”

<https://www.financialexpress.com/defence/india-to-tap-lithium-triangle-for-lithium-ion-batteries-onboard-indian-navy-subs/2149690/>

MSME must upgrade and accept new technologies: Nitin Gadkari

New Delhi: Union Minister of Micro, Small and Medium Enterprises (MSME) Nitin Gadkari has said that MSME must upgrade their technology and accept new technologies in order to make products that can substitute imports and increase India's exports.

While speaking at the 10th MSME Convention of All India Management Association (AIMA), Gadkari said,"

We have to identify the products that are indigenous, import substitute, innovative, of good quality and that can be made at a lower cost and made available to the international market," he said.

Gadkari shared his ideas on innovation needs and potential of Indian MSMEs. Gadkari also applauded AIMA for bringing industry focus on innovative solutions for the MSMEs.

Mr Harsh Pati Singhanian, President, AIMA and Vice Chairman & Managing Director, JK Paper appreciated the minister's efforts to save India's MSME sector during the covid crisis.

"The MSME sector was the key to raising the contribution of the manufacturing sector to 25% of the GDP and creating 5 crore additional jobs in the coming five years," he stressed.

However, he added, for that to happen, Indian MSMEs needed to take advantage of new technologies.

The minister declared that the government's mission was to raise the MSME sector's contribution to GDP growth to 40% from the current 30% and increase its share in India's exports to 60% from the current 48%. He said that the MSMEs were the key to increasing GDP of the rural and the tribal areas.

On technology upgrade and adoption, the minister said that Indian enterprises and research organizations needed to upgrade domestic technologies and also source technology from foreign research institutes through joint ventures. He said that a lot of research in India was conducted by the defence labs, such as DRDO, and they needed to share their technology with common people.

To increase exports, India's MSMEs must align with technological changes introduced by the government, especially in the automobile sector, the minister said. He pointed out that while the government was prioritizing electric vehicles, the country was dependent on imports for components. "We have to develop vendors for e-vehicles."

Gadkari pointed out that Amazon was exporting products of Indian MSMEs worth Rs 70,000 crore, which included handlooms, handicraft and honey etc.

"We need to present and market in a proper way in international market," he said.

Highlighting the government's mission of import substitution, Gadkari said that India could substitute the import of Rs 8 lakh crore of petroleum with ethanol made from sugar cane, rice and corn, which were surplus in the country.

"To meet the need of ethanol on such a scale, he suggested creating mills that directly made ethanol instead of sourcing it from sugar mills," he added.

He also pointed out that the market price of corn was Rs 1,000 per quintal compared to the government's MSP of Rs 1700 because of surplus output.



MSME must upgrade and accept new technologies: Nitin Gadkari

"We can make the Rs 25,000 crore ethanol industry a Rs 2 lakh crore industry and we can create employment opportunities in rural areas," the minister said.

Dr JS Juneja, Chairman MSMEs and Past President, AIMA requested the minister to accept the suggestion of the Prabhat Kumar Committee for creation of an MSME Innovation Fund of Rs 1000 crore and sanction the amount promptly.

<https://knnindia.co.in/news/newsdetails/msme/msme-must-upgrade-and-accept-new-technologies-nitin-gadkari>



Tue, 15 Dec 2020

India's Advanced Missile Defense Shield: Implications for Contemporary South Asian Security Environment – OpEd

By Haris Bilal Malik

Over the last few years, India has been carrying out an overwhelming and offensive military modernization program. This has been primarily inspired by its long term strategic goal of achieving the status of great power. At the same time, India aspires to dominate the regional security environment with the provision of a strong military outlook. In pursuit of this objective, India has been enhancing both its conventional and unconventional capabilities.

In this regard, while maintaining an aggressive military posture, India's major focus has been to ensure a multilayered and advanced missile defence shield. This has been materialized with the provision of both indigenous developed and foreign acquired missile systems that are capable enough of providing a non-penetrable air defence shield. As such, this has further added to the air defence capabilities of the Indian military.

These capabilities in turn would likely undermine Pakistan's strategic deterrence posture. Consequently, the Indian military modernization drive with a more focus on the provision of a multilayered air defence shield would bring long-lasting implications for the contemporary regional security environment in general and Pakistan in particular.



As of now, India's air defence shield is primarily based on diverse missile systems aimed at providing a multilayered aerial defence. At the indigenous level, India has developed Ballistic Missile Defence (BMD) systems like the Prithvi Air Defence (PAD), the Advanced Air Defence (AAD) also known as the Ashwin missile system, and the Akash Air Defence System. The PAD has been developed to provide interception against ballistic missiles at higher altitudes while the AAD is meant for the interception at lower altitudes. The Akash system, a medium-range surface-to-air missile system, is aimed at covering multiple targets at low, medium as well as high altitudes.

Similarly, as a joint venture with Israel, India has developed the Barack-8 missile system. Though this system is of Israeli origin, it has been jointly developed by both countries. It is a medium-range missile system that provides defence against a wide range of airborne threats including ballistic and cruise missiles, drones, helicopters, and combat jets. It is quite noteworthy

that amid the recent border crisis with China in the disputed Ladakh region in June this year, India requested an emergency deployment of the Barak-8 system to Israel.

Most significantly, under a much-hyped foreign deal, India has signed an agreement with Russia for the purchase of five units of the S-400 missile system back in October 2018. As per the available record, the delivery with a bit delay on account of the COVID-19 pandemic is scheduled to start by the end of 2021, whereas all the additional units are planned to be supplied no later than 2025. The S-400 system is widely believed to be one of the most advanced missile systems currently available in the world. It has some very incredible capabilities which currently no other advanced missile system possesses. Like for instance, 8 launchers can fire some 112 diverse types of missiles having different ranges. It has an unmatched tracking range of up to 600 kilometers.

Furthermore, the system can engage 80 targets at a time including ballistic and cruise missiles, fighter jets, and drones at a range of 400 kilometers. These provisions make it the most lethal and deadliest missile system that has ever been developed to date. Given the Indian aggressive military posturing against Pakistan, the S-400 system once acquired would provide India a long-range air defence shield most likely against Pakistan. Also, in wake of the recent humiliating border clashes with China, India is looking forward to receiving the system as early as possible.

It would be pertinent to discuss here that India intends to acquire the National Advanced Surface to Air Missile-II (NASAMS-II) from the US as well. It is known to be one of the advanced missile systems that are more likely to protect important cities. It can intercept and destroy medium-range aerial targets with a wide array of missiles. NASAMS-II is a sophisticated missile system with the provision of 3D radars for surveillance, robust command and control, and fire distribution centers.

Though the deal has not been finalized yet, this missile system holds great significance for India vis-à-vis its notion of a multilayered missile defence shield. Another very important element that needs to be considered while analyzing this proposed deal is the recently signed India-US Basic Exchange and Cooperation Agreement (BECA). According to this, along with other benefits, the US would share classified geospatial and intelligence information with India. This would likely be ultimately utilized for enhancing the accuracy of the US' supplied military hardware to India including the missile defence systems which rely on satellites for surveillance and pinpoint accuracy. This very much indicates the likely significance of the US origin missile system for India which would likely boost-up the proposed deal of NASAMS-II.

Hence at present, the South Asian security environment remains in a state of influx due to India's ongoing aggressive military modernization drive. In this regard, the indigenous development of BMD systems and the acquisition of some of the most advanced missile systems from countries like Russia and the US are a clear attempt to undermine the contemporary regional security environment.

With such acquisitions, India might be in a stronger position to challenge Pakistan's existing nuclear force posture by neutralizing the deterrent value of the nuclear warhead delivery systems that majorly include ballistic and cruise missiles and jet planes. This would ultimately disturb the deterrence equilibrium in the South Asian region that prevails to date primarily because of Pakistan's credible nuclear deterrence posture. To address this security dilemma, Pakistan, for the time being, might continue to rely on its MIRV capabilities to penetrate the Indian sophisticated missile defence shields. However, in the longer-term, the prospects of acquiring the same missile systems are needed to be considered and cannot be entirely ruled out. This seems to be a difficult but plausible way out since Pakistan might be compelled to follow the same suit.

(The writer currently works as a Research Associate at the Strategic Vision Institute (SVI) in Islamabad, Pakistan.)

<https://www.eurasiareview.com/14122020-indias-advanced-missile-defense-shield-implications-for-contemporary-south-asian-security-environment-oped/>

China's PLA carrying out development work in Tibet; India ready for any eventuality: CDS Bipin Rawat

Kolkata: Chief of Defence Staff (CDS) General Bipin Rawat stated on Monday that the People's Liberation Army (PLA) is carrying out development activities in Tibet Autonomous Region of China, amid the Sino-Indian standoff at Ladakh.

He also underlined that Indian forces are well- equipped to deal with any eventuality, and similar activities are being undertaken in the country.

"We are locked in a stand-off in Ladakh. There is some development activity which has been going on in Tibet Autonomous Region of China. Every nation will continue to make preparations to boost its security based on its strategic interests.

"I don't think there should be much concern in that because we, on our side, are also carrying out similar activities," Rawat told reporters after the launch of indigenously built state-of-the-art stealth frigate 'Himgiri' at Defence PSU Garden Reach Shipbuilders and Engineers here.

Indian Armed forces will leave no stone unturned to safeguard the country's frontiers, he insisted.

"China's attempt to change the status quo on the Line of Actual Control along the northern borders amidst the Covid-19 pandemic necessitated high levels of preparation on land, sea and in the air," the CDS said.

The Indian Army, following the Doklam stand-off in 2017, has taken measures to ensure that the situation does not escalate there any further, he maintained.

Indian forces are carefully watching the activities of the PLA at Doklam, where the armies of the two most populous countries in the world were engaged in a 73-day eyeball-to- eyeball stand-off in 2017.

"We have taken necessary action to counter anything that would be a cause of concern to our national security," he said, when asked about possible Chinese misadventures in the eastern sector, in the midst of the Ladakh impasse.

The CDS further said that the Indian Armed forces have adequate strength and reserves to counter any threat, and is looking to equip themselves with more cutting-edge technology.

"Time has come now to look at the future of war fighting, imbibing technology into our systems," he said.



Chief of Defence Staff General Bipin Rawat (PTI)

Talking about the continuous ceasefire violation by Pakistan, he said India is fully prepared to deal with it and that it is the other side which should be more concerned about carrying out such activities.

Asked whether India should have more submarines or procure another aircraft carrier, Rawat said both have their advantages and disadvantages.

"Submarines have a separate place in naval warfare, in domination of the seas, and so does an aircraft carrier," he said, maintaining that the Navy needs an air wing.

The country needs to utilise its large number of island territories for strengthening security along the sea lanes of communication, Rawat said.

He also said that islands can be an option for launching naval strike aircraft.

"Once we have studied all that and understood in detail, we will take a call," he asserted.

Rawat said that the three forces -- Army, Navy and Air Force -- will be integrated, while retaining the niche capabilities of each service.

"We strongly believe that no single force or no single service can succeed in any conflict situation if we are to face conflict with our adversaries anywhere -- whether it is land, air or sea," he said.

The integration will ensure synergised application of the country's combat potentials, the CDS said.

"We had some hiccups on this, we have to have understanding of each other's service, integration is taking place and gradually we are moving forward in that direction.

"We have successfully overcome some of the misconceptions about force restructuring by allowing space to each force to develop niche capabilities based on their strengths, and thus enhance our overall combat power," he added.

<https://timesofindia.indiatimes.com/india/chinas-pla-carrying-out-devpt-work-in-tibet-india-ready-for-any-eventuality-cds-bipin-rawat/articleshow/79724473.cms>



Tue, 15 Dec 2020

Carrier or submarine for Navy? being examined, Says General Bipin Rawat

***"Himgiri will provide a major boost to Indian Navy's
defence preparedness," General Bipin Rawat said***

By Monideepa Banerjee

Kolkata: A state-of-the-art guided missile stealth frigate was launched in Kolkata today and will soon join the fleet of Indian Navy. Called Himgiri, this is the first of the three Stealth Frigates ordered in 2015 at the cost of ₹ 19,293 crore. The frigate was launched two months ahead of schedule, said shipbuilder GRSE, by Madhulika Rawat, wife of the Chief of Defence Staff, General Bipin Rawat.

"Himgiri will provide a major boost to Indian Navy's defence preparedness," General Rawat said, congratulating GRSE and the Indian Navy for achieving this "milestone despite adverse effects of the Covid pandemic". Speaking to the media after the launch, General Rawat spoke on a debate over what the Navy needs more -- aircraft carriers or submarines.

"Both have their advantages and disadvantages. Submarines have their separate place in the naval warfare and so does an aircraft carrier. I am in no way saying the Navy does not need its Air wing. Yes it needs an Air wing. But how to manage it and how to ensure the security and sanctity of our sea lines of communication we are thinking about," he said.

General Rawat indicated a probable alternative to an aircraft carrier.

"I think you also need to look at our Island territories that we have in large numbers. If we can leverage our Island territories to our advantage, then we can balance out... this can be used as territories to launch naval strike aircraft or do we need an aircraft carrier. Once we have studied all that in detail we will take a call," he said.

The Stealth Frigate Himgiri is 149 m long, with a displacement of approximately 6,670 tonnes and has an advanced CODOG Propulsion system enabling speed of over 28 knots.



Stealth frigate Himgiri is 149 m long, with a displacement of 6,670 tonnes

"These complex weapon platforms are equipped with a powerful weapon & sensor package capable of neutralising threats in all three dimensions, Air, Surface & Sub-surface," a GRSE statement said. An Italian company, Fincantieri, is the knowhow provider for technology upgrade for the project.

For GRSE, the frigate is a prestige project and one of the biggest orders it has ever got from the Defence Minister. GRSE is also currently executing two more major projects of Indian Navy – the construction of four Survey Vessel Large ships and eight ASW SWC ships.

Speaking at the launch, CMD Rear Admiral VK Saxena (Retired) said GRSE has delivered 105 warships so far. It has orders for 15 warships for the Navy to be delivered by 2027.

Other military brass present at the launch included Eastern Naval Command Commander-in-Chief Vice Admiral AK Jain and Army Commander, Eastern Command Lieutenant-General Anil Chouhan.

<https://www.ndtv.com/india-news/state-of-the-art-stealth-frigate-himgiri-launched-soon-to-be-inducted-in-navy-2338616>



Tue, 15 Dec 2020

ब्लू वाटर नेवी बनने में जुटी भारतीय नौसेना, फ्रीगेट युद्धपोत लॉन्च | जानें खास बातें

ब्लू वाटर नेवी बनने में जुटी भारतीय नौसेना स्वदेशी युद्धपोतों को अपने जंगी बेड़े में शामिल करनी में जुटी है। प्रोजेक्ट 17ए के तहत कोलकता स्थित गार्डन रिच शिपयार्ड इंजीनियर्स में पहला फ्रीगेट युद्धपोत समंदर में लॉन्च किया गया।

By नीरज राजपूत

नई दिल्ली: ब्लू वाटर नेवी बनने में जुटी भारतीय नौसेना अब तेजी से स्वदेशी युद्धपोतों को अपने जंगी बेड़े में शामिल करनी में जुट गई है। सोमवार को प्रोजेक्ट 17ए के तहत कोलकता स्थित गार्डन रिच शिपयार्ड इंजीनियर्स (जीआरएसई) में पहला फ्रीगेट युद्धपोत समंदर में लॉन्च किया गया।

इस मौके पर चीफ ऑफ डिफेंस जनरल बिपिन रावत की मौजूदगी में उनकी पत्नी मधुलिका रावत ने सैन्य परंपरा के तहत इस युद्धपोत को लॉन्च किया। आपको बता दें कि भारतीय नौसेना के 41 युद्धपोत फिलहाल देश के अलग-अलग शिपयार्ड्स में बन रहे हैं।

नौसेना के पास करीब 150 छोटे-बड़े युद्धपोत हैं

प्रोजेक्ट 17ए के तहत भारतीय नौसेना के कुल 07 फ्रीगेट बनाए जाने हैं। इनमें से चार मुंबई स्थित मझगांव डॉकयार्ड में बनने हैं और तीन जीआरएसई में। जीआरएसई में फिलहाल इस तरह के दो फ्रीगेट्स का निर्माण शुरू हो चुका है। सोमवार को जिस फ्रीगेट को लॉन्च किया है वो नौसेना में शामिल होने के बाद 'आईएनएस हिमगिरी' के नाम से जाना जाएगा। मझगांव डॉकयार्ड में भी इस प्रोजेक्ट के तीन युद्धपोत का निर्माण शुरू हो चुका है। ये सभी 'नीलगिरी क्लास' युद्धपोत हैं।

आपको बता दें कि भारतीय नौसेना को वर्ष 2030 तक करीब 200 युद्धपोत और पनडुब्बियों की जरूरत है। इस समय नौसेना के पास करीब 150 छोटे-बड़े युद्धपोत हैं। लेकिन नौसेना में जंगी जहाजों के शामिल करने का काम तेजी से चल रहा है। नौसेना प्रमुख एडमिरल करमबीर सिंह ने नौसेना दिवस के मौके पर जानकारी दी थी कि फिलहाल 43 युद्धपोत, एयरक्राफ्ट कैरियर और पनडुब्बियों के निर्माण का काम चल रहा है। जिनमें से 41 देश के ही अलग-अलग शिपायर्ड में बनाए जा रहे हैं। जीआरएसई, एमडीएल, गोवा स्थित जीएसएल, कोच्चि स्थित कोचिन शिपायर्ड और विशापट्टनम स्थित हिंदुस्तान शिपायर्ड में।

तीसरे एयरक्राफ्ट कैरियर की जरूरत

सरकारी डॉकयार्ड के अलावा अब निजी क्षेत्र की कंपनियां भी नौसेना और कोस्टगार्ड के लिए जहाज बना रही हैं। नौसेना के आंकड़ों की माने तो पिछले छह साल में जितने भी युद्धपोत और पनडुब्बियां नौसेना के जंगी बेड़े में शामिल हुई हैं वे सभी भारत में ही तैयार की गई हैं। आपको बता दें कि पूरे हिंद महासागर क्षेत्र के साढ़े सात करोड़ वर्ग किलोमीटर की सुरक्षा और निगहबानी के लिए भारतीय नौसेना को एक बड़े जंगी बेड़े की जरूरत है। खुद प्रधानमंत्री नरेंद्र मोदी के 'सागर' प्लान यानि सिक्वियरेटी एंड ग्रोथ फॉर ऑल इन द रिजन के तहत हिंद महासागर के लिए भारतीय नौसेना एक 'नेट-सिक्वोरिटी प्रोवाइडर' है। इसके अलावा इंडियन ओसियन रिजन के सभी मित्र-देशों की सुरक्षा हो या कोई प्राकृतिक आपदा उन सभी की मदद करना भारतीय नौसेना की जिम्मेदारी।

यही वजह है कि भारतीय नौसेना पूरी तरह से 'ब्लू-वॉटर नेवी' बनने के लिए एक तीसरे एयरक्राफ्ट कैरियर की मांग कर रही है। अभी भारतीय नौसेना के पास रूस से लिया एक एयरक्राफ्ट कैरियर, आईएनएस विक्रमादित्य है। इसके अलावा एक स्वदेशी विमानवाहक युद्धपोत कोच्चि स्थित कोचिन शिपायर्ड में जल्द बनकर तैयार होने वाले है। लेकिन नौसेना प्रमुख साफ कह चुके हैं कि हिंद-प्रशांत महाक्षेत्र में ओपरेट करने के लिए तीसरे एयरक्राफ्ट कैरियर की जरूरत है।

लेकिन चीफ ऑफ डिफेंस स्टाफ, सीडीएस जनरल बिपिन रावत ने हाल ही में कहा था कि नए एयरक्राफ्ट कैरियर के लिए नौसेना को एक बड़े रकम की जरूरत पड़ सकती है। इसलिये अंडमान निकोबार कमान को भी एक एयरक्राफ्ट कैरियर की तरह हिंद महासागर में 'स्टेटिक' एयरक्राफ्ट कैरियर की तरह इस्तेमाल किया जा सकता है।

<https://www.abplive.com/news/india/indian-navy-embarked-on-becoming-blue-water-navy-launched-first-frigate-warship-in-the-sea-ann-1679092>

INS 'Himgiri', Indian Navy's advanced P17A-class stealth frigate, launched at GRSE yard — here's all you need to know

The Project 17A Stealth Frigate 'INS Himgiri' was launched at the GRSE facility in Kolkata in the presence of Chief of Defence Staff (CDS) General Bipin Rawat on this day

Kolkata: 'INS Himgiri', alias 'Project 17A' — a *Nilgiri*-class frigate for the Indian Navy — was launched on Monday (i.e. December 14) at the Garden Reach Shipbuilders & Engineers (GRSE) facility here. The 'INS Himgiri', which is a follow-up on the Project 17 *Shivalik*-class frigate, is the first of three such Project 17A (P17A)-class advanced stealth warships that the armed forces have contracted the GRSE to build.

The Project 17A Stealth Frigate 'INS Himgiri' was launched at the GRSE facility in Kolkata in the presence of Chief of Defence Staff (CDS) General Bipin Rawat on this day, news agencies reported.

According to *Defpost*, the GRSE had laid the keel for the vessel two years back on November 9, 2018.

'Project 17A'

The *Nilgiri*-class frigate or 'Project 17A (P17A)'-class is a follow-up on the currently-operational 'Project 17 (P17)' or the *Shivalik*-class stealth frigates.

It's called *Nilgiri*-class after the lead ship, or the first major warships (now decommissioned) to be built in India, which in turn were named after hill ranges in India.

The original *Nilgiri*-class ships were updated versions of the British Leander class frigates. The new ones are to be named as so — INS Nilgiri, INS Himgiri, INS Udaygiri, INS Dunagiri, INS Taragiri, INS Vindhyagiri, and finally, INS Mahendragiri.

A total of seven such advanced stealth warships have been planned. Four of them will be developed by the state-owned Mazagon Dock Ltd. (MDL) in Mumbai, while the other three are to be built by the GRSE in Kolkata.

Features

The new vessels are built with indigenously developed steel and will be incorporated with the latest stealth features, including improved roll stabilisation and a discreet visual profile so as to voyage in a trice into enemies during maritime conflicts.

The Project 17A (P17A)-class frigates also feature state-of-the-art weapons systems and sensors along with advanced Integrated Platform Management, according to *Defpost*.

The report also elaborates on how the P17A frigates will be "powered by two GE LM2500 marine gas turbines and two diesel engines in a combined diesel or gas (CODOG) turbine configuration."

The LM2500 gas turbines are being assembled right here in India by the Industrial and Marine Gas Turbine division of the state-owned Hindustan Aeronautics Limited (HAL).

The new warships, in a major deviation from earlier frigates, also features a high-level of automation, which is estimated to cut operational costs by around 20% and, in turn, result in higher operational availability due to its productive effectiveness, on part of the modular integration construction. Thus, the crew compartment has also been reduced from the existing 257 (including 35 officers) to about 150 now.



Photo via Twitter

Weapons

The P17A-class will be armed and ready with the state-of-the-art Barak 8 and BrahMos surface-to-air and supersonic cruise missiles to defend against any type of airborne threat, including aircraft, helicopters, anti-ship missiles, and UAVs as well as ballistic missiles, other cruise missiles, and combat jets.

The weapon systems will be flush deck mounted allowing vertical launch of missiles from under the deck.

Amplifying the stealth measures, the Project 17A-class will have a covered mooring deck and the number of antennae on the ship will be reduced using the EL/M-2248 MF-STAR multi-function Active Electronically Scanned Array (AESA) radar. It will also brandish the Ajanta Electronic Warfare (EW) system and the HUMSA-NG Sonar system.

Cost and completion

The construction of the first ship started in 2017, and all of them are expected to be delivered by 2022 at an anticipated cost of over Rs 45,000 crore in total. Each vessel is supposed to cost over Rs 4,000 crore.

<https://www.freepressjournal.in/india/ins-himgiri-indian-navys-advanced-p17a-class-stealth-frigate-launched-at-grse-yard-heres-all-you-need-to-know>

THEWEEK

Tue, 15 Dec 2020

Gen Naravane's visit to Saudi Arabia will strengthen bilateral defence cooperation Indian Army

Riyadh: Army Chief General M M Naravane's historic visit to Saudi Arabia will strengthen bilateral defence cooperation, the Indian Army said on Monday.

Gen Naravane, who arrived in Saudi Arabia on the second leg of his two-nation visit that included the United Arab Emirates, is the first-ever head of the Indian Army to travel to the two strategically important Gulf countries.

"COAS visit to #SaudiArabia will strengthen bilateral defence cooperation between the two countries," the Indian Army's Additional Directorate General of Public Information said in a tweet.

On the first day of his visit on Sunday, Gen Naravane met top Saudi generals, including Commander of the Royal Saudi Land Forces Gen Fahd Bin Abdullah Mohammed Al-Mutir, Chief of General Staff Gen. Fayyadh bin Hamid Al-Ruwaili and Commander of the Joint Forces Lt Gen Mutlaq bin Salim, and discussed issues of common interest and ways to enhance bilateral defence cooperation.

On Monday, Gen Naravane visited King Abdul Aziz Military Academy and exchanged views on military training.

He also visited Saudi Armed Forces Command and Staff College and National Defence University, where he addressed the Faculty and student officers attending the War Course, the Indian Army tweeted.

His wife Veena Naravane and other delegates visited the TCS All Women Center in Riyadh. She appreciated the commitment of the TCS towards gender empowerment, investment and growth in Saudi Arabia through such initiatives, it said in another tweet.

She also visited Princess Nourah University and Wipro Women Business Park in Riyadh, which bear testimony to women enabling and empowerment, it added.

Gen Naravane's visit is seen as a reflection of India's growing strategic ties with the two key Gulf countries and is expected to further open up new avenues for cooperation in the defence and security sphere.

His visit comes in the midst of fast-paced developments in the Gulf region including normalisation of Israel's relations with several Arab countries as well as situation arising out of the assassination of Iran's top nuclear scientist Mohsen Fakhrizadeh.

Ahead of his visit to the UAE and Saudi Arabia, the Army said in a statement in New Delhi that his "visit is historic in the sense that it will be the first time an Indian Army chief is visiting the UAE and Kingdom of Saudi Arabia."

Gen. Naravane's visit to the Gulf region comes days after External Affairs Minister S Jaishankar's trips to Bahrain and the UAE during which he called on top leaders of the two countries.

Last month, the Army chief travelled to Nepal on a three-day visit that had significant diplomatic overtone.

In October, Gen. Naravane travelled to Myanmar along with Foreign Secretary Harsh Vardhan Shringla on a very crucial visit during which India decided to supply an attack submarine to the Myanmar Navy besides agreeing to further deepen military and defence ties.

(This story has not been edited by THE WEEK and is auto-generated from PTI)

<https://www.theweek.in/wire-updates/international/2020/12/14/fgn27-saudi-naravane.html>

◆ APN NEWS

Tue, 15 Dec 2020

Indian Army uniforms will change! Prime Minister Modi finalised the sample review. New uniforms, new identities to be held in the next year

By Bhupen Goswami

Guwahati: With Chinese assistance in India, insurgency outfits are doing their best to spread the disturbed. It is being disturbed by the Government of India that the Ministry of Home Affairs and the Ministry of Defence are suffering. Talking to the reporter, a senior officer of the Indian Army's 4 Corps Gajraj headquarters at Tezpur said that militant outfits are misleading the people by wearing uniforms like the Indian Army.

Thereafter, the intelligence agency has suggested to the Government of India that the Indian Army, which has 8 uniforms, will have to change slightly. After the report of the Indian intelligence agency, Prime Minister security advisor Ajit Doval started a number of sample tests for the new uniform. Now the process of change in the uniform of the Indian Army has intensified. The sample review was being done for this.



The official, along with the correspondent, said that the Indian Army uniform will soon change. Prime Minister Modi has already finalised the sample review. Indian Army to create new uniforms, new identities in next year. According to the information received, some samples were invited from the industry to make the uniform more comfortable and smart, which has been completed these days. The purpose of the change in uniform is to make it more comfortable and smart and to bring uniformity in the uniforms of officers. Looking at the uniforms of the high-post officers, they do not know which regiment or which arms division they belong to. In addition, the entire army

looks alike. According to reports, samples were sought from the industry for change in uniforms which have been received and are being reviewed. According to sources, the army's summer-winter uniforms, including ceremonies and mess uniforms, can also be changed. In fact, the review is also being checked with uniform fabrics and designs as well as its comfort level.

The Prime Minister has finalised the same after reaching all the samples from the Ministry of Defence to the Ministry of Home Affairs. According to sources, the Indian Army will have a new uniform and new identity in the next years, the uniform will have bullet proof and there will be no impact in winter or heat. Let us say that the process of change in uniform was started last year when Indian Army chief Bipin Rawat was there. A senior officer of the 4 Corps headquarters at Tezpur in the Indian Army said that it is the standard area uniform of the Indian Army. The disruptive pattern of the uniform has a forest camouflage pattern and hence, it is also called a "jungle dress". In winter, a sweater or jacket is worn over it. This dress is embroidered on rank flaps and is not worn normal metal rank. An army man is uniquely identified by three things of civilians – their haircut, the way they carry themselves and the way they wear clothes. The Indian Army is an organisation where every man is a potential leader. And it reflects very well the way they carry themselves and wear clothes. But these clothes, these uniforms come at a price. The Indian Army has 8 types of uniforms.

The Indian Army uniforms have been changed three times in the first three times. For the first time, there was a change in uniform so that there was a difference between the army of India and Pakistan. For the second time, the uniform was converted in the year 1980 and was called a combat dress. However, it was changed again because the uniform made of polyester was quite uncomfortable in the summer season and the third time the uniform was changed to 2005. So that the border Security Force (BSF) and the Central Reserve Police Force (CRPF) appear to be different and now the information about the change in uniform is coming out for the fourth time.

<https://www.apnnews.com/indian-army-uniforms-will-change-prime-minister-modi-finalised-the-sample-review-new-uniforms-new-identities-to-be-held-in-the-next-year/>

PM Modi expresses hope in India become Space assets manufacturing hub

The PM said that the decision to unlock India's potential in the space sector has heralded a new age of public-private partnership in this sector

Prime Minister Narendra Modi on Monday interacted with key industries, startups and academia from the space sector through video conferencing to encourage their participation in space activities. He also expressed hope that the country would soon become a manufacturing hub of space assets.

The Union Cabinet led by the Prime Minister took the decision in June this year to open up the space sector and enable the participation of Indian private sector in the entire gamut of space activities. With the creation of Indian National Space Promotion and Authorisation Centre (IN-SPACe), the government believes the reforms will provide a level playing field for private companies and start-ups.



File Photo

Subsequently, several ventures have submitted proposals with IN-SPACe under the Department of Space. The proposals pertain to a vast range of activities including satellite constellation, small satellite launch vehicles, ground station, geospatial services, propulsion systems and application products.

The Prime Minister said that the decision to unlock India's potential in the space sector has heralded a new age of public-private partnership in this sector. He assured the participants of complete and wholehearted support of the government in this endeavour. He noted that the professionalism and transparency in policies, as well as the decision-making process of the government, will prove beneficial for the companies joining the space sector.

Taking note of the plans of companies to make rockets and satellites, Modi remarked that this marks a big change that will further strengthen India's foray into the space sector. He said that private investment in the sector will lead to the creation of hi-tech jobs, which will provide a host of opportunities to the talent pool in IITs/NITs and other technical institutions. He said that it is his firm belief that just like Indian talent has been able to attain worldwide fame in the IT sector, it will be able to do so in the space sector as well.

Underlining that the reforms in the space sector are not limited to ensuring ease of doing business, he said that necessary mechanisms have also been put in place to ensure help for the participants at each stage, including making available testing facilities and launchpads. He added that through these reforms, the endeavour is not only to ensure that India becomes a competitive space market, but also to ensure the benefits of the space programme reach out to the poorest.

The Prime Minister also underlined the significance of the space sector in communication and navigation. He assured the participants that they will be co-passengers with ISRO in this age of space research and expressed hope that the country would soon become the manufacturing hub of space assets.

Dr K. Sivan, who is the Secretary of Department of Space (DoS) and Chairman of ISRO, briefed the Prime Minister on various proposals received from industry for obtaining permission from IN-SPACe and support from the Department of Space. He informed that more than 25 industries have already approached DoS for undertaking their space activities.

During the interaction, the participants provided feedback on the reforms to the Prime Minister. Sunil Bharti Mittal from Bharti Enterprises, Jayant Patil from Larsen & Toubro Ltd, Srinath Ravichandran from Agnikul Cosmos Pvt Ltd, Pawan Kumar Chandana from Skyroot Aerospace Ltd, Col H S Shankar from Alpha Design Technologies Pvt Ltd, Rakesh Verma from MapmyIndia, Awais Ahmed from PIXXEL India and Srimathy Kesan from Space Kidz India expressed their views during the session.

They appreciated the help and guidance being provided by ISRO for their projects and said that the collaboration of private agencies with ISRO will not only result in more rocket launches per year but will also shape new technological advancements in the development of rocket engines. They also suggested opening up ISRO facilities for children to draw them further into this sector.

<https://www.dnaindia.com/india/news-pm-modi-expresses-hope-in-india-become-space-assets-manufacturing-hub-2861910>

The Tennessee Tribune

Tue, 15 Dec 2020

India opens doors to foreign firms to share its space technology

Tamil Nadu: Foreign companies will now be able to access technology developed by the Indian Space Research Organization (ISRO), which previously was restricted to use by domestic entities.

Recent government guidelines point out the change in policy, from the transfer of technology for domestic use to foreign entities, by the Department of Space (DOS).

“The technology transfer activities of the DOS are primarily intended for the domestic utilisation of DOS,” the guidelines state. “ISRO developed technologies by Indian industries. However, in the context of liberalisation and globalisation, requests from foreign organisations for transfer of DOS or ISRO developed technologies shall be encouraged as per the guidelines issued by Government of India.”



ISRO Chief K. Sivan said that the agency will transfer technology to foreign companies in an effort to encourage startups. The transfer of technology will occur on a case-to-case basis, with restrictions on anything considered to be sensitive. This will encourage foreign firms to use Indian technology or collaborate with Indian companies, he said.

Former ISRO chief, G. Madhavan Nair, told Zenger News that ISRO might not give out its rocket technology, which is sensitive information. But he acknowledged that the new policy would be an immense help to startups.

“I think this knowledge-sharing based on contracts with companies will help startups to the extent that the startup would not have to spend time in conducting research,” said Nair.

ISRO’s “brand name” will also be beneficial to companies that use technology, analysts say.

“These companies will get the backing of ISRO, which will make it easy to attract funding,” said S. R. Chakravarthy, a professor in aerospace engineering department at the Indian Institute of

Technology in Madras, and a mentor to Agnikul Cosmos, a space-tech startup incubated at the institute.

Agnikul Cosmos recently partnered with ISRO to test its small rockets, which aim to launch 100 kg (220-pound) satellites. Agnikul will use ISRO's facility for this project.

Close to 500 technologies are open for transfer and are already being used by Indian firms.

“One of India’s USPs [unique selling points] is that ISRO makes these technologies at much cheaper costs as compared to counterparts in other countries,” said Ajay Lele, senior fellow at the Manohar Parrikar Institute for Defence Studies and Analyses in New Delhi. “Companies have started to realize that launching their satellite is becoming expensive in other countries, which is why they will come to ISRO.”

Chakravarthy agrees.

“When Mangalyaan (India’s mission to Mars) was launched, India’s prime minister [Narendra Modi] stated that the per kilometer cost was less than an auto-rickshaw ride in Ahmedabad in his home state Gujarat,” said Chakravarthy. “That is how frugal ISRO is.”

India completed the mission for a cost of about \$70 million, down from the estimated cost of \$100 million. In 2013, With this mission, India became the first country in Asia to reach Martian orbit.

Modi had also compared this mission, which was launched in 2014” to the Hollywood film “Gravity.” He said, to his knowledge, the budget of Mangalyaan was less than what it cost to make the movie [reportedly \$100 million].

In recent years, India has launched U.S. satellites from the ISRO space center in Sriharikota in the southern state of Andhra Pradesh. ISRO’s Polar Satellite Launch Vehicle has attracted deals from companies based in France, the United States and Canada for their satellites to be launched. These launches are operated by ISRO’s commercial arm, Antrix, which has revenue of more than \$4 million.

In November , ISRO launched 10 satellites, many from foreign countries, from its Sriharikota space center.

“Companies might have ideas but not the wherewithal to go ahead with it, especially to test their products. ISRO will be able to provide them with the needed help to develop their ideas,” said Lele.

When it comes to space science, security is a concern.

In regard to security concerns, Chakravarthy said, “According to international space laws, even though a company is conducting a project, the government of the company where the firm is originally registered is also responsible. This sovereign oversight will help. Also, ISRO usually trains private companies so that these companies can supply hardware which can be assembled at ISRO’s centers.”

ISRO’s technology transfer to industry will be done through NewSpace India Ltd., a company incorporated by the government for commercializing ISRO’s research. While ISRO is helping companies with technology transfer, it is also working with organizations like NASA to develop new technologies.

(Edited by Uttaran Das Gupta and Judith Isacoff)

<https://tribune.com/india-opens-doors-to-foreign-firms-to-share-its-space-technology/>

Quantum interference in time

Since the very beginning of quantum physics, a hundred years ago, it has been known that all particles in the universe fall into two categories: fermions and bosons. For instance, the protons found in atomic nuclei are fermions, while bosons include photons—which are particles of light—as well as the BroutEnglert-Higgs boson, for which François Englert, a professor at ULB, was awarded a Nobel Prize in Physics in 2013.

Bosons—especially photons—have a natural tendency to clump together. One of the most remarkable experiments that demonstrated photons' tendency to coalesce was conducted in 1987, when three physicists identified an effect that was since named after them: the Hong-Ou-Mandel effect. If two photons are sent simultaneously, each towards a different side of a beam splitter—a sort of semitransparent mirror—, one could expect that each photon will be either reflected or transmitted.

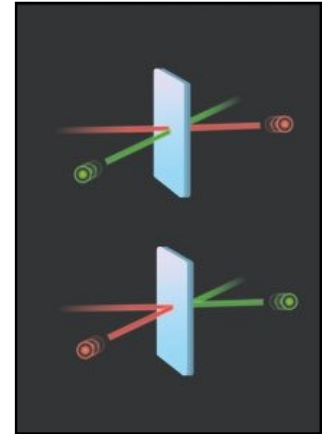
Logically, photons should sometimes be detected on opposite sides of this mirror, which would happen if both are reflected or if both are transmitted. However, the experiment has shown that this never actually happens: the two photons always end up on the same side of the mirror, as though they 'preferred' sticking together. In an article published recently in US journal *Proceedings of the National Academy of Sciences*,

Nicolas Cerf—a professor at the Centre for Quantum Information and Communication (École polytechnique de Bruxelles)—and his former Ph.D. student Michael Jabbour—now a postdoctoral researcher at the University of Cambridge—describe how they identified another way in which photons manifest their tendency to stay together. Instead of a semi-transparent mirror, the researchers used an optical amplifier, called an active component because it produces new photons. They were able to demonstrate the existence of an effect similar to the Hong-Ou-Mandel effect, but which in this case captures a new form of quantum interference.

Quantum physics tells us that the Hong-Ou-Mandel effect is a consequence of the interference phenomenon, coupled with the fact that both photons are absolutely identical. This means it is impossible to distinguish the trajectory in which both photons were reflected off the mirror on the one hand, and the trajectory in which both were transmitted through the mirror on the other hand; it is fundamentally impossible to tell the photons apart. The remarkable consequence of this is that both trajectories cancel each other out! As a result, the two photons are never observed on the two opposite sides of the mirror. This property of photons is quite elusive: if they were tiny balls, identical in every way, both of these trajectories could very well be observed. As is often the case, quantum physics is at odds with our classical intuition.

The two researchers from ULB and the University of Cambridge have demonstrated that the impossibility to differentiate the photons emitted by an optical amplifier produces an effect that may be even more surprising. Fundamentally, the interference that occurs on a semi-transparent mirror stems from the fact that if we imagine switching the two photons on either sides of the mirror, the resulting configuration is exactly identical. With an optical amplifier, on the other hand, the effect identified by Cerf and Jabbour must be understood by looking at photon exchanges not through space, but through time.

When two photons are sent into an optical amplifier, they can simply pass through unaffected. However, an optical amplifier can also produce (or destroy) a pair of twin photons: so another possibility is that both photons are eliminated and a new pair is created. In principle, it should be possible to tell which scenario has occurred based on whether the two photons exiting the optical



The Hong-Ou-Mandel effect.
Credit: Université libre de Bruxelles

amplifier are identical to those that were sent in. If it were possible to tell the pairs of photons apart, then the trajectories would be different and there would be no quantum effect. However, the researchers have found that the fundamental impossibility of telling photons apart in time (in other words, it is impossible to know whether they have been replaced inside the optical amplifier) completely eliminates the possibility itself of observing a pair of photons exiting the amplifier. This means the researchers have indeed identified a quantum interference phenomenon that occurs through time. Hopefully, an experiment will eventually confirm this fascinating prediction.

More information: Nicolas J. Cerf et al, Two-boson quantum interference in time, *Proceedings of the National Academy of Sciences* (2020). DOI: [10.1073/pnas.2010827117](https://doi.org/10.1073/pnas.2010827117)

Journal information: [Proceedings of the National Academy of Sciences](https://phys.org/news/2020-12-quantum.html)
<https://phys.org/news/2020-12-quantum.html>



Tue, 15 Dec 2020

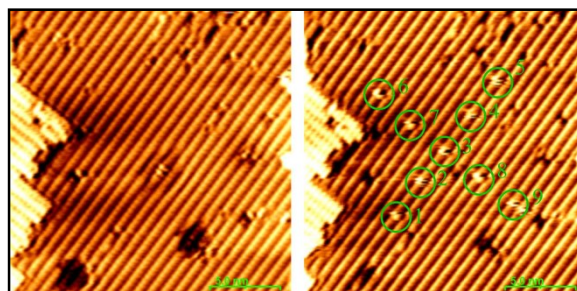
Researchers pinpoint more precise method for atomic-level manufacturing

By Kim Horner

Quantum computers have the potential to transform fields such as medicine, cybersecurity and artificial intelligence by solving hard optimization problems that are beyond the reach of conventional computing hardware.

But the technology to manufacture the devices on a large scale does not yet exist.

Researchers at The University of Texas at Dallas have developed a technique that could remove one of the challenges to scaling the production of silicon quantum devices. The researchers outlined their method, which provides greater control and precision during the fabrication process, in a study published online May 28 and in the July print edition of the *Journal of Vacuum Science & Technology B*. Silicon is the preferred material for the base of quantum devices because of its compatibility with conventional semiconductor technology.



Building a silicon-based qubit, or quantum bit, the basic unit of information in a quantum computer, starts with an atomically flat silicon surface (left) coated with a layer of hydrogen. On the right, areas where UT Dallas researchers removed hydrogen atoms are highlighted. Credit: University of Texas at Dallas

The study's corresponding author, Dr. Reza Moheimani, the James Von Ehr Distinguished Chair in Science and Technology and a professor of systems engineering in the Erik Jonsson School of Engineering and Computer Science, received a \$2.4 million U.S. Department of Energy grant in 2019 to develop technology for atomically precise manufacturing, the process of building new materials and devices atom by atom.

Moheimani's team is addressing a range of challenges to quantum device fabrication.

"Our latest work increases the precision of the fabrication process," Moheimani said. "We're also working to increase throughput, speed and reliability."

The researchers' method for building a silicon-based qubit, or quantum bit, the basic unit of information in a quantum computer, starts with an atomically flat silicon surface coated with a layer of hydrogen, which prevents other atoms or molecules from getting absorbed into the surface. Next, researchers use a scanning tunneling microscope (STM), which features a probe with an atomically sharp tip, functioning as a micro-robotic arm, to remove atoms of hydrogen selectively from the surface. The STM was designed for imaging atomic features on a surface, however,

researchers also use the device to manipulate atoms in a mode called hydrogen depassivation lithography (HDL).

The painstaking process involves positioning the tip over an atom of hydrogen, adding a high-frequency signal to the tip-sample bias voltage and ramping up the amplitude of the high-frequency signal until the atom of hydrogen detaches from the surface, revealing silicon underneath. After a predetermined number of hydrogen atoms are selectively removed from the surface, phosphine gas is introduced in the environment and after a specific process, atoms of phosphorus are adsorbed to the surface, where each functions as a qubit.

The problem with conventional HDL is that it can be easy for the operator to pluck the wrong atom of hydrogen resulting in creation of qubits at unwanted locations. Using the STM for HDL requires a higher voltage than for imaging, which too often causes the tip to crash into the surface sample, forcing the operator to start over.

The researchers were working on their solution to the STM tip-crash problem when they discovered a more precise method for manipulating the surface atoms.

"Conventional lithography cannot achieve the requisite atomic precision," Moheimani said. "The issue is that we are using a microscope to do lithography; we're using a device to do something it's not designed for."

The researchers found that they could achieve higher precision by performing HDL in imaging mode, rather than the conventional lithography mode, with some adjustments to the voltage and a change to the STM's feedback control system.

"We realized that we could actually use this method to remove hydrogen atoms in a controlled fashion," Moheimani said. "This came as a surprise. It's one of those things that happens during experiments, and you try to explain it and take advantage of it."

Quantum computers are expected to be able to store more information than current computers. Current transistors, which relay information, cannot be made any smaller, said Hamed Alemansour, a mechanical engineering doctoral student and lead author of the study.

"The kind of technology that's used now for making transistors has reached its limit. It's difficult to decrease the size any more through conventional methods," Alemansour said.

While a conventional computer uses the precise values of 1s and 0s to make calculations, the fundamental logic units of a quantum computer are more fluid, with values that can exist as a combination of 1s and 0s at the same time or anywhere in between. The fact that a qubit can represent two numbers at the same time allows the quantum computer to process information much faster.

One of the next challenges, Moheimani said, will be to develop technology to operate multiple STM tips at a time.

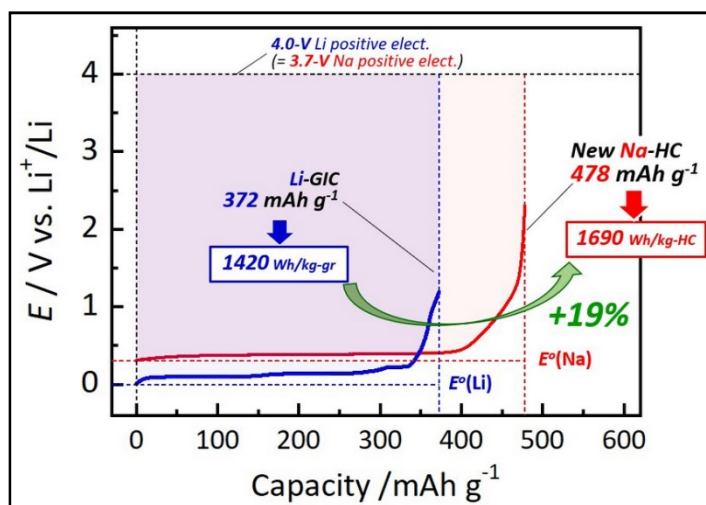
"What if we can use 10 or 100 tips in parallel with each other so we can do the same lithography multiplied by 100 times? What if we can do it 10 times faster? If we can manufacture 100 qubits 10 times faster, we're 1,000 times better off already," Moheimani said.

More information: Hamed Alemansour et al. Controlled removal of hydrogen atoms from H-terminated silicon surfaces, *Journal of Vacuum Science & Technology B* (2020). DOI: [10.1116/6.0000241](https://doi.org/10.1116/6.0000241)
<https://phys.org/news/2020-12-precise-method-atomic-level.html>

New hard-carbon anode material for sodium-ion batteries will solve the lithium conundrum

Cost-effective rechargeable batteries are at the heart of virtually all portable electronic devices, which have become ubiquitous in modern daily life. Moreover, rechargeable batteries are essential components in many environment-friendly technologies, such as electric cars and systems that harvest renewable energy. They are also key enablers of various medical devices and facilitate research in various fields as the energy source of electronic sensors and cameras. So, it shouldn't come as a surprise that there is a lot of effort spent in developing better and cheaper rechargeable batteries.

So far, rechargeable lithium-ion batteries hold the number-one spot thanks to their great performance across the board in terms of capacity, stability, price, and charging time. However, lithium, and other minor and costly metals like cobalt and copper, are not among the most abundant materials on the earth's crust, and their ever-increasing demand will soon lead to supply problems around the world. At the Tokyo University of Science, Japan, Professor Shinichi Komaba and colleagues have been striving to find a solution to this worsening conundrum by developing rechargeable batteries using alternative, more abundant materials.



The higher capacity of this new hard carbon electrode material means that a 19% increase in energy density by weight is possible in sodium-ion batteries compared with lithium-ion batteries. Credit: Shinichi Komaba from Tokyo University of Science

In a recent study published in *Angewandte Chemie International Edition*, the team found an energy efficient method to produce a novel carbon-based material for sodium-ion batteries. Apart from Prof. Komaba, the team also included Ms. Azusa Kamiyama and Associate Prof. Kei Kubota from Tokyo University of Science, Dr. Yong Youn and Dr. Yoshitaka Tateyama from National Institute for Materials Science, Japan, and Associate Prof. Kazuma Gotoh from Okayama University, Japan. The study focused on the synthesis of hard carbon, a highly porous material that serves as the negative electrode of rechargeable batteries, through the use of magnesium oxide (MgO) as an inorganic template of nano-sized pores inside hard carbon.

The researchers explored a different technique for mixing the ingredients of the MgO template so as to precisely tune the nanostructure of the resulting hard carbon electrode. After multiple experimental and theoretical analyses, they elucidated the optimal fabrication conditions and ingredients to produce hard carbon with a capacity of 478 mAh/g, the highest ever reported in this type of material. Prof. Komaba states, "Until now, the capacity of carbon-based negative electrode materials for sodium-ion batteries was mostly around 300 to 350 mAh/g. Though values near 438 mAh/g have been reported, those materials require heat treatment at extremely high temperatures above 1900°C. In contrast, we employed heat treatment at only 1500°C, a relatively low temperature." Of course, with lower temperature comes lower energy expenditure, which also means lower cost and less environmental impact.

The capacity of this newly developed hard carbon electrode material is certainly remarkable, and greatly surpasses that of graphite (372 mAh/g), which is currently used as the negative electrode material in lithium-ion batteries. Moreover, even though a sodium-ion battery with this

hard carbon negative electrode would in theory operate at a 0.3-volt lower voltage difference than a standard lithium-ion battery, the higher capacity of the former would lead to a much greater energy density by weight (1600 Wh/kg versus 1430 Wh/kg), resulting in +19% increase of energy density.

Excited about the results and with his eyes on the future, Prof. Komaba remarks, "Our study proves that it is possible to realize high-energy sodium-ion batteries, overturning the common belief that lithium-ion batteries have a higher energy density. The hard carbon with extremely high capacity that we developed has opened a door towards the design of new sodium-storing materials."

Further studies will be required to verify that the proposed material actually offers superior lifetime, input-output characteristics, and low temperature operation in actual sodium-ion batteries. With any luck, we might be on the verge of witnessing the next generation of rechargeable batteries!

More information: Azusa Kamiyama et al, MgO-Template Synthesis of Extremely High Capacity Hard Carbon for Na-Ion Battery, *Angewandte Chemie International Edition* (2020). [DOI: 10.1002/anie.202013951](https://doi.org/10.1002/anie.202013951)

Journal information: [Angewandte Chemie International Edition](https://phys.org/news/2020-12-hard-carbon-anode-material-sodium-ion-batteries.html)
<https://phys.org/news/2020-12-hard-carbon-anode-material-sodium-ion-batteries.html>

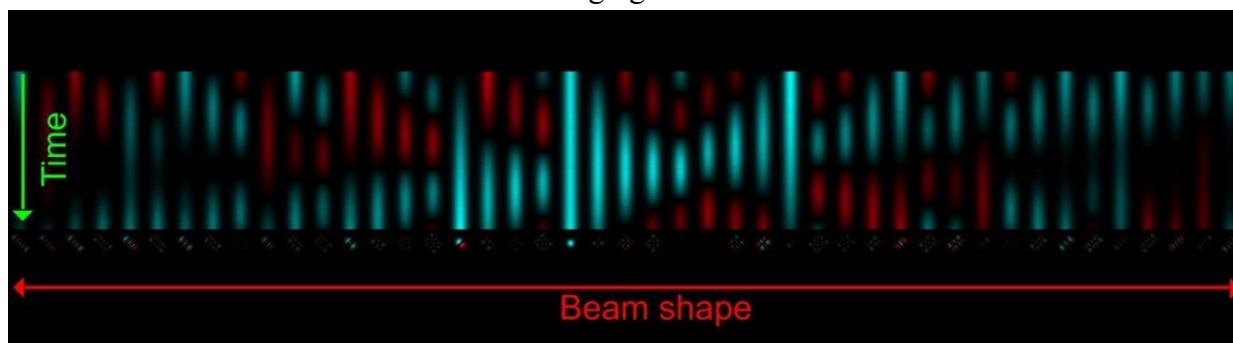


Tue, 15 Dec 2020

Physicists create time-reversed optical waves

By Genevieve Worrell

Optics researchers from The University of Queensland and Nokia Bell Labs in the US have developed a new technique to demonstrate the time reversal of optical waves, which could transform the fields of advanced biomedical imaging and telecommunications.



Credit: University of Queensland

Time reversal of waves in physics doesn't mean traveling back to the future; it describes a special type of wave which can retrace a path backwards through an object, as if watching a movie of the traveling wave, played in reverse.

UQ's Dr. Mickael Mounaix and Dr. Joel Carpenter, together with Dr. Nick Fontaine's team at Nokia Bell Labs, are the first to demonstrate this time reversal of optical waves, using a new device they developed that allows full 3-D control of light through an optical fiber.

"Imagine launching a short pulse of light from a tiny spot through some scattering material, like fog," Dr. Mounaix said.

"The light starts at a single location in space and at a single point in time but becomes scattered as it travels through the fog and arrives on the other side at many different locations at many different times.

"We have found a way to precisely measure where all that scattered light arrives and at what times, then create a 'backwards' version of that light, and send it back through the fog.

"This new time reversed light wave will retrace the original scattering process like watching a movie in reverse—finally arriving at the source just as it began: a single position at a single point in time."

Dr. Carpenter said the backwards version of the light beam, known as the time reversed wave, was a random-looking 3-D object, like a little cloud of light.

"To create that light cloud, you need to take an initial ball of light flying into the system, and then sculpt it into the 3-D structure you want," Dr. Carpenter said.

"That sculpting needs to take place on time scales of trillionths of a second, so that's too fast to sculpt using any moving parts or electrical signals—think of it like shooting a ball of clay at high speed through a static apparatus with no moving parts, which slices up the ball, diverts the pieces, and then recombines the pieces to produce an output sculpture, all as the clay flies through without ever slowing down.

Dr. Fontaine said there was no device that could fully control and shape a light beam in 3-D before the team developed this technique.

"It's very important to control light delivery as accurately as possible for many applications, ranging from imaging to trapping objects with light, to creating very intense laser beams," Dr. Fontaine said.

Using the new device, researchers will be able to conduct experiments that were previously impossible, putting theoretical concepts in many fields to the test.

This research was published in *Nature Communications*.

More information: Mickael Mounaix et al. Time reversed optical waves by arbitrary vector spatiotemporal field generation, *Nature Communications* (2020). [DOI: 10.1038/s41467-020-19601-3](https://doi.org/10.1038/s41467-020-19601-3)

Journal information: [Nature Communications](https://phys.org/news/2020-12-physicists-time-reversed-optical.html)
<https://phys.org/news/2020-12-physicists-time-reversed-optical.html>



Tue, 15 Dec 2020

Controlling the speed of light bullets

Though it sounds like something straight out of science fiction, controlling the speed of light has in fact been a long-standing challenge for physicists. In a study recently published in *Communications Physics*, researchers from Osaka University generated light bullets with highly controllable velocities.

According to Albert Einstein's principle of relativity, the speed of light is constant and cannot be exceeded; however, it is possible to control the group velocity of optical pulses.

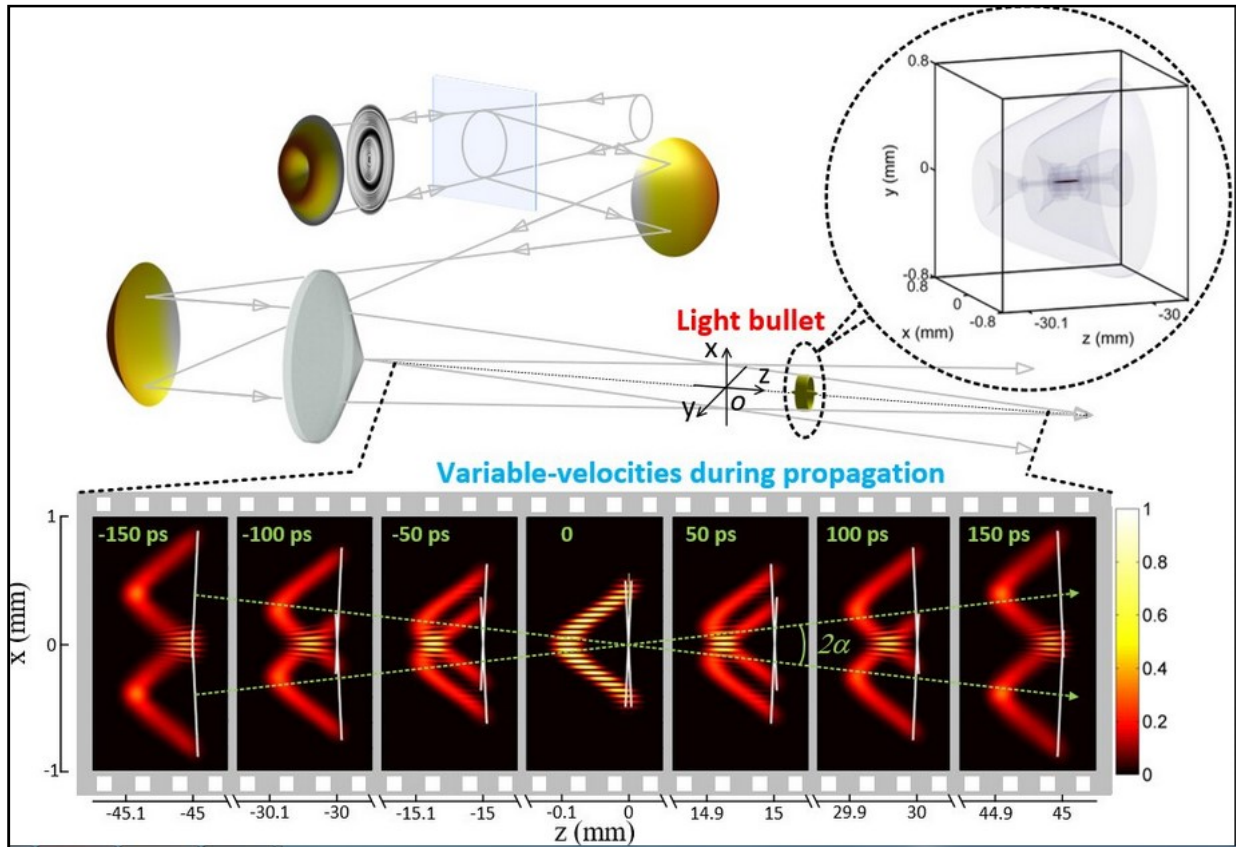
Currently, the spatiotemporal coupling of optical pulses provides an opportunity to control the group velocity of three-dimensional non-diffraction optical wave-packets, known as "light bullets," in free space.

In their previous study (*Scientific Reports*), this group found that by deforming the pulse-front of optical pulses and keeping the phase-front unchanged, the velocity and the acceleration of the generated flying Bessel-Gaussian (diffraction- and dispersion-free) light bullets can be controlled.

"However, the problem is that only one determined motion form, for example, superluminal or subluminal for velocity and accelerating or decelerating for acceleration, can be achieved in a single propagation path," explains corresponding author Zhaoyang Li.

In this newly improved method, by using the combination of a deformable mirror and a spatial light modulator, the pulse-front of optical pulses can be arbitrarily deformed, which results in light

bullets with arbitrarily-variable velocities (and accelerations) during a single propagation path; e.g., subluminal followed by superluminal and/or accelerating followed by decelerating.



Flying light bullet with variable-velocities (see beam center). Credit: Osaka University

"This non-diffraction light bullet with nearly-programmable flying velocities may bring new opportunities in a wide range of applications, such as free-space communication, bio-imaging, optical detection and processing, particle acceleration and manipulation, radiation generation, among others," says Zhaoyang Li.

More information: Zhaoyang Li et al. Optical wave-packet with nearly-programmable group velocities, *Communications Physics* (2020). DOI: [10.1038/s42005-020-00481-4](https://doi.org/10.1038/s42005-020-00481-4)

Zhaoyang Li et al. Velocity and acceleration freely tunable straight-line propagation light bullet, *Scientific Reports* (2020). DOI: [10.1038/s41598-020-68478-1](https://doi.org/10.1038/s41598-020-68478-1)

Journal information: *Communications Physics*, *Scientific Reports*
<https://scx2.b-cdn.net/gfx/news/2020/5fd752dd09807.jpg>

Genetic variants linked to severe Covid-19: Study

Scientists said Friday they had identified genetic variants that made patients more likely to develop severe Covid-19

Scientists said Friday they had identified genetic variants that made patients more likely to develop severe Covid-19, in a breakthrough that could see new and existing drugs help patients survive the illness.

To determine why some people develop severe lung inflammation when sick with Covid-19, researchers analysed mutations on the genomes of more than 2,000 critically ill patients across Britain. They compared their genetic make-up to that of a control group and identified as many as eight sequences that were more common among the Covid-19 patients. They found that these sequences are involved in the body's inflammatory response and how the immune system battles pathogens such as the novel coronavirus. After further computer analysis, they highlighted two specific genes -- TYK2 and CCR2 -- that encode inflammatory protein molecules.



Genetic variants linked to severe Covid-19: Study | Photo Credit: Pixabay

The researchers found that individuals who produce more of the TYK2 enzyme appeared to be at higher risk of developing severe Covid-19. "We're trying to cut through the tremendous complexity of the human immune system to find the levers that we can pull that will change the outcome for the patient," said Kenneth Baillie, a geneticist at the University of Edinburgh and lead author of the study published in Nature. "The beauty of genetics is that it can predict the effects that a drug might have. The really exciting thing about this study is that we have found genes that are directly therapeutically relevant, so they lead us directly to treatment."

Baillie said that there is already a group of drugs on the market that limits the action of TYK2. These are known as JAK inhibitors and are often prescribed for chronic diseases such as cancer and arthritis. "We showed that people who produce more TYK2 are more at risk of Covid. And there's a drug that inhibits it," he told journalists via video-link.

The authors noted that there was also an antibody treatment currently in clinical trials that blocks CCR2, a protein involved in the immune response. They said wide-scale trials were urgently needed to test these treatments on patients with severe Covid-19.

Sir Mark Caulfield, the chief scientist for Genomics England and director of the NIHR Biomedical Research Centre at Barts Hospital, called Friday's research "a remarkable result". He said the team's study of patient genomes could eventually create a "comprehensive inventory of variants that change our susceptibility to the severity of Covid". "And maybe, just maybe, as a result, we will find a new therapy that will help people survive this better."

<https://www.timesnownews.com/health/article/genetic-variants-linked-to-severe-covid-19-study/694222>

