Jan
2021

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खंड : 46 अंक : 19 28 जनवरी 2021

Vol. : 46 Issue : 19 28 January 2021

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CONTENTS

DRDO News

DRDO Technology News

Thu, 28 Jan 2021

The untold story of LCA Tejas journey

By Nitin A. Gokhale

With the government approval of the purchase of 83 indigenously developed Light Combat Aircraft, Tejas Mark 1A from Hindustan Aeronautics Ltd (HAL), the negativity about the delayed programme and doubts over its performance have dissipated in no time. It is the biggest-ever contract worth $ 5.6 billion (Rs. 48,000 crores) awarded to India's domestic military aviation industry, involving about 500 Indian companies, including MSMEs (Micro, Small and Medium Enterprises) in the design and manufacturing sectors, which will be working with HAL in this procurement. The programme would surely act as a catalyst for transforming the Indian defence and aerospace manufacturing ecosystem into a vibrant Atmanirbhar (self-sustaining) sector.

Defence Minister Rajnath Singh has rightly hailed the move as a "game-changer" for India's defence manufacturing has so far been seen as being incapable of catering to the country's defence needs.

The smallest, lightweight, multi-role, single-engine tactical fighter aircraft in the world, Tejas highlights the success story of indigenous design, development, production and induction of a '4+ Generation Fighter' into the Indian Air Force (IAF). Though it was conceptualised in 1983 to replace the Russian-made MiG-21, the Tejas programme actually commenced with government approval for 'LCA Full Scale Engineering Development Phase 1' only in June 1993. With this sanction, the indigenous project took wings seven and half years later when TD-1, the Technology Demonstrator of Tejas aircraft flew its maiden flight on 4 January 2001 followed by the LCA Demonstrator II flying in June 2002.

The success of Tejas programme is a collaborative effort of Aeronautical Development Agency (ADA) as lead Design Agency under Defence Research & Development Organisation (DRDO) and HAL as lead Production Agency along with many other agencies. However, getting the LCA project off the ground was a long and arduous three-decade journey plagued with multiple problems and several missed deadlines due to various factors.

Journey-in-the-Making: What Took Tejas so Long to Fly

Speaking about the chequered journey with BharatShakti, the former Director of ADA and Project Director of LCA programme, Commodore CD Balaji (Retd), who is widely regarded as one of the main architects of the LCA programme said, "Actually in 1983, the government decided to set up ADA with a small team to find out whether India can build and develop an indigenous

aircraft or not? Dr Kota Harinarayana was heading that group and that is how it was started. However, the final Cabinet approval for full-scale design and development of Tejas prototypes was given in 1993 – 10 years down the line. That is the actual start point of the programme formally. It was not 1983 but 1993 was the base year for the journey".

The first trigger of the project was when Wing Commander Rajiv Kothiyal took to the skies for a short sortie of 18 minutes on 4 January 2001.

Countering the criticism over delays of the naval version of LCA, Cdre Balaji clarified that the Cabinet approval was given on 23 March 2003 and the aircraft was rolled out in 2010; seven years down the line. "We had promised in the Cabinet note that it would take about seven years plus time because it's completely a different animal compared to the air force version. We had a flight in April 2012 which was exactly nine years. It's fairly contemporary if you look at it from whichever way you look at. That's history and all the negativity has been washed away now," he said.

While Tejas was being tested and flown in India, one of the landmark events took place in January 2016 when it was flown at an airshow abroad for the first time, recalled Cdme Balaji and Dr. Radhakrishnan, then the man in charge of industry interface at DRDO headquarters. They feel the crucial trigger was LCA Tejas making a spectacular debut in foreign airspace to participate in the Bahrain International Air show from 21 to 23 January 2016. The performance of the Tejas in the Air show was phenomenal with Tejas soaring majestically over the Bahrain sky. Tejas impressed not only global aerospace experts but the international media took note of it which helped deflect all the negative perceptions about the aircraft's operational performance that makes it a combat-worthy fighter.

Turning Point: Tejas v/s JF-17

Dr S Radhakrishnan, who was then the Director, Directorate of Industrial Interface and Technology Management, DRDO fondly recalls, "Bahrain was a historic event not only because LCA left the shores of India for the first time and was flown in full view of an international audience and the global media, but because 'Tejas presence called the Pakistani bluff when they withdrew the JF-17 Thunder fighter produced with Chinese from the aero show. They didn't want to be compared with our LCA in terms of performance. They decided to pull back by paying a huge penalty to the Bahrain authorities for not turning up. It was a huge victory for our LCA because Tejas was far better than the Chinese JF-17; not only in performance but in every aspect."

Milestones

The second trigger was the IAF's Iron Fist exercise held at Pokhran in the Thar deserts of Rajasthan on 18 March 2016 where Tejas fired US and Russian origin missiles, shoulder to shoulder with contemporary aircrafts with flying colours, as the users watched with a hawk's eye.

The third trigger was provided when the then Air Chief Marshal Arup Raha flew in the two-seater LCA trainer on 17 May 2016. Raha said it's a good aircraft to fly and it should be inducted into IAF's fleet. The current Air Chief RKS Bhadauria was the Deputy Chief of IAF then and he was present in Bengaluru during the flight.

On 1st July 2016, history was enacted when the 'Flying Daggers' – 45 Squadron of the Indian Air Force was formed based at Air Force Station, Sulur in Tamil Nadu. It was a big step forward in the journey of these 83 aircrafts.

"One more trigger was enacted in August 2016, when the 2-seater aircraft which the Air Force Chief flew, was flown to Leh for the hot and high altitude trials as a confidence build-up", Cdre Balaji disclosed. Flying fighters is a challenge and the trainer model is an additional challenge because of its heavier mass with two pilots and full weapons load. The requirement was to carry 1500 kg of payloads. We carried 2300 kg of payloads in the hot and higher altitudes successfully", said Balaji revealing the operational details.

Probably the final trigger was the Republic Day Flypast on 26 January 2017. It was after two-decades, a single-engine aircraft was allowed to fly past the Rajpath. It was the then Defence Minister Manohar Parrikar who not only approved the exercise but insisted on showcasing its prowess on that occasion.

Parrikar was Instrumental in Pushing Tejas Forward

In November 2016, Defence Acquisition Council (DAC) chaired by Manohar Parrikar cleared the acquisition of 83 Tejas Mk1A variants, bringing the total number of orders to 123. It was no secret that Parrikar put his weight behind the project and helped overcome the resistance of the IAF and bring the project to fruition. "It was Parrikar who pushed to showcase Tejas' prowess to the world in the Bahrain Air Show", disclosed Radhakrishnan, the man-in-charge of industry interface of LCA programme.

The orders for 83 aircraft will, in the long run, will cement the industry as India fast becomes a manufacturing hub for not only Indian equipment but also for exports to markets abroad. "India was always faced with the question – 'can we'; that has now changed to 'we can'. That sense has changed from scepticism to optimism. We are poised for great things in the future – we have the building blocks available, infrastructure, human resource capital which we need to nurture," said Balaji. Commenting on the significance of the indigenous programme, he added, "This project has brought up a technological development base in India as there was no technological development programme in this country before. This base would work as a springboard for future programmes – a big positive take away from the Tejas project".

India now aspires to indigenously make the Advanced Medium Combat Aircraft (AMCA). If AMCA is to avoid the path taken by the LCA, it will need stronger political handholding than that given to the LCA over the last three decades. India needs to have a more sophisticated technological base to successfully execute high technology projects. The achievement of Tejas should provide the momentum to create a long term manufacturing eco-system for fighter aircraft not just for the use of Indian Air Force but also for exports to other friendly countries.

https://bharatshakti.in/the-untold-story-of-lca-tejas-journey/

INDIA TODAY

Thu, 28 Jan 2021

Aatmanirbhar aviation boost at Aero India | India Today Insight

Formal contract signing of 83 LCA Tejas, inauguration of third LCA assembly line and clearance for the Light Utility Helicopter. Why Asia's biggest air show will be vocal for local

By Sandeep Unnithan

Delhi: The 13th edition of Aero India, the defence ministry's biannual air show, will see heightened government pitch for indigenous aircraft designs. Defence Minister Rajnath Singh will formally sign India's largest defence orders for Indian industry, a Rs 48,000 crore contract for 83 LCA Tejas Mark 1 aircraft on February 3. The contract--73 combat jets in the Mark 1A configuration and 10 Mark 1 trainers--will be signed on the inaugural day of the three-day Aero India 2021 air show beginning in Bengaluru on February 3. This contract, the single-largest order for an indigenously produced defence platform after the indigenous nuclear submarine project, was cleared by the Cabinet Committee on Security (CCS) on January 13.

HAL is also poised to get a Rs 3,000 crore order for 15 Light Combat Helicopters, two of which have already been produced. It is not clear, however, whether this order will be inked at Aero India. The HAL-built Light Utility Helicopter (LUH), currently in development trials, will get its Initial Operational Clearance (IOC) at the air show.

On February 2, the defence minister will inaugurate the LCA's third assembly line in Bengaluru. The new greenfield assembly line in Doddanekundi, co-located near the existing two production

lines at the Bengaluru complex, was completed last year. The third line will be dedicated for producing 18 LCA Tejas Mark 1 trainers. HAL will convert the line into the future hub for export versions of the aircraft.

Defence Minister Rajnath Singh after his maiden sortie in LCA Tejas, at HAL Airport, Bengaluru, Sept. 19, 2019 (ANI)

HAL is to start delivering the LCAs beginning February 2024. The aircraft maker will complete deliveries of all 83 jets to the IAF by 2028-29. To meet the delivery schedules of 16 aircraft per year, the aircraft-maker is sourcing Tejas wing sections from its Su-30 MKI assembly line in Nashik. The Nashik line has been building Su-30MKIs for the IAF since 2004 though production has been tapering down to build the last squadron of the Russian-designed aircraft.

The IAF currently operates two squadrons of the LCA's Mark 1 variant. The first squadron was raised in Sulur, Coimbatore, in 2016 and now has 16 jets. The second, No. 18 squadron, was operationalised with a single Final Operational Clearance (FOC) aircraft in May last year. Four more HAL-produced FOC aircraft will be on display at the air show next week. The 123 LCAs in the Mark 1 and 1A versions will replace the six squadrons of MiG-21 Bisons as they fly out of service towards the end of this decade. Meanwhile, another indigenously designed and built machine is lining up to replace the armed forces' fleet of 1960s' vintage Chetak and Cheetah LUHs.

The military version of the LUH is to get its IOC at Aero India. The machine was designed and built by HAL in a short span of five years. It demonstrated its ability to operate in high altitudes in September this year. During 10-day trials, the machine flew from Leh and did a 'hot and high' hover performance at the Daulat Beg Oldie advanced landing ground which, at over 16,000 feet, is the world's highest. The helicopter also demonstrated its payload capability at the Siachen glacier and received an IOC for the civilian variant last February.

https://www.indiatoday.in/india-today-insight/story/aatmanirbhar-aviation-boost-at-aero-india-1763376-2021-01-27

Thu, 28 Jan 2021

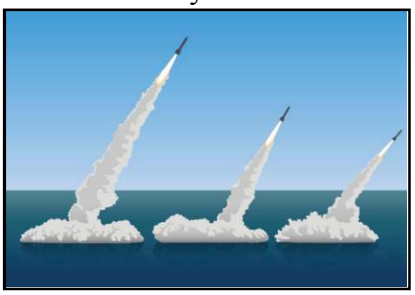
All about DRDOs' Akash NG Missile

Know all about the maiden test launch of DRDO's Akash NG Missile. Get to know about the specifications, the features here. Take a look

By Tulika Tandon

Why in News?

The Defence Research and Development Organization, DRDO successfully conducted the launch of Akash New Generation missile from Integrated Test Range, Odisha.



Akash Missile

It is a new generation surface to air missile that is meant for use of the Indian Air Force.

What is the Integrated Guided Missile Development Programme?

This programme was started by Dr APJ Abdul Kalam

It was approved by the Government of India on July 26, 1983

The missiles developed under the programme are

1. Short-range surface to surface ballistic missile- Prithvi
2. Intermediate-range surface to surface ballistic missile- Agni

3. Short-range low-level surface to air missile- Trishul
4. Medium range surface to air missile- Akash
5. Third-generation anti-tank missile- Nag

Significance:

In a boost to Indian Air Force Defence System, the DRDO successfully test-fired surface to air Akash NG Missile than can intercept high manoeuvring aerial threats.

Akash NG Missile: Details

1. Akash is a medium-range mobile surface to surface air missile defence system developed by the Defence Research and Development Organization, DRDO and produced by Bharat Dynamics Limited for Missile Systems.
2. Bharat Electronics, Tata Power Strategic Engineering Division and Larsen and Toubro for other radars, control centres, launcher systems in India.
3. It has the capability to neutralize aerial targets such as fighter jets, cruise missiles and air to surface missiles and ballistic missiles.
4. It has been deployed as operational service with the Indian Army and the Indian Air Force.

Variants of Akash Missile:

Akash 1S: This missile has a strike range of 30 kilometres and is capable to carry a warhead of 60 kilogram

Mark II: This has an intercept range of 40 kilometres and the accuracy has been increased for the missile guidance system.

Akash NG: The range of the missile is 80 kilometres and has an active electronically scanned array Multi-Function Radar (MFR) and Optical Proximity Fuze system.

Successful Maiden Test Launch of Akash-NG Missile - A new generation Surface to Air Missile meant for use by Indian Air Force with the aim of intercepting high manoeuvring and low RCS aerial threats.

Optical Proximity Fuze: Details

A proximity fuze is something that detonates an explosive device automatically when the distance to the target becomes smaller than a value that was decided.

It is estimated that this increases the lethality of this weapon by 5 to 10 times as compared to other fuzes.

What is an Active Electronically Scanned Multi-Function Radar

An active electronically scanned array AESA is a type of phased array antenna, which is a computer-controlled array antenna.

The AESA is a more advanced, sophisticated, second generation of the original PESA phased array technology. PESAs only emits a single beam of radio waves at a single frequency at a time.

https://www.jagranjosh.com/general-knowledge/all-about-drdos-akash-new-generation-ng-missile-1611733580-1

Defence News

Defence Strategic: National/International

ThePrint

Thu, 28 Jan 2021

'Stark need for modernisation' — why armed forces want a big jump in defence budget

Forces cite ongoing LAC standoff with China to point out the desperate need for defence modernisation. But experts say not much room for significant jump

By Snehesh Alex Philip

New Delhi: The armed forces are hoping for a miracle this Union Budget from Finance Minister Nirmala Sitharaman — a substantial rise in the defence allocation, which will enable them to bring on track the mega procurement plans that have either slowed or stalled.

Citing the ongoing border standoff with China, sources in the forces said there is a stark need for defence modernisation.

A number of mega deals are pending or have slowed due to budgetary constraints, including those for new transport and fighter aircraft, and helicopters for the Indian Air Force (IAF); artillery guns, assault rifles, snipers and specialised vehicles for the Army; and fighter aircraft, submarines, new warships and helicopters for the Navy.

An Indian Army truck on a Kashmir highway leading to Ladakh | Representational image | ANI

Experts, however, say a large budgetary rise is not on the cards. Given that the pandemic has hit India's economy and the government's priority will be investment in infrastructure and health, a raise of Rs 10,000-15,000 crore in capital budget would be welcome, they say.

Government sources too indicated to ThePrint that the Ministry of Defence's push for a rollover budget or a non-lapsable fund for itself is unlikely to be met on 1 February when FM Sitharaman will present the Union Budget 2021-22.

Last budget and modernisation bid

In 2020-21, the Narendra Modi government increased India's defence budget by a mere 1.82 per cent to Rs 3.37 lakh crore, excluding expenditure on pension. ThePrint had then reported that the allocation isn't enough for a military that has been forced to cut back on its procurement and modernisation plans due to lack of funds.

The capital budget for the military, which is used for new acquisition and modernisation, saw a meagre 3 per cent rise, or Rs 3,400 crore, over the revised 2019-20 estimates.

The IAF, which is in the middle of buying nearly 200 new fighter aircraft, saw its capital budget lowered from revised estimates of Rs 44,869.14 crore to Rs 43,281.91 crore.

According to a 2019 report, the Modi government has firmed up a mega plan to spend $130 billion to bolster combat capability of the armed forces in the next five to seven years. However, all three services have since spoken on record about the budgetary constraints, and impediments to modernisation.

In a scathing January 2020 report, the Parliamentary Standing Committee on Defence had also criticised the Modi government for inadequate budgetary allocation for the Army.

What the forces say

According to sources in the armed services, the standoff with China in eastern Ladakh has brought out the desperate need for modernisation out in the open.

Since the standoff began in April-May, all three services have gone in for emergency procurement.

A source in the forces said, "The budget has to come up with an increased hike for the defence sector. China is going to be a constant challenge now. There is no other way than having a strong military to deal with China. A strong military means having the deterrence power to deal with a country which is not just bigger militarily but also economically."

A second source said it's not just the Army that needs modernisation to tackle China, but also the Navy and the Air Force.

"Chinese military is expanding, be it the Army, Navy or the Air Force. From being a manpower intensive military, they are in advanced stages of being a capital intensive force. To even offer the slightest credible deterrence power, the Indian armed forces need to modernise and for this money is important," the second source said.

Earlier this month, former defence secretary G. Mohan Kumar noted the need to equip India's forces, especially the Army and the Air Force on the eastern front through fast-track procurement on priority, which will necessitate heavy revenue and capital expenditure.

"This could effectively hobble long-term capability building and 'Make in India', unless the government increases defence-service allocations disregarding its resource crunch. Strategically, a strong naval presence in the Indian Ocean is vital for keeping China at bay," he wrote.

Major General Yash Mor (Retd), former General Officer Commanding of the Leh Sub Area, said India spends one of the lowest per capita on defence compared to the largest six. "We need to spend more. Budget has to factor in the economic situation and also the threat perception," he said.

Experts don't see chances of big jump

Laxman Behera, associate professor at Jawaharlal Nehru University's Special Centre for National Security Studies, said there is no doubt India's defence is in urgent need for substantial increase in allocation, but wasn't hopeful of a big jump.

"Any increase would be welcome given the state of the economy. But I don't think there will be a huge increase," he said.

"The fact that the defence budget was kept away from the Covid curbs in 2020 is encouraging. Since DA was not given, no major raise in revenue budget for defence should be expected. However, a raise of Rs 10,000 to Rs 15,000 crore in capital allotment would be welcome," Behera added.

Tara Kartha, former director, National Security Council Secretariat, said there is no way a drastic jump is possible. India will have to decide what kind of war it wants to fight and rationalise the mass spending on purchase of the next generation of the same equipment, she argued.

https://theprint.in/defence/stark-need-for-modernisation-why-armed-forces-want-a-big-jump-in-defence-budget/592249/

THE ECONOMIC TIMES

Thu, 28 Jan 2021

View: The age old dictum 'Butter vs Guns' takes front seat in Union Budget 2021

By Maj Gen Rohit Gupta (Retd.), Amit Dugar

Synopsis

For a nation which has been virtually at war, both overt and covert, the importance of military capability generation still is a discussion point in every Union Budget because of various other commitments and very cogent reasons

On February 28, 1963, Morarji Desai as the Finance Minister, presented the Union Budget which had a Rs 708.5 crore allocation for defence; a whopping 38% share out of a total budget of Rs 1852 crore. This was after the Indo-China war in 1962. The realisation of the importance of defence, in economic progress of the country dawned a bit late in this case. For a nation which has been virtually at war, both overt and covert, the importance of military capability generation still is a discussion point in every Union Budget because of various other commitments and very cogent reasons, given the competing priorities, including meeting basic needs.

We argue that most large counties that have driven long term economic growth and want to play at the global stage have invested signicantly in military capabilities. India needs to look at a five-year plan, that takes our defence allocation to beyond the 1.5% of GDP (ex-pensions) to 3%. NATO guidelines are for a minimum of 2% of GDP on defence, so +1% to begin with would be ideal given our geographic reality. Other measures would have to be coupled with it to generate finances and focus shifted to acquisitions enhancing deterrence.

Army tanks and other weapon systems being showcased during the 72nd Republic Day parade

While we hope that the current scenario with China will get resolved sooner than later, it is pragmatic to presume that some of our neighbours will continue to present tactical and strategic challenges. Long term budget allocation to defence has to be strategic and to be analysed in different scenarios.

Scenario 1

A reconciliation with China, fuelled by the realisation that military aggression would mean immense loss in human lives, impact on economy and unachieved objectives leading to loss of international standing. In this case, punitive military capability provides deterrence. The key factor in a successful war avoidance philosophy is military capabilities.

Scenario 2

A hot summer with escalation of armed clashes which could result in localised or widespread aggression. That Chinese will suffer unacceptable losses may not be presumed by China, leading to adoption of aggression by them. The key point here being that the Indian military engages with what it presently has; all planned/pipeline projects do not come into play.

Scenario 3

We may well see a long drawn-out stand-o lasting a number of years, like the one in Sumdorong Chu. At the end, either Scenario 1 or 2 could emerge. What matters is that time is on the Indian side to ramp up capability. Greater the Indian punitive capability generated, more the swing of the pendulum towards a likely favourable Scenario 1.

It is Scenario 3 that the Defence Budget should address and thereby lead to Scenario 1 for any future. The adversary must believe that the damage caused by retaliation to his aggression will take unacceptable toll and objectives will not be met.

The Defence Budget already needs to carry a committed liability for the emergency procurement of almost Rs 40,000 crore. It is expected that the revenue expenditure, due to an enhanced deployment in Ladakh and infrastructure development, would also increase.

It is also relevant to look at how and where the allocations are being spent. As a country which has needs of fund for infrastructure, basic health services, aordable housing, water supply, etc, it is also not possible to keep enhancing the defence budget. Hence, as we develop a plan for an uptick in the defence budget, especially on capital side, we need to plan on how we reduce our revenue budget. This would leverage technology and bring in eiciency by partnerships with the private sector. Alternate means of resource generation will have to be factored in.

Creating a Defence Modernisation Corpus (DMC) could be considered. A 49% disinvestment in DPSUs could generate ~Rs 42,000 crore. This could be increased multi fold with privatisation of OFBs. Secondly, an oer to discharge the balance of defence osets of about Rs 50,000-60,000 crore into the DMC, with an investor benefit multiplier factor of 2x, could generate a total of up to Rs 25,000-30,000 crore. This is apart from further osets that could possibly come from contracts signed in the last year and any future contracts with oset obligations. The DMC could thereby add around Rs 60,000-70,000 crore in the kitty for capital acquisitions.

A Deferred Financing Model (DFM), as applicable only to long term high value procurements under Strategic Partnership, may be required to ride over the current cash crunch. For the rst year, no payment on delivery model can be adopted, thereby providing time for fund accumulation in DMC. The Industry could be facilitated to ride over the period of 'no payment' with adoption of long-term procurement contracts. In this

- Strategic Partnership Policy (SPP) must come into play in almost all major equipment purchases.
- With a contract for about 10-15 years, the company can focus on facilitating production lines of greater capacity. Ecosystem of Tier 2 and 3 vendors is facilitated who, with long term benets, could transfer that to component quality and faster delivery time.
- Reportedly, HAL NSE 0.82 % share price went up on the award of contract for 83 Tejas aircraft. A long-term contract facilitates the contracted company to sustain the one-year deferred payment cycle by generation of nances from the market
- The DMC could, having reached sustainable levels, cater to Scheme Based Financing.

Ramping up production capacities would take time. To meet the immediate requirement, of bolstering punitive deterrence, an initial immediate lease of the equipment from foreign technology provider may be carried out, followed by a replacement procurement from the Indian production line set up in collaboration. A strategic G-to-G understanding that long term contract would be given to a JV with manufacture in India. Initial provision of equipment ex-stock could be factored in. Immediate training of core personnel may be carried out on the equipment.

As difficult as it may be, given how the pandemic is impacting us, enhanced defence budget is required for punitive deterrence capability to ensure war avoidance and negotiate from a position of strength.

(Maj Gen Rohit Gupta, SM (Retd) heads the Aerospace and Defence practice and Amit Dugar is the Vice President, at Primus Partners.)

(Disclaimer: The opinions expressed in this column are that of the writer. The facts and opinions expressed here do not reflect the views of www.economictimes.com.)

https://economictimes.indiatimes.com/news/defence/view-the-age-old-dictum-butter-vs-guns-takes-front-seat-in-union-budget-2021/printarticle/80478237.cms

hindustantimes

Thu, 28 Jan 2021

3 more Rafale jets land in India after non-stop flight from France

The aircraft got airborne earlier Wednesday from Istres Air Base in France and few non-stop for 7000 km.

By Rahul Singh

India's Rafale squadron added more muscle after the third batch of three fighter jets arrived in India on Wednesday night after flying non-stop from France, the Indian Air Force said.

"The third batch of three Rafale aircraft landed at an IAF base a short while ago. They flew over 7000Km with in-flight refuelling. The aircraft got airborne earlier in the day from #IstresAirBase in France. IAF deeply appreciates the tanker support provided by UAE Air Force," the IAF tweeted.

The third batch of 3 Rafale aircraft landed at an IAF base Wednesday night. (ANI)

The new jets will bolster the strength of the Indian Air Force's only Rafale squadron which is based in Ambala.

This is the third set of deliveries of the aircraft to the IAF. India ordered 36 warplanes from France (equivalent of two squadrons) in September 2016 for ₹59,000 crore under a government-to-government deal. With the new jets, the number of Rafales in the IAF's inventory has increased to 11.

The second batch of the IAF's three Rafale fighter jets had reached the Jamnagar airbase in Gujarat from France in early November before they flew to their home base in Ambala. The first batch of five Rafale jets reached the Ambala air base on July 29 after a stopover at the Al Dhafra air base near Abu Dhabi. A formal induction ceremony of the war planes took place later on September 10, 2020.

The IAF has been operating the fighter jets in the Ladakh theatre where the military is on high alert amid a border row with China.

On Tuesday, the Rafales took part in the Republic Day flypast for the first time.

All the 36 planes are likely to join the IAF's fighter fleet by the year-end. The second Rafale squadron will be based at Hasimara in West Bengal to strengthen the IAF's capabilities in the eastern sector.

https://www.hindustantimes.com/india-news/3-rafale-jets-take-off-from-france-will-land-in-india-tonight-101611756501463.html

mint

Thu, 28 Jan 2021

UP defence corridor attracts investments worth ₹3,000 crore

By Elizabeth Roche

- ***The industrial corridor was one among two announced in the 2018-19 national budget and is planned around six nodes or centres***
- ***It has attracted projects worth ₹3,000 crore so far***

New Delhi: The recently-launched Defence Industrial Corridor running through Uttar Pradesh has garnered about ₹3,000 crore worth of projects in pledges and commitments from private investors, with the state government looking at the upcoming national budget for tax breaks and incentives to further boost investor interest.

Uttar Pradesh Chief Minister Yogi Adityanath calls on Prime Minister Narendra Modi (ANI)

The industrial corridor was one among two announced in the 2018-19 national budget and is planned around six nodes or centres of Lucknow, Kanpur, Jhansi, Agra Aligarh, Chitrakoot in Uttar Pradesh. The second industrial corridor runs through Tamil Nadu.

Prime Minister Narendra Modi had inaugurated the UP corridor in 2019 and the defence ministry organized the biennial DefExpo in Lucknow last year to attract investments and showcase the state to foreign investors. The aim of the project is to spur job creation as well as to encourage foreign and domestic companies to support defence manufacturing in India.

According to officials in New Delhi and Uttar Pradesh, ₹1,500 crore of investment has been pledged for the Aligarh node with companies allotted almost all of the 76 hectares of land procured for the project.

According to the UP government's website, 32 preliminary agreements have been signed so far between private firms and the state government. The projects being considered include those for the manufacture of components, aircraft engines, airframes, the design and development of drones, swarms and electronic warfare systems besides communication equipment and ammunition.

The state government has been working on land acquisition for the other centres with 94% of the land in Jhansi, 81% in Kanpur and 96% in Chitrakoot having either being bought or requisitioned for the corridor, Awanish Awasthi, Uttar Pradesh Additional Chief Secretary in charge of the corridor project said by phone from Lucknow.

Some of the big names that have expressed interest in investing in the UP Corridor include the Tata group and Dassault Aviation of France, Awasthi said. In the Lucknow area, defence public sector units like Bengaluru-based Hindustan Aeronautics Ltd and Hyderabad-based Bharat Dynamics Ltd have shown interest.

"We hope that the budget (to be unveiled on 1 February) will have more incentives for companies" to invest in the northern corridor, he said.

https://www.livemint.com/budget/news/budget-2021-up-seeking-incentives-for-investments-at-defence-corridor-11611668540371.html

THE DIPLOMAT
Read The Diplomat, Know the Asia-Pacific

Thu, 28 Jan 2021

India to host Indian Ocean Defense Ministers meeting

Beijing's growing activities in the Indian Ocean region are of great concern in New Delhi

By Rajeswari Pillai Rajagopalan

According to Indian media reports, Indian Defense Minister Rajnath Singh will host all the defense ministers of the Indian Ocean region on February 4, 2021. The meeting will take place during India's biennial Aero India air show, to be held in Bangalore from February 3-5. The meeting comes against the backdrop of China's increasingly aggressive behavior toward many of its neighbors, including India, and its growing military presence in the Indian Ocean region. Meanwhile, the conflict between India and China in Ladakh that started in the summer of 2020 is ongoing and there appears to be no resolution, as yet. There was fresh violence just last week in Sikkim, more than a thousand kilometers away from the initial flashpoint in Ladakh.

According to officials who spoke to the media, the defense ministers' meeting, titled "Enhanced Peace, Security, and Cooperation in the Indian Ocean," is meant to shore up "India's commitment and continued engagement in the Indian Ocean both for defense diplomacy as also for economic prosperity through sustained engagement, dialogue, experience sharing and exchange of best practices." The meeting, in addition, is an effort to bring about greater synergy to share resources and efforts among partners in the region. That India is hosting the meeting clearly reflects its intent to institutionalize its leadership role in the Indian Ocean region by calling for dialogue among like-minded partners in order to advance peace, security, and stability in the region.

For more than a decade, India has remained concerned about the growing Chinese military power. China's creeping presence in the Indian Ocean has been a source of worry for New Delhi. Experts argue that China's efforts at seeking greater influence in the Indian Ocean are not merely about challenging India's strategic role in the region but also aimed at consolidating its own key role in the Indian Ocean and as a global maritime power. While the Indian Ocean is seen by New Delhi as India's own backyard, the safety and security of sea lanes of communications (SLOCS) are vital to all global powers. These are lifelines for transportation of oil and gas and important trade corridors, making countries concerned about any possible disruptions. India has adapted itself quite well to the changing security contours of the region. In older Indian security conceptualizations, India would have been wary of speaking to others about securing the Indian Ocean. The Indira Gandhi approach of the 1970s, for instance, did not see any role for extra-regional powers. But, increasingly perturbed by Beijing's growing influence and footprint, New Delhi is ready to embrace all forms of partnerships in Indian Ocean and in the broader Indo-Pacific.

The immediate imperative for India to convene a defense ministers meeting is possibly China's growing activities in the Indian exclusive economic zone (EEZ). In January 2020, commenting on the Chinese naval presence, Indian Navy Chief Admiral Karambir Singh said that New Delhi has been monitoring the Chinese research vessels and fishing boats that have been seen in the Indian Ocean, including in the Indian EEZ. Reportedly, in August 2020, amid the current conflict in Ladakh, the Chinese navy had sent a Yuan Wang class research vessel into the Indian Ocean. Government officials claim that there are around 600 Chinese fishing boats present in the Indian Ocean region every year from 2015 onward. While these numbers are concerning, a larger worry is Chinese research vessels possibly studying the features of the sea water, including currents, as well as surveying the Indian Ocean floor. Such data could be useful in improving Beijing's submarine warfare capabilities.

China's maritime outreach was boosted when it first started deploying warships to the Gulf of Aden as part of international anti-piracy efforts in 2008. Even though the threat of piracy has abated, China has continued to maintain its presence. In fact, only a few days ago, China sent out its 37th escort task force of the PLA Navy to the Gulf of Aden and waters off of Somalia. The 37th task force consisted of missile destroyer Changsha, guided-missile frigate Yulin, and comprehensive supply ship Honghu.

India worries that China's naval presence is here to stay, and as a result New Delhi has to step up both military and diplomatic maneuvering to confront it. Thus, India has been beefing up its naval presence in the region, including through strengthened deployment of warships, submarines, and other naval assets in the region. However, India faces significant limitations in terms of its maritime capacity. This is one reason India has signed logistics agreements with a number of like-minded partners to help expand its naval presence beyond its immediate maritime neighborhood. The United States, France, and Australia are particularly significant in the Indian Ocean context. While these big naval powers are important, Darshana Baruah of Carnegie Endowment for International Peace argues that smaller island nations such as Mauritius, Seychelles, and Madagascar should also be in India's maritime security calculations. Sri Lanka and the Maldives also occupy critical importance both as South Asian and Indian Ocean neighbors.

While there are a few platforms such as the Indian Ocean Rim Association (IORA) and Indian Ocean Naval Symposium (IONS) in the Indian Ocean context for policy conversations and security dialogues, these do have some gaps. For instance, David Brewster says that though IORA is "the only pan-regional multilateral political grouping . . . it doesn't include all Indian Ocean states in the IORA." More importantly, with many minilaterals in the broader Indo-Pacific gaining traction, it might be worthwhile to start engagements on a smaller scale with like-minded partners rather than looking for "pan-regional" institutions. India being a resident naval power in the Indian Ocean, it already has the credentials to kick off a new minilateral for the Indian Ocean region.

https://thediplomat.com/2021/01/india-to-host-indian-ocean-defense-ministers-meeting/

THE HINDU

Thu, 28 Jan 2021

Rolls-Royce keen to offer naval defence solutions to Indian Navy

Bangaluru: Rolls-Royce said it will present its capabilities in advanced technologies including the MT30 marine gas turbine, claimed to be the world's most power-dense marine gas turbine for naval vessels, at Aero India 2021, scheduled to be held in Bengaluru between February 3 and 5.

The focus will be on Rolls-Royce MT30, which offers capabilities of a 21st-century machine derived from the Aero Trent engine family. It gives navies more power in less machinery space than alternative engine types, as per a company statement.

Kishore Jayaraman, president, Rolls-Royce India & South Asia said: "Aero India 2021 will be an important platform for Rolls-Royce to explore opportunities to further collaborate, co-create and co-manufacture in India. We are also excited to discuss how our naval defence offerings such as the MT30 gas turbine can propel the Indian Navy's modernisation programme by providing integrated power and propulsion solutions.''

Rolls-Royce has been manufacturing in India for over 60 years in partnership with Hindustan Aeronautics Limited (HAL) and other Indian supply chain partners, and remains keen to partner on the co-development programme of an indigenous engine for the Advanced Medium Combat Aircraft (AMCA), the company said.

https://www.thehindu.com/business/rolls-royce-keen-to-offer-naval-defence-solutions-to-indian-navy/article33678920.ece

Hindustan Times

Thu, 28 Jan 2021

India sticking to S-400 deal with Russia despite threat of possible US sanctions

Russia is set to train the first group of Indian military specialists in operating the S-400 and the first batteries are expected by September

By Rahul Singh, Rezaul H Laskar

India is sticking to its guns on the $5.4-billion deal with Russia for S-400 air defence systems despite reports of possible US sanctions, an issue with the potential for becoming an early irritant with the new Biden administration.

The Russian S-400s air defence system (Representational image/REUTERS)

India's decision to acquire the S-400, instead of other air defence systems offered by the West, was based on a thorough evaluation and national security requirements, including already delayed plans to create a ballistic missile defence shield over key cities, people familiar with developments said on condition of anonymity.

The lingering standoff with China in Ladakh has seen India deploy a raft of weapons and systems in the sector, including hardware bought from the US, Russia and France, to strengthen its military deployments.

"India's strategic interests are supreme and it is for us to decide what weapons we buy and from whom to pursue those interests. If the US has concerns about procurements from Russia, the latter is also upset over military equipment we are importing from the US," a senior government official said on condition of anonymity.

"We buy platforms factoring in the security threats we face," the official said, adding the US and Russia understand India's complex security challenges.

A second official, who too declined to be named, acknowledged India is walking a fine line in defence cooperation with Russia and the US, which are both strategic partners.

"But the more important point is the country's independent foreign policy and strategic autonomy to decide defence purchases in line with national security interests," the second official said.

Though India has been procuring US military hardware in growing numbers, including Apache and Chinook helicopters and P-8I maritime surveillance aircraft, about 60% of the inventory of the three services continues to be of Russian-origin.

The US has sanctioned its NATO ally Turkey under the Countering America's Adversaries Through Sanctions Act (CAATSA) for taking delivery of the S-400, and this was mainly due to concerns that Western platforms operating in the same environment as the S-400 would provide Russia valuable data on how to defeat those systems, said Vipin Narang, associate professor of political science at the Massachusetts Institute of Technology.

"The fact that Turkey didn't escape CAATSA sanctions suggests the US is very concerned about the S-400 system, and it's probably not just junk. India's insistence to take delivery of its first S-400 batteries later this year therefore sets the Biden administration potentially on a collision course on the sanctions question with India," Narang said.

Russia is set to train the first group of Indian military specialists in operating the S-400 and the first batteries are expected by September.

Air Vice Marshal (retired) Manmohan Bahadur of the Centre for Airpower Studies said no other country, no matter how friendly, can have a veto on India's defence purchases. "The US is a valued partner and would, rather should, understand India's interests. Washington's geo-political

necessities cannot override India's imperatives and one is sure no action would be taken that hurts New Delhi's position," he said.

There are also concerns that US sanctions, even if seen as a slap on the wrist, will revive old concerns about America's reliability as a defence partner and bring back memories of punitive sanctions after India's 1998 nuclear tests that set back several defence programmes, including one to develop the light combat aircraft (LCA). The US had then held back engines to power the LCA.

Narang said it may be "very hard" for the US to apply different standards to India than it did to Turkey, which hosts American nuclear weapons. "If India does not receive a waiver, it is possible the basket of sanctions – over which there is some leeway – may be simply symbolic, and not painful," he said.

"Applying even symbolic sanctions, it seems to me, would be counterproductive. It would not only fail to deter India from purchasing Russian military equipment, it would likely accelerate it and empower those in Delhi who have been sceptical of the reliability of the US as a defence partner," Narang said.

https://www.hindustantimes.com/india-news/india-sticking-to-s-400-deal-with-russia-despite-threat-of-possible-us-sanctions-101611754305999.html

Science & Technology News

Hindustan Times

Thu, 28 Jan 2021

Students of college in Coimbatore develop satellite for ISRO

Students of Sri Shakti Institute of Engineering and Technology, in Coimbatore, have designed and developed a satellite at a cost of ₹2.5 crore

Students of Sri Shakti Institute of Engineering and Technology, in Coimbatore, have designed and developed a satellite at a cost of ₹2.5 crore. It would be inaugurated by chairman of Indian Space Research Organisation (ISRO) Dr R Sivan on January 28.

The formation of the Indian National Space Promotion and Authorisation Centre in June last by Prime Minister Narendra Modi inspired 12 students of the institute to collaborate with ISRO and develop 'SriShaktiSat', the institute chairman Dr Thangavel told reporters here on Wednesday.

ISRO has short-listed 20 space-based experiment proposals from Russia, France, Sweden and Germany for its proposed Venus orbiter mission 'Shukrayaan' to study the planet for more than four years, sources in the Bengaluru-headquartered space agency said.

After installing Sri Shakti Sat Ground Station in collaboration with Serbia-based Community for Space Programme Development, the institute became a member of the Satellite Networked Open Ground Station (SATNOGS) project, he said.

Thangavel said SATNOGS aimed at providing technologies for a distributed network of low earth orbit satellite ground stations. Srishaktisat would be weighing only 460 grams but can perform like any other nano satellites weighting upto 10 kgs, he said. The satellite would be used as a technology demonstrator for Internet of Things in space and for inter-satellite communication, he said. After

the virtual inauguration, the satellite would be handed over to ISRO in February for its use, he added.

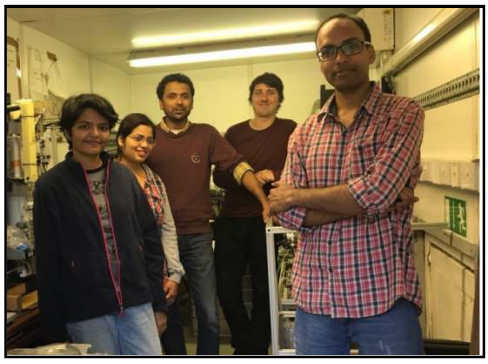
https://www.hindustantimes.com/education/students-of-college-in-coimbatore-develop-satellite-for-isro-101611750737623.html

Thu, 28 Jan 2021

Delhi Pollution: IIT Madras researchers led international study finds Chloride-rich Particles responsible for visibility reduction over Delhi

Chennai: An International Study led by Researchers from Indian Institute of Technology Madras has found Chloride to be the highest inorganic fraction in particulate matter, primarily responsible for haze and fog formation in Northern India including National capital Delhi.

The Study has been published in a prestigious peer-reviewed International Journal Nature Geoscience. A video of Dr. Sachin Gunthe, IIT Madras, explaining the important findings can be downloaded from the following link – https://fromsmash.com/Delhi-Pollution



Many studies in the past have identified PM2.5 (particulate matter or aerosol particles with diameter less than 2.5 micrometre) as a major pollutant, responsible for haze and fog formation over Indo-Gangetic plain including Delhi.

However, the role of PM2.5 and detailed chemistry of haze and fog formation over national capital was poorly understood. Such a lack of understanding was the biggest hurdle in developing the policies to improve the air quality and visibility. This study now greatly enhances our understanding about the precise role of PM2.5 in chemistry of fog formation, which will help policy makers to frame the better policies for improving the air quality and visibility over national capital.

With the approaching winter season, every year, most of the Indo Gangetic Plain invariably is engulfed in a dense fog and haze, particularly during the months of December and January. Over the national capital dense fog negatively impacts the air and surface transport resulting in huge financial losses and jeopardise human lives. Overall life comes to standstill during the dense fog!

This study not only provides the scientific explanation for source of high chloride in PM2.5 mass over Delhi but also quantifies its role in haze and fog formation and visibility reduction. The study explains that complex chemical reactions involving Hydrochloric Acid (HCl), which is directly emitted in the atmosphere from plastic contained waste burning and few industrial processes, is primarily responsible for high PM2.5 chloride and subsequent haze and fog formation over Delhi during chilly winter nights. While previous researchers also have observed high chloride in PM2.5, the potential source of such a high chloride and if it played any role in haze and fog formation was a scientific mystery.

The study, led by IIT Madras and was carried out in collaboration with Max Planck Institute for Chemistry, Germany; Harvard University, USA; Georgia Institute of Technology, USA; and Manchester University, UK.

The group of scientists and students deployed state-of-the-art instruments to measure the chemical composition and other important properties of PM2.5, along with relative humidity and

temperature in Delhi, which were operated round the clock for one month with extreme care and dedicated expertise. The observations were then used in complex chemical models.

The findings were surprising for the researchers and unfolded the mystery of high chloride in PM2.5 and scientifically unravelled its precise role in fog and haze formation over Delhi. Dr. Sachin S. Gunthe, Associate Professor, Department of Civil Engineering, IIT Madras, who overall supervised and led the study and his team asked themselves a very basic question "If overall PM2.5 mass burden over Delhi is much lower than polluted megacity Beijing, then why visibility reduction is major problem in Delhi?"

Elaborating about the findings of this Research, Dr. Sachin S. Gunthe said, "We realised that despite absolute PM2.5 mass burden over Delhi being much less than other polluted megacities around the world, including Beijing, the pollution and atmospheric chemistry of Delhi is much more complex to understand. This work put forward importance of measurements and modelling approaches to scientifically conclude that half of the water uptake and visibility reduction by aerosol particles around Delhi is caused by the HCl emissions, which is locally emitted in Delhi potentially due to plastic contained waste burning and other industrial processes."

Further, Dr. Sachin Gunthe added, "The real challenge was to delineate the role of high chloride in visibility reduction. The resolution of the mechanism was derived with the collaborative effort from all the partners in this project with various tools of analysis. This study is a demonstration of a successful large scale scientific collaborations that are so vital for climate studies."

Elaborating on this research, Prof. R. Ravikrishna, Department of Chemical Engineering, IIT Madras, who was also part of the team that conducted this study, said, "With the results from first couple of days, it was very clear to us that Delhi is different; because generally for a polluted urban region like Delhi, one would expect sulfate to be highest inorganic fraction of particulate matter; however, we found chloride to be the highest inorganic fraction of particulate matter."

The HCl from various sources combines with ammonia, which is emitted in great amounts over this region. Thus, ammonium chloride (NH_4Cl) so formed condenses to aerosol and exponentially increase the water uptake ability of aerosol particles resulting increase in size, eventually leading to dense fog formation. In the absence of the excess chloride, the fog formation otherwise would be suppressed significantly.

Enhancement in understanding of water uptake by particles in Delhi is of enormous significance as very poor visibility over this region leads to financial burden and loss of human lives. Further, not only this study emphasises plastic burning emits toxic substances in the atmosphere impacting human health but also these emissions are for the first time linked to visibility and climate.

Speaking about the findings, Dr. Sachin Gunthe said, "Scientifically, our job is half done. Plastic-contained waste burning can emit highly toxic chemicals called 'dioxins', which can accumulate in food chain causing severe problems with reproduction and immune system. We further need to investigate in this direction. Enhancement in fundamental science of air pollution should be given importance as much as technology development to tackle pollution."

Dr. Sachin Gunthe further added, "Given that we find plastic burning as a potential cause of the reduced visibility, we hope these findings will help policy makers to efficiently enforce and implement policies that are already in place towards regulating open burning of plastic contained-waste and other potential chlorine sources."

The study identifies waste burning as a major pollutant source, which is responsible for emissions of aerosol precursors as well as other toxic substances such as chlorinated dioxins and other persistent pollutants that affect human health. The study also emphasised need to improve the policies related to air pollution, solid waste management including e-waste, and food safety to systematically address the environmental issues in India.

The IIT Madras and The University of Manchester team members in advanced state-of-the-art aerosol laboratory, which was setup in Delhi to investigate the science behind the visibility reduction.

About IIT Madras

Indian Institute of Technology Madras (IITM) was established in 1959 by the Government of India as an 'Institute of National Importance.' The activities of the Institute in various fields of Science and Technology are carried out in 16 academic departments and several advanced interdisciplinary research academic centres. The Institute offers undergraduate and postgraduate programmes leading to B.Tech., M.Sc., M.B.A., M.Tech., M.S., and Ph.D., degrees in a variety of specialisations. IITM is a residential institute with more than 580 faculty and 9,500 students. Students from 18 countries are enrolled here. IITM fosters an active entrepreneurial culture with strong curricular support and through the IITM Incubation Cell.

IITM has been ranked No.1 in the 'Overall' Category for the second consecutive year in India Ranking 2020 released by National Institutional Ranking Framework, Ministry of Education, Govt. of India. The Institute has also been ranked No.1 in the 'Engineering Institutions' category in the same Rankings for five consecutive years – 2016, 2017, 2018, 2019 and 2020. It was also adjudged as the 'Top innovative Institution' in the country in Atal Ranking of Institutions on Innovation Achievements (ARIIA) in 2019 and 2020. ARIIA Ranking was launched by the Innovation Cell of Ministry of Education.

https://indiaeducationdiary.in/delhi-pollution-iit-madras-researchers-led-international-study-finds-chloride-rich-particles-responsible-for-visibility-reduction-over-delhi/

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Thu, 28 Jan 2021

A new way to measure record-setting electron beams

By Glenn Roberts Jr.

Physicists at the U.S. Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) are figuring out new ways to accelerate electrons to record-high energies over record-short distances with a technique that uses laser pulses and exotic matter known as a plasma. But measuring the properties of the high-energy electron beams produced in laser-plasma acceleration experiments has proven challenging, as the high-intensity laser must be diverted without disrupting the electron beam.

Now, a new, compact system has been successfully demonstrated at the Berkeley Lab Laser Accelerator (BELLA) Center to provide simultaneous high-resolution measurements of multiple electron-beam properties.

Sam Barber, left, a research scientist at Berkeley Lab's BELLA Center, and Jeroen van Tilborg, a staff scientist at the BELLA Center, hold the active plasma lens, right, and dipole magnets used in an electron-beam diagnostic experiment. The setup enabled measurements of electron-beam energy, with range and resolution comparable to what is achieved using the multi-ton magnet located behind them. Credit: Marilyn Sargent/Lawrence Berkeley National Laboratory

The new system uses ultrathin liquid-crystal films, developed by Prof. Douglass Schumacher and his team at Ohio State University, to redirect the laser while allowing the electron beam to pass through, largely unaffected. The laser forms a plasma that reflects the bulk of its laser light.

While each laser pulse destroys the liquid-crystal film, similar to a bubble machine, the liquid-crystal film is replenished by a rotating disc and wiper device after each laser shot. The films formed by this device are just tens of nanometers (billionths of meters) in thickness, about a factor of 1,000 thinner than those in other replenishable plasma mirror systems that use VHS cassette tape, for example. This reduction in thickness serves to preserve the electron beam's properties.

The deflection of laser light away from the electron beam is essential for producing a precise diagnostic of the electron beam, noted Jeroen van Tilborg, a BELLA Center staff scientist, and it is also crucial for multistage laser-plasma acceleration experiments, in which the laser pulses are refreshed at each stage to provide an additional "kick" of acceleration for the electron beam until it reaches its required acceleration.

The liquid-crystal plasma mirror (LCPM) also enables the use of a gas-filled, 6-centimeter-long strong focusing device for the electron beam, known as an active plasma lens.

This lens allows a compact alternative to a large diagnostic tool called a magnetic spectrometer device, which has bulky magnets that weigh more than a ton and are coupled to a large power supply.

"We were able to replace this with dipole (two-pole) magnets about the size of a sandwich," said Sam Barber, a research scientist at the BELLA Center in Berkeley Lab's Accelerator Technology and Applied Physics (ATAP) Division. "Laser plasma accelerators can produce high-energy electrons in compact footprints, but there is still much that can be done to shrink some of the components, including electron beam diagnostics."

He added, "This is a huge reduction in the scale. We are combining a petawatt (high-power) laser with ultrathin LCPMs and active plasma lenses—all novel technologies that have just recently been developed. We combined all three of them and we got a nice result. We are making big steps forward. There is a whole slew of new applications that this could be used for."

Barber was the lead author of a study detailing the performance and setup of the new diagnostic tool, published in the journal *Applied Physics Letters*. Other BELLA Center researchers participated in the study, too, along with researchers from UC Berkeley and Ohio State University. The current advances were supported by LaserNetUS, the recently formed network of high-power laser facilities that is funded by the DOE Office of Science, Office of Fusion Energy Sciences, and Office of High Energy Physics.

Carl Schroeder, a Berkeley Lab senior scientist who is deputy director of the BELLA Center, said that besides its compactness, the new diagnostic technique can collect several electron-beam properties at once, including the detailed energy distribution of the electron beam and the beam's emittance, on a single-shot basis. Emittance is a critical property of an electron beam that dictates how tightly the beam can be focused. A low emittance means the beam can be focused down to a very small spot, crucial for most accelerator applications like colliders and free-electron lasers.

"Typically, these are multishot diagnostics," he said, which average the measurements of several beam pulses but don't measure on a pulse-by-pulse basis—as does the new technique.

In the demonstrated setup, a laser is focused into a gas cell, where it creates and interacts with a plasma, generating and accelerating an electron beam. After passing through this cell, the combined laser beam and electron beam arrive at the LCPM, at which point the laser is deflected while the electron beam is transmitted—with negligible disruption.

The electron beam then passes through the active plasma lens. The lens is used to focus the electron beam into a sequence of small magnets. The magnetic field disperses the electrons according to energy—much like the way light is dispersed by color when passing through a prism.

The dispersed electron beam then passes through a special crystal that produces light as the electron passes through. High-resolution images of the crystal's light signature enable a precise, sub-percent-resolution mapping of the energy of the electron beam, and simultaneous emittance measurements.

The measurements can ultimately help researchers to troubleshoot, tune, and improve the performance of laser-plasma acceleration experiments, and the setup could potentially be relevant for future collider applications and compact X-ray free-electron lasers, researchers noted, which could have a wide array of applications.

"You want to be able to rapidly characterize these beams and use that as feedback for optimization," Barber said. "This is useful for the characterization and control of electron-beam properties."

More information: S. K. Barber et al. A compact, high resolution energy, and emittance diagnostic for electron beams using active plasma lenses, *Applied Physics Letters* (2020). DOI: 10.1063/5.0005114

Journal information: *Applied Physics Letters*

https://phys.org/news/2021-01-record-setting-electron.html

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Thu, 28 Jan 2021

Solar material can 'self-heal' imperfections, new research shows

A material that can be used in technologies such as solar power has been found to self-heal, a new study shows.

The findings—from the University of York—raise the prospect that it may be possible to engineer high-performance self-healing materials which could reduce costs and improve scalability, researchers say.

Credit: CC0 Public Domain

The substance, called antimony selenide (Sb_2Se_3), is a solar absorber material that can be used for turning light energy into electricity.

Professor Keith McKenna from the Department of Physics said: "The process by which this semi-conducting material self-heals is rather like how a salamander is able to re-grow limbs when one is severed. Antimony selenide repairs broken bonds created when it is cleaved by forming new ones.

"This ability is as unusual in the materials world as it is in the animal kingdom and has important implications for applications of these materials in optoelectronics and photochemistry."

The paper discusses how broken bonds in many other semiconducting materials usually results in poor performance. Researchers cite as an example, another semiconductor called CdTe that has to be chemically treated to fix the problem.

Professor McKenna added: "We discovered that antimony selenide and the closely related material, antimony sulphide, are able to readily heal broken bonds at surfaces through structural reconstructions, thereby eliminating the problematic electronic states.

"Covalently-bonded semiconductors like antimony selenide find widespread applications in electronics, photochemistry, photovoltaics and optoelectronics for example solar panels and component for lighting and displays.

The paper, "Self-healing of broken bonds and deep gap states in Sb_2Se_3 and Sb_2S_3" is published in *Advanced Electronic Materials*.

More information: Self-Healing of Broken Bonds and Deep Gap States in Sb2Se3 and Sb2S3, DOI: 10.15124/3232bc8b-416b-4494-96d5-4b2df882f605, pure.york.ac.uk/portal/en/data … 5-4b2df882f605).html

https://phys.org/news/2021-01-solar-material-self-heal-imperfections.html

COVID-19 Research News

The Indian EXPRESS

Thu, 28 Jan 2021

Covaxin is effective against UK variant, shows study: what this means for India

India has seen a rising number of cases of infection with the UK variant; on January 23, the Ministry of Health and Family Welfare said that at least 150 people have tested positive for the mutant strain

By Anuradha Mascarenhas, Prabha Raghavan

New Delhi: Covaxin, the indigenously developed vaccine against the novel coronavirus, can work against the new UK variant, a new study by the Indian Council of Medical Research (ICMR) and National Institute of Virology (NIV) has said.

Study finding

Hyderabad-based Bharat Biotech conducted a test of its Covid-19 vaccine, Covaxin, against the UK strain of the virus. The "plaque reduction neutralization" test (PRNT50) involved collecting the serum — the protein-rich liquid separated from blood after it is clotted — of 38 people who had received the vaccine. The sera was then tested against the UK variant of the virus as well as a heterologous strain of the virus that Covaxin was previously tested against.

"Our study evidently highlighted comparable neutralization activity of vaccinated individuals' sera against variant as well as heterologous SARS-CoV-2 strains. Importantly, sera from the vaccine recipients could neutralise the UK-variant strains discounting the uncertainty around potential escape," the researchers said in the study published online on Tuesday in bioRxiv, a preprint server for biology. ('Neutralization of UK-variant VUI-202012/01 with COVAXIN vaccinated human serum')

Bharat Biotech's vaccine at District General Hospital in Aundh, Pune (Express Photo: Arul Horizon)

"It was reassuring from the PRNT50 data generated in our laboratory that the indigenous BBV152/ COVAXIN, following its rollout in vaccination program, could be expected to work against the new UK-variant. It is unlikely that the mutation 501Y would be able to dampen the potential benefits of the vaccine in concern," the study said.

Significance

India has seen a rising number of cases of infection with the UK variant; on January 23, the Ministry of Health and Family Welfare said that at least 150 people have tested positive for the mutant strain. This is a concern not just because the UK strain has been found to spread more quickly than the more common strain of the virus, but also because British Prime Minister Boris Johnson had said on January 22 that there was "some evidence" to suggest that this variant was associated with a "higher degree of mortality", making it more deadly.

The UK strain was one of the main reasons that Bharat Biotech received restricted emergency approval in India despite Covaxin not having completed enough large-scale human trials to show even interim information on its efficacy (ability to bring down symptomatic Covid-19 cases in those vaccinated).

The pre-print findings are the first set of evidence of the vaccine's ability to work against the UK mutant strain.

ICMR Director General Dr Balram Bhargava told The Indian Express that the data generated in the laboratory was “reassuring”.

“If the mortality is 10 per 1,000 for the regular one then it is 13 for this variant of coronavirus. Hence, it is great that we were able to isolate and culture the UK variant within a week’s time and test with sera of Covaxin-vaccinated people. It is reassuring that the vaccine can work against the new UK variant,” Dr Bhargava said.

Dr Samiran Panda, one of the researchers and head of ICMR’s Epidemiology and Communicable Diseases division, said, “The serum samples were collected from vaccine recipients and have been able to neutralise the UK variant, which is good news.”

Caution

The findings of the study are still to be peer-reviewed. While the data collected from 38 people looks promising, there is no clarity on the vaccine’s efficacy yet, as it is being administered to priority groups in “clinical trial” mode. Greater clarity is expected to emerge later this year, when Bharat Biotech will have enough information to say how effective the vaccine is in preventing those inoculated from showing serious symptoms, even if they do get infected.

Also, the pre-print findings show the vaccine’s ability to protect against the UK strain only. There are various other mutant strains of the virus that pose a threat to vaccination programmes around the world, with a variant from South Africa being of equal concern.

https://indianexpress.com/article/explained/covaxin-is-effective-against-uk-variant-shows-study-what-this-means-for-india-7164596/