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Hindustan Times

Mon, 13 June 2022

India Developing 300km Range Air-to-Air Missile

The Astra Mk-2 and Mk-3 missiles are likely to be tested next year and in 2024 respectively, and are among the Defence Research and Development Organisation's (DRDO) key ongoing programmes, said one of the officials cited above. India is developing two advanced variants of the Astra beyond visual range air-to-air missiles, with one of them capable of striking targets at a range of 160km, when ready, and the other at almost 300km, senior government officials said on Friday on the condition of anonymity. The Astra Mk-2 and Mk-3 missiles are likely to be tested next year and in 2024 respectively, and are among the Defence Research and Development Organisation's (DRDO) key ongoing programmes, said one of the officials cited above.

The current Astra Mk-1 variant has a range of around 100km.

The defence ministry on May 31 signed a ₹2,971-crore contract with Bharat Dynamics Ltd (BDL) to equip the Indian Air Force and Indian Navy with Astra Mk-1 missiles and associated equipment, which was seen as a shot in the arm for "Atmanirbharta", or self-reliance, in the defence manufacturing sector. DRDO has transferred technology to BDL for the production of the Astra Mk-1 and associated systems. "Future air combat will be about detecting and striking targets at the farthest possible range. It will be the outcome of increase in the detection ranges of radars and the advent of longer-range missiles. It is important for India to develop missiles like Astra Mk-2 and Mk-3 to meet IAF's requirements," said Air Marshal Anil Chopra (retd), director general, Centre for Airpower Studies.

China has developed the PL-15 beyond visual range air-to-air missile that can hit targets at around 200km, while the Meteor with a range of around 160 km is considered the best in its class in the western world, and the new Astra variants will put India in the big league, he added. The Astra Mk-1 missile has been fully integrated with the Sukhoi-30 fighters and will now add to the capabilities of other combat planes including the Tejas light combat aircraft, the officials said. Also, the navy's MiG-29K fighters, which operate from India's sole aircraft carrier INS Vikramaditya, will be equipped with the Astra Mk-1 missile. The ongoing Russia-Ukraine crisis has exposed India's overwhelming dependence on imported weaponry, especially from Russia, and underlined the urgent need for speeding up the indigenisation drive to become self-reliant.

Long-range missiles allow fighter jets to shoot down hostile aircraft from a significant standoff range, staying out of the adversary's air defence envelope. India has imposed a phased ban on the import of 310 different types of weapons and systems during the last two years to boost self-reliance in the defence manufacturing sector. These include lightweight tanks, naval utility

helicopters, artillery guns, missiles, destroyers, ship-borne cruise missiles, light combat aircraft, light transport aircraft, long-range land-attack cruise missiles, basic trainer aircraft, multi-barrel rocket launchers, assault rifles, sniper rifles, specified types of helicopters, next-generation corvettes and airborne early warning and control (AEW&C) systems.

The 310 weapons and systems that have to be developed in the country were notified in three separate positive indigenisation lists published by the defence ministry in August 2020, May 2021 and April 2020. Since the notification of the first and second lists, contracts for 31 projects worth ₹53,839 crore have been signed by the defence services as of April 2022, according to defence ministry data. Also, acceptance of necessity (AoN) for 83 projects worth Rs.1,77,258 crore was accorded by April 2022, and cases worth Rs. 2,93,741 crore will be taken up in the next five to seven years. The domestic industry is likely to receive orders worthRs. 2,10,000 crore in the next five years as a result of the third list, according to the defence ministry's projections.

https://www.hindustantimes.com/india-news/india-developing-300km-range-air-to-air-missile-101654886565073.html

Telangana Today

FOR LOCAL TO GLOBAL NEWS

Sun, 12 June 2022

DRDO is Encouraging Startups, Young Talents: DRDO Chairman

Secretary of the Department of Defence R&D and Chairman, Defence Research and Development Organisation (DRDO) Dr G Satheesh Reddy said that the DRDO was encouraging startups and young talents through its programmes like the Defence Technology Development Fund (DTDF) and the 'Dare to Dream' Programme. "Innovative ideas that will lead to building of systems are being funded under these schemes. The idea is to build a strong eco-system which would foster breakthroughs in important areas such as defence, healthcare, energy and clean technologies," he said. He has inaugurated the 37 th and 38 th Graduation Day of the third and fourth autonomous batches (2016-20 and 2017-21) of the Kakatiya Institute of Technology and Science, Warangal, here on Sunday.

Addressing the students on the occasion, Dr Reddy said, "At present there are 65000 startups in India. Due to this phenomenal change in the country i.e. instead of going abroad 70 percent of students reverse migrated to our country. Start-ups are doing a lot for the benefit of society. In future, India will soon become a hub of start-ups. There are more than 50 students who got Rs 50 crore funding each for their innovative ideas through start-ups," KITS, Warangal, Governing Body Chairman V Lakshmikantha Rao declared the 'Graduation Day Open' followed by the overall institute report presented by the principal, Prof. K. Ashoka Reddy.

Kakatiya University (KU) Vice-Chancellor Prof Thatikonda Ramesh has said the KITS was nurturing research with Innovation, Incubation, Research and Entrepreneurship. He stressed the need to focus on applied research by forming consortiums with state level private institutions as competent with government institutions like NITs, IIITs, etc. KITS Principal Prof K Ashoka Reddy said that they had presented 12 gold medals to the graduates for the overall academic excellence in various engineering disciplines for this academic year. "All nine departments of the institute were accredited by the NBA, New Delhi. We are also part of an Indo-American

artificial heart research project. Two faculty authored two engineering books and for this academic year 2021-22 there were 360 above research papers published in International and national journals. The campus placements for the academic year 2016-20 were 6 percent, 2017-2021 was 73 percent and 2018-22 batch students have got 95 percent placements and they landed the MNCs," he said.

Our library has 7000 AICTE Modulated Audio Video journals and a remote access facility, 85000 books. KITS, Warangal, has also inked 32 MOUs with multinational companies and government research centers. Our students have got the overall KU championship in athletics in sports and games in national level competitions," Prof Ashoka Reddy said. KITS treasurer P Narayana Reddy, Husnabad MLA V Satish Kumar, and faculty members attended the programme.

https://telanganatoday.com/drdo-is-encouraging-startups-young-talents-drdo-chairman

THE TIMES OF INDIA

Mon, 13 June 2022

DRDO Secy Urges Youth to Turn into Job Providers

The Chairman and secretary of the DRDO Dr G Satheesh Reddy called upon the young graduates to turn into job providers and stressed the need of entrepreneurial spirit . Speaking at the graduation day at KITS Warangal, he said that DRDO believes in the ability of the young scientists to transform the defence scenario in a positive way.

https://timesofindia.indiatimes.com/city/hyderabad/drdo-secy-urges-youth-to-turn-into-job-providers/articleshow/92169748.cms

THE HANS INDIA

Mon, 13 June 2022

India to be Start-Up Hub: DRDO Chief

The Defence Research and Development Organisation (DRDO) was encouraging startups and young talents through Defence Technology Development Fund (DTDF) and the 'Dare to Dream' programmes, said its chairperson G Satheesh Reddy. "The idea is to build a strong ecosystem which would foster breakthroughs in important areas such as defence, healthcare, energy and clean technologies etc. At present there are 65,000 start-ups in India as 70 per cent of the engineers chose to return to India," Reddy said, taking part in the 37th and 38th Graduation Day of the Kakatiya Institute of Technology and Science, Warangal, on Sunday.

Kakatiya University Vice-Chancellor Prof. Thatikonda Ramesh praised the institution for nurturing research with I2RE (Innovation Incubation Research and Entrepreneurship) methodology with excellent achievements in solving real world problems at state level. He also advised to focus on applied research by forming consortiums with state level private institutions as competent with Govt. institutions like NITs, IIITs, etc. KITSW Governing Body Chairman, Capt. V Lakshmikantha Rao suggested that the engineers must work on solving the real world problems instead of running after money.

Principal Prof. K Ashoka Reddy said that there were 12 gold medals awarded for the overall academic excellence in various engineering disciplines for this academic year. "To make the students technically superior and ethically strong by providing advanced versions of technology and highly qualified faculty to the all nine departments which were Tier-1 accredited by the NBA New Delhi. We were part of an Indo-american artificial heart research project. The campus placements for AY 2016-20 61%, 2017-2021 is 73% and 2018-22 batch students have got 95% placements," he said.

https://www.thehansindia.com/amp/news/cities/warangal/india-to-be-start-up-hub-drdo-chief-748326

The Indian EXPRESS

Mon, 13 June 2022

BrahMos, 21 and Developing

By Sushant Kulkarni

On June 12, 2001, the BrahMos supersonic cruise missile was first tested from a land-based launcher in Chandipu.r In the 21 years since, BrahMos has been upgraded several times, with versions tested on land, air and sea platforms. A take a look at the 21-year journey of the versatile asset, which recently bagged an export order from the Philippines.

Background and Development

Since the early 1980s, the integrated Guided Missile Development Programme, conceived and led by Dr A P J Abdul Kalam, began development a spread of missiles together with Prithvi, Agni, Trishul, Akash and Nag, with a large spectrum of capabilities and ranges. In the early 1990s, India's strategic leadership felt the need for cruise missiles — guided missiles that traverse nearly all of their flight path at almost constant speed and deliver large warheads over long distances with high precision. The need was felt primarily following the use of cruise missiles in the Gulf War.

An Inter-Governmental agreement was signed with Russia in Moscow in 1998 by Dr Kalam, who headed the Defence Research and Development Organisation (DRDO), and N V Mikhailov, Russia's then Deputy Defence Minister. This led to the formation of BrahMos Aerosspeed, a joint venture between DRDO and NPO Mashinostroyenia (NPOM), the Indian side holding 50.5% and the Russians 49.5%. In 1999, work on development of missiles began in labs of DRDO and NPOM after BrahMos Aerosspeed recieves funds from the two governments. The first successful check in 2001 was conducted from a specifically designed land-based launcher. The missile system has since reached some key milestones, with the first main export order of $375 million received from the Philippines Navy this Year,

Strategic signifiisce

BrahMos is a two-stage missile with a solid propellant booster engine. Its first stage brings the missile to supersonic speed and then get separated. The liquid ramjet or the second stage then takes the missile closer to three times the speed of sound in cruise phase. The missile has a very

low radar signature, making it stealthy, and is achieve a variety of trajectories. The 'fireplace and neglect' kind missile is achieve a cruising altitude of 15 km and a terminal altitude as low as 10 m to hit the target. Cruise missiles such as BrahMos, referred to as "standoff range weapons", are fired from a spread far enough to allow the attacker to evade defensive counter-fire. These are In the arsenal of most major militaries in the world.

The BrahMos has three times the speed, 2.5 instances flight range and higher range in comparison with subsonic cruise missiles. With missiles made available for export, the platform is also seen as a key asset in defence diplomacy.

An extended range versions of the Brahmos air-launched missile was testedfrom a Sukhoi-30 MKI recently. On January 11, an advanced sea-to-sea variant of BrahMos was tested from the newly commissioned INS Visakhapatnam. The BrahMos is also said to have been concerned in a recent controversy. Pakistan claimed that an unarmed Indian missile had landed in its territory on March 9, and the Ministry of Defence said a technical malfunction had led to accidental firing. While the government, which ordered a high-level court of enquiry, didn't officially identify the missile, experts felt its trajectory suggested the signature of BrahMos.

Present and future

Senior DRDO scientists say what makes the missile system unparalleled is its extreme accuracy and versality Land-based BrahMos formations along the borders, BrahMos-equipped Sukhoi-30s at bases in Northern theatre and Southern peninsula, and BrahMos-capable ships and submarines deployed in sea together type a triad. With requirement evolving in multi-dimensional warfare, the BrahMos is undergoing number of upgrades and work is on to develop variations with higher ranges, manoeuvrability and accuracy. Variations presently being tested embody ranges up to 350 km, as compared to the originals 290 km. Versions with higher ranges, upto 800 km, and with hypersonic speed are said to be on cards. Efforts are also on to reduce the size and signature of existing versions and augment its capabilities further.

Versions deployed in all three Armed forces are still being tested regularly, and so are versions currently under development.

LAND-BASED: The land-based BrahMos complex has four to six mobile autonomous launchers, each with three missiles on board that can be fired almost simultaneously. Batteries of

the land-based systems have been deployed along India's land borders in various theatres. The upgraded land attack version, with capability of using at 2.8 Mach, can hit targets at a range upto 400 km with precision. Advanced versions of higher range and speed upto 5 Mach are said to be under development. The ground systems of BrahMos are described as 'tidy' as they've very few components.

SHIP-BASED: The Navy began inducting BrahMos on its frontline warships from 2005. These have the capability to hit sea-based targets beyond the radar horizon. The Naval version has been successful in sea-to-sea and sea-to-land modes. The BrahMos can be launched as a single unit or in a salvo of upto eight missiles, separated by 2.5 second intervals. These can target a group of frigates with modern missile defence systems.

AIR-LAUNCHED: On November 22, 2017, BrahMos was successfully flight-tested for the first time from a Sukhoi-30MKI against a sea-based target in the Bay of Bengal. It has since been successfully tested multiple times. BrahMos-equipped Sukhoi-30s, which have a range of 1,500 km at a stretch without mid-air refuelling, are considered key strategic deterrence for adversaries both along land borders and in the strategically important Indian Ocean region. The IAF is set to be integrating BrahMos with 40 Sukhoi-30 fighter jets across the various bases.

SUBMARINE-LAUNCHED: This version can be launched from around 50 m below the water surface. The canister-stored missile is launched vertically from the pressure hull of the submarine, and uses different settings for underwater and out-of-the-water flights. This version was successfully tested first in March 2013 from a submerged platform off the coast of Visakhapatnam.

https://indianexpress.com/article/explained/explained-brahmos-21-and-developing-7966393/

The Indian EXPRESS

SUN, 12 Jun 2022

BrahMos JV has Fortifield India- Russia Strategic Military Relationship

BrahMos JV has fortified India-Russia strategic military relationship

SUPERSONIC cruise missile BRAHMOS – one of India's most formidable modern military assets – has established its prowess as the world's best and deadliest tactical weapon in the 21st century.

Developed by India's Defence Research & Development Organisation (DRDO) in close cooperation with Russia's NPO Mashinostroyeniya (NPOM) under a Joint Venture (JV) military-technological programme, the state-of-the-art BRAHMOS remains the distinct flag-bearer of the long-standing strategic partnership between New Delhi and Moscow.

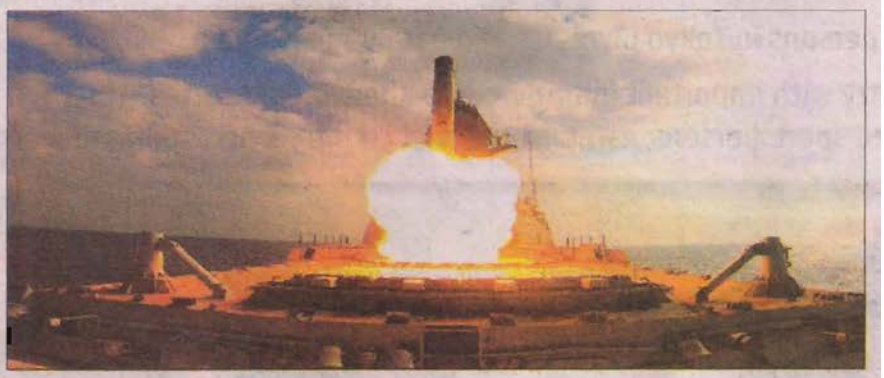
Since the programme's inception on February 12, 1998 following the signing of a landmark Inter-Governmental Agreement (IGA) between India and Russia and the subsequent establishment of BrahMos Aerospace as the JV entity entrusted with the task of designing, developing, producing and delivering the powerful, highly versatile weapon to the armed forces, BRAHMOS has charted many incredible milestones.

The best of scientific and engineering minds from both the partner nations worked hand-in-hand to design and develop BRAHMOS as a high-end precision-guided weapon which no nation in the world had possessed until then. On June 12, 2001, coinciding with the 'Russia Day', the supersonic cruise missile underwent its maiden successful test launch from a mobile, land-based platform to validate its anti-ship capability.

The weapon has evolved since then by incorporating cutting-edge technologies, thereby establishing its credence as an unparalleled tactical system having impeccable anti-ship and land-attack capability. The missile has been developed and successfully inducted in land-to-land, land-to-sea, sea-to-land, sea-to-sea, air-to-land and air-to-sea configurations in the Indian armed forces.

Combining supersonic speed, pin-point accuracy, devastating fire-power, range and versatility, BRAHMOS has galvanised the Indian armed forces' warfighting capability. Having been inducted in the Indian Navy in 2005, in Indian Army in 2007 and the Indian Air Force in 2020, BRAHMOS has become a powerful "force multiplier" asset for undertaking network-centric combat operations in times of conflict and volatility.

"Since its first successful test firing conducted in June 2001, BRAHMOS has been tested numerous times from ground, sea and air platforms and charted highest success rate. No other weapon world-wide holds such a distinct record," says Atul Dinkar Rane, Director General, BrahMos (DRDO) and CEO & MD of BrahMos Aerospace.



BrahMos Aerospace

In the year 2022, the supersonic cruise missile has continued on its glorious trajectory by being successfully test-fired a number of times from frontline land, naval and air platforms of the Indian defence forces. Featuring more indigenous technologies, components and sub-systems, BRAHMOS has achieved newer advancements and validated its operational and functional efficiency.

In fact, the year 2022 has become a historic one for BrahMos Aerospace.

"On January 28, 2022, we signed the historic contract with the Republic of Philippines to supply shore-based anti-ship BRAHMOS systems for the Philippine Navy. This is a watershed moment for us. It has positioned BRAHMOS as India's first full-scale, state-of-the-art weapon of such class and calibre to be exported to a third-party friendly, responsible nation," says Atul Dinkar Rane.

"From being one of the flag-bearers of 'Make-In-India' and 'Design-In-India', BrahMos Aerospace is now going to 'Make-for-the-World'," says the BrahMos chief.

The multi-million dollar BRAHMOS export deal with the Philippines, a part of the Govt of India's policy of promoting responsible defence exports, has propelled forward India's ambition to achieve an overall export turnover of $5 billion in the defence & aerospace sector by the year 2025.

With this breakthrough deal, the India-Russia JV entity has also realised its far-sighted "Mind-to-Market" strategy which was conceptualised as a part of the weapon development programme.

To carry forward the powerful legacy of the formidable BRAHMOS, BrahMos Aerospace, in the meantime, has initiated work on the next-generation BRAHMOS (BRAHMOS-NG) system. The new advanced missile variant featuring smaller, smarter, stealthier and swifter dimensions, promises to arm a wider number of modern-day military platforms on land, sea/underwater and air in more numbers, thus holding the potential to emerge as yet another modern missile system for export in the international arms market in the foreseeable future.

BrahMos Aerospace extends its warm wishes on 'Russia Day'.

DRDO On Twitter

Defence News

Defence Strategic: National/International

पत्र सूचना कार्यालय
भारत सरकार

रक्षा मंत्रालय

Fri, 10 Jun 2022 6:56 PM

भारत सरकार ने समुद्र में तैनात भारतीय नौसेना के कर्मियों के लिए जोखिम और कठिनाई हेतु दिए जाने वाले भत्तों में संशोधन को लागू किया

भारत सरकार द्वारा समुद्र में तैनाती के दौरान भारतीय नौसेना के कर्मियों के सामने आने वाले जोखिम और कठिनाइयों (सी गोइंग अलाउंस) के प्रतिपूरक भत्ते के संबंध में मौजूदा विसंगति को दूर करने के लिए एक ऐतिहासिक निर्णय लिया गया है। यह समुद्र में तैनात नौसेना कर्मियों के संकल्प एवं मनोबल को

और बढ़ाएगा, जो हिंद महासागर तथा उसके बाहर भी हमारे समुद्री हितों की रक्षा करते हुए उच्च जोखिम वाले क्षेत्रों, एंटी-पायरेसी ऑपरेशन, समुद्री सुरक्षा तथा आईएमबीएल गश्त आदि में संचालन के लिए अपनी सेवाएं दे रहे हैं।

यह आजादी के अमृत महोत्सव वर्ष में हमारे नौसैनिक पुरुषों और महिलाओं द्वारा प्रदान की जा रही सेवाओं की एक उत्कृष्ट प्रतिपूर्ति व मान्यता है।

https://www.pib.gov.in/PressReleasePage.aspx?PRID=1833039

पत्र सूचना कार्यालय
भारत सरकार

रक्षा मंत्रालय

Fri, 10 Jun 2022 6:07 PM

सेना प्रमुख ने हिमाचल प्रदेश और उत्तराखंड में वास्तविक नियंत्रण रेखा-एलएसी पर सुरक्षा स्थिति की समीक्षा की

थल सेनाध्यक्ष, जनरल मनोज पांडे वर्तमान में हिमाचल प्रदेश और उत्तराखंड राज्यों में वास्तविक नियंत्रण रेखा-एलएसी पर अग्रिम क्षेत्र के तीन दिवसीय दौरे पर हैं। भारतीय थल सेना प्रमुख का पदभार संभालने के बाद सेनाध्यक्ष का इस सेक्टर का यह पहला दौरा है। मध्य कमान के सेना कमांडर और उत्तर भारत क्षेत्र के जीओसी भी सेना प्रमुख के साथ इस दौरे पर हैं। अग्रिम चौकियों के दौरे के दौरान, थल सेना प्रमुख को स्थानीय कमांडरों द्वारा सीमाओं पर मौजूदा स्थिति के बारे में जानकारी दी जा रही है। अग्रिम क्षेत्रों में परिचालन तैयारियों का प्रत्यक्ष मूल्यांकन करते हुए, सेना प्रमुख के पर्वतारोहण कौशल और लंबी दूरी की गश्त सहित तैनात संरचनाओं की अधिक ऊंचाई वाली परिचालन क्षमताओं का प्रदर्शन देखने की योजना है। इस दौरान थल सेना प्रमुख इस क्षेत्र में जारी बुनियादी ढांचे और विकास कार्यों और अग्रिम क्षेत्रों में सेना-नागरिक संपर्क की भी समीक्षा कर रहे हैं।

अपनी यात्रा के दौरान कमांडरों के साथ बातचीत करते हुए, सेना प्रमुख ने सीमाओं पर सतर्कता और चौकसी की आवश्यकता पर बल दिया। उन्होंने रक्षात्मक मुद्रा में तेजी से सुधार और संरचनाओं की परिचालन तैयारी पर संतोष व्यक्त किया। सेना प्रमुख ने लगातार निगरानी करने में आधुनिक तकनीक के समावेश की सराहना की। थल सेनाध्यक्ष ने अग्रिम चौकियों पर तैनात सैनिकों के साथ बातचीत के दौरान उनके उच्च मनोबल की सराहना की और उनसे पेशेवर उत्कृष्टता के उच्च मानकों को बनाए रखने का आह्वाहन किया। उन्होंने सीमावर्ती क्षेत्रों में परिचालन प्रभावशीलता और सतत विकास की दिशा में सेना, सीएपीएफ, नागरिक प्रशासन और पुलिस के बीच उत्कृष्ट तालमेल की भी सराहना की।

https://www.pib.gov.in/PressReleasePage.aspx?PRID=1833076

FINANCIAL EXPRESS
Read to Lead

Mon, 13 June 2022

Exclusive Interview with IAF Chief: 'Indian Air Force is Progressing Well on a Capability Driven Modernization Plan'

The Indian Air Force (IAF) is on a path of becoming a multi domain capable aerospace power that would provide suitable response options throughout the spectrum of conflict irrespective of duration and intensity. To achieve the sustenance of force and its combat capability for long duration, IAF has established an efficient and sustainable network supported op logistics chain. "To make the force sharp and offensive, the focus is on multirole offensive platforms and systems, varied type of precision and standoff weapons, secure and seamless networking, and contemporary operational training of all the planners and field operators in realistic combat conditions," says IAF Chief Air Marshal VR Chaudhari.

According to him, "Towards force preservation, the IAF has instituted various measures that include induction and operationalisation of various modern air defence sensors and weapons, and expediting op infrastructure at airbases. To achieve the sustenance of force and its combat capability for long duration, IAF has established an efficient and sustainable network supported op logistics chain." Technology is at the core of an air force – and acquiring it is your primary challenge. How are you planning to handle this?

As a technology intensive force, IAF recognises the changing dynamics of air warfare brought about by new technology. IAF is sensitive to the fact that the side with superior technology will have an overwhelming advantage in any conflict. We have been on a path of gradual transformation to tackle threats over the entire spectrum of conflict. Towards this, new technology enabled capabilities are envisioned that meet key requirements of long range strike, air defence, cyber and networking. Recent procurements of Rafale & LCA fighter aircraft, C-17, C-130J & C-295 transport aircraft, Apache & Chinook helicopters, S-400 Air Defence Missile Systems are steps in that direction. Development of the Operational Data Link (ODL) and upgraded version of Integrated Air Command and Control System (IACCS) are at advanced stages of completion which would enable the IAF to be ready to fight modern hi-tech wars. We are also pursuing induction of Software Defined Radios which will be a major step towards Network Centric Operations (NCO). Processes have also been put in place to ensure infusion of Artificial Intelligence (AI) and Machine Learning (ML) in all future procurements.

However, technology is an ever evolving field and there are new advancements taking place continuously. Therefore, remaining abreast with emerging technologies and inducting hardware based on cutting edge tech is essential to retain the combat edge. How will the Russia-Ukraine conflict impact the upgrade of some part of the IAF fleet? IAF has a large number of Russian aircraft and other defence equipment. India also has defence equipment procured from Ukraine. Impediments in the delivery of products are likely as a result of the Russia-Ukraine conflict. However, operational preparedness of IAF would not be hampered as we have sufficient technical resources/ support available within the country and a robust stocking policy. In order to maintain operational preparedness in the coming years, IAF is exploring alternate sourcing for spares including increased indigenisation.

Any update on the modernisation plans of IAF?

To meet emerging challenges the IAF is progressing well on a capability driven modernization plan in consonance with the roadmap laid down in the IAF's Long Term Perspective

Plans.This is being achieved by the induction of new platforms and weapon systems along with the continuous up gradation of existing equipment. Fighter aircraft like Rafale and Light Combat Aircraft (LCA) as well as Special Operations Transport aircraft(C-130), Heavy Lift Aircraft (C-17), Attack Helicopters (Apache) & Heavy Lift Helicopters (Chinook) have already been inducted and operationalized. Additional combat support assets like Airborne Warning and Control System (AWACS), Airborne Early Warning and Control (AEW&C), Flight Refuelling Aircraft (FRA) are also being procured. Air Defence Radars, long and medium range surface-to-air missile systems (S-400, MRSAM), Low Level Quick Reaction Missiles (LLQRM) and Close In Weapon System (CIWS) are being procured in order to provide adequate multi-layered air defence.

Proposals to induct modern technology include Advanced Medium Combat Aircraft (AMCA), C-295 transport aircraft, Light Combat Helicopter (LCH) and equipment to enable Network Centric Operations.In order to obviate technology obsolescence; we are upgrading existing equipment so that they remain relevant and contemporary. Up-gradation of numerous weapons platforms like MiG-29, Jaguar, Mirage-2000 fighter aircraft, An-32 transport aircraft, Mi-17/ Mi17 1V helicopters and SAGW& communication systems is also in progress. Do you think future conflicts are going to be sharp and swift"? Is the IAF prepared for long drawn conflicts which could be challenging and unpredictable?

The conflicts in the future can be Short High Intensity, Protracted Low Intensity, or Protracted Conflict of varying intensity. Though the capability demands of short and swift conflict as against the prolonged one can be widely different; there are certain common aspects that would be imperative for creating a balanced force structure and capability. While short and swift conflict would require a sharp, agile, and offensive force, the outcome of a protracted conflict would largely be determined by force preservation, sustenance, and maintenance capabilities. IAF is working on both these aspects to build a credible air force for short and intense as well as prolonged conflicts. In order to handle the contingencies of interruption of logistics lines that could be a concern in any conflict, dynamic options like large scale air bridging of fuel, armament and other crucial airpower components are regularly war gamed, reviewed and refined. Networking and assimilation of space, both are interdependent. How prepared is IAF to meet this challenge?

The fast paced technological advancements, seamless flow of information and diversified roles of state and non-state actors has widened the spectrum of conflict.Today, it also includes the non-kinetic domain encompassing the information and cyber space. The repudiatory nature and asymmetric effects make these domains a lucrative choice of application in conventional as well as non-conventional operations. In the future, encroachment of space, cyber, and information verticals on conventional domains is inevitable.

IAF is continuously building up its capabilities to effectively handle conventional and non-conventional threats in the cyber and space domain. Network centric operational capability with modern combat and combat support platforms, rapid deployment and redeployment capability ensures effective handling of conventional threats within the available resources. A strong and robust operational network based on secure fibre optics, ground network and SATCOM links allow pan IAF connectivity.

https://www.financialexpress.com/defence/exclusive-interview-with-iaf-chief-indian-air-force-is-progressing-well-on-a-capability-driven-modernization-plan/2556195/lite/

FINANCIAL EXPRESS
Read to Lead

Mon, 13 June 2022

HAL's Trainer Aircraft Achieving Milestones, En Route to Help IAF Despite Delays

By Girish Linganna

Six years after its first flight, Hindustan Aeronautics Limited (HAL)-designed Hindustan Turbo Trainer- the HTT-40 has received its airworthiness certificate. Tracking the development of HAL's basic and stage two trainers shows that with its progress, this area has become a milestone of self-reliance in defence. HTT-40's predecessor, the Hindustan Piston Trainer (HPT-32), had multiple issues related to the engine and fuel supply. These issues often led to accidents and pilot fatalities. The HPT-32 fleet was grounded in 2009. Following this, the Indian Air Force (IAF) acquired a fleet of 75 Pilatus PC-7 Mk II trainers.

Later, the HTT-40 project was allotted $78 million for design and development. The HTT-40 is a trainer aircraft that has a speed of 450 kilometres per hour and a range of 1000 kilometres, with a maximum take-off weight of 2,800 kilograms. A Honeywell TPE-331-12B turboprop engine powers the aircraft, which HAL reports has 950 thrust horsepower. It will be used to provide personnel with basic flight training while also training them in instrument flying, navigation, aerobatics, night flying and close formation flying. The latest data on HAL's website states that the projected requirement is for 106 aircraft. The HTT-40 has been delayed and received spin certification only last year.

After both the certification and the approval from the Centre for Military Airworthiness came a design evaluation, aircraft systems tests and flight tests; HAL and the Indian Air Force (IAF) pilots were involved in these. Having received the airworthiness certificate, the HTT-40 now meets Preliminary Staff Qualitative Requirements (PSQR) and Federal Aviation Administration (FAA) 23 standards. Pilots need to receive 80 hours of training on the HTT-40. Following this, they train on the stage-two trainer- the Intermediate Jet Trainer (IJT).

Stage 2 Trainer Upcoming

In January this year, HAL's IJT managed to carry out six turn spins, a significant necessity for the aircraft. While this marked a milestone, the IJT will still need to undergo two more years of testing before it is ready for induction. Although this jet is now approaching production fairly steadily, this only comes after over two decades of work on the platform, which was built for stage two training of fighter pilots. It will replace the outdated Kiran Mk 2 trainers. Also called HJT-36, this platform has found testing to be a rocky road. In 2016, the IJT departed from a controlled flight, bringing the programme to a standstill. HAL then redesigned the aircraft by shifting the vertical tail aft and expanding the rudder surface'. The plane must go through multiple rounds of flight trials and certifications before going into production. The IAF requires around 75 IJTs. However, HAL has not committed to any timelines, so IAF will have to continue using the trainers it presently has.

With the Atmanirbhar Bharat campaign focusing heavily on defence, the chances of procuring trainers from abroad have significantly diminished. HAL has claimed that it would soon have sophisticated trainers for stages 1 and 2 of training pilots of the IAF based on the completion of spin certification of the HTT-40 and the progress achieved by the IJT. Group Captain Anupam

Banerjee, a former IAF spokesperson, explained: 'It is more about efficient asset management of limited resources. Advanced jet trainers are limited in number and best utilized for honing skills of air combat and armament training, while the basic trainer in the IJT category focuses on sharpening the basic flying skills of a trainee.'

However, training has remained an issue for the IAF, plagued for decades by simultaneous availability issues for all three trainer types – the Pilatus PC-7 basic trainer, IJT, and Hawk advanced jet trainer. HAL advancing with the work on current trainers can alleviate trouble here, even if some delays exist. (Author is Aerospace & Defence Expert. Views expressed are personal and do not reflect the official position or policy of Financial Express Online. Reproducing this content without permission is prohibited).

https://www.financialexpress.com/defence/hals-trainer-aircraft-achieving-milestones-en-route-to-help-iaf-despite-delays/2557174/lite/

IDN INDIAN DEFENCE NEWS
Global Defence, Aerospace & Security

Mon, 13 Jun 2022

IAF Plans to Build 96 Fighter Jets in India Under Rs 1.5 Lakh Cr for 114 Combat Aircraft

Amid a big push for the Aatmanirbhar Bharat scheme by the PM Narendra Modi-led government, the Indian Air Force is planning to acquire 114 fighter jets of which 96 would be built in India, and rest 18 would be imported from the foreign vendor chosen for the project. The Indian Air Force has plans of acquiring 114 Multirole Fighter Aircraft (MRFA) under 'Buy Global and Make in India' scheme under which Indian companies would be allowed to partner with a foreign vendor. "Recently, the Indian Air Force held meetings with the foreign vendors and asked them about the way they would carry out the Make in India project," government sources told ANI.

As per the plan, after the initial 18 aircraft are imported, the next 36 aircraft would be manufactured within the country and the payments would be made partially in foreign currency and Indian currency, the sources said. The last 60 aircraft would be the main responsibility of the Indian partner and the government would make payments only in Indian currency, the sources said. The payment in Indian currency would help the vendors to achieve the over 60 per cent 'Make-in-India' content in the project, the sources said. Global aircraft manufacturers including Boeing, Lockheed Martin, Saab, MiG, Irkut Corporation and Dassault Aviation are expected to participate in the tender.

The Indian Air Force has to rely heavily on these 114 fighter jets for maintaining its superiority over the neighbouring rivals Pakistan and China. The 36 Rafale aircraft procured under emergency orders helped immensely in maintaining an edge over the Chinese during the Ladakh crisis which started in 2020 but the numbers are not enough and more such capability would be required by it. The force has already placed orders for 83 of the TEJAS MK-1A aircraft but it still requires a higher number of capable aircraft as a large number of MiG series planes have either been phased out or are on their last legs. The fifth-generation Advanced Medium Combat Aircraft project is moving ahead at a satisfactory pace but it will take a lot of time to be able to be inducted in an operational role.

The IAF is also looking for a cost-effective solution for its fighter jet requirement as it wants a plane that is low on operational cost and gives more capability to the service, the sources said. The IAF is highly satisfied with the operational availability of the Rafale fighter jets and wants similar capability in its future aircraft.

http://www.indiandefensenews.in/2022/06/iaf-plans-to-build-96-fighter-jets-in.html

IDN INDIAN DEFENCE NEWS
Global Defence, Aerospace & Security

Mon, 13 Jun 2022

Delivery of S-400 Missile Systems to India Proceeding Well: Russian Ambassador

Russia's delivery of S-400 Triumf air defence missile systems to India is "proceeding well" in accordance with the schedule, Russian ambassador Denis Alipov has said. The comments of the envoy came amid concerns in New Delhi over possible delays in the supply of major military hardware to India by Russia in view of its military invasion of Ukraine. "The best-of-a-kind S-400 systems delivery is proceeding well according to the schedule," Alipov said. The ambassador made the comments in a foreword he wrote in the Russia Digest magazine on the occasion of the 75th year of the establishment of diplomatic relations between India and Russia.

"Today's Russia-India multidimensional cooperation is one of the world's most elaborate ones," he said. In the piece, Alipov also said Russia and India continue to successfully implement flagship initiatives that make the cooperation unparalleled. In this context, he cited the Kudankulam nuclear power plant project in Tamil Nadu and various ambitious defence partnership programmes under the framework of the "Make in India" and "Aatmanirbhar Bharat" (self-reliant India) initiatives. Referring to defence projects, Alipov listed the joint venture for the production of AK-203 rifles, combat aviation and manufacture of the main battle tanks as well as frigates, submarines, Brahmos supersonic missiles and other missile projects.

Russia started the delivery of the first regiment of the S-400 missile systems in December last year while it began supplying the second one in April. The missile system has already been deployed in such a way that it can cover parts of the border with China in the northern sector as well as the frontier with Pakistan. In March, Russia said there will be no impact of the western sanctions against it on the supply of S-400 missile systems to India. Western countries have imposed severe sanctions on Russia following its military invasion of Ukraine. In October 2018, India signed a USD 5 billion deal with Russia to buy five units of the S-400 air defence missile systems, despite a warning from the Donald Trump administration that going ahead with the contract may invite US sanctions.

Russia has been a major supplier of military hardware to India. The two countries have been holding discussions on what kind of payment mechanisms can work between them in view of the western sanctions on Moscow. Unlike many other leading powers, India is yet to directly criticise Russia for its invasion of Ukraine and has abstained from the votes at the UN platforms in condemning the Russian aggression. India has been pressing for the resolution of the crisis through diplomacy and dialogue.

http://www.indiandefensenews.in/2022/06/delivery-of-s-400-missile-systems-to.html

IDN INDIAN DEFENCE NEWS
Global Defence, Aerospace & Security

Sun, 12 Jun 2022

India to Soon Deploy Underwater Drones in Indian Ocean Region, South China Sea

In order to bolster the Indian Navy in the Indian Ocean Region (IOR), the South China Sea and the Indo-Pacific, the Ministry of Defence (MoD) has begun a preliminary process that will ultimately develop into acquiring autonomous underwater vehicles (AUVs) or underwater drones with twin surveillance and strike capabilities. Earlier this month, the MoD is learnt to have issued an expression of interest (EoI) with the objective of inviting the Indian industry to design and develop an "underwater launched unmanned aerial vehicle" at a time when the Defence Research and Development Organisation (DRDO) is also working to "enhance submarine situational awareness" and real-time visuals – photographs and videos.

Government sources said that the Navy is open to both indigenous and foreign-origin AUVs even as senior officials are aware that "it will take a long time" for Indian-made underwater drones to be available for military purposes. The UAV industry in India, nascent now, has already begun taking the first steps to fulfil the Navy's objectives. Recently, Larsen & Toubro signed a memorandum of understanding with Bengaluru-based New Space Research & Technologies to develop and build "underwater launched UAVs" under the DRDO's Technology Development Fund initiative. The L&T-New Space Research & Technologies underwater drone, which will take at least "a couple of years" to be built, will be "purely for surveillance purposes to begin with", according to industry sources.

Foreign-made underwater drones will likely be used till indigenous capabilities are developed. However, the larger aim is to launch these AUVs from submarines initially for surveillance. Subsequently, these AUVs will be used for military strikes, if needed. The need for underwater drones arose when the Navy found to its consternation three years ago that the Chinese People's Liberation Army Navy (PLAN) "was routinely using AUVs right within Indian territorial waters" and in the wider IOR. Sources said that one Chinese underwater drone was detected by the crew of an American warship in the South China Sea when it malfunctioned and was "physically lifted to the surface" and its technological capabilities and surveillance records were studied.

On December 11, 2019, "upgraded Haiyi (Sea Wing) underwater gliders" were deployed from a Chinese government scientific research vessel. They are said to have conducted "underwater survey in the East Indian Ocean". "The Indian Navy is fully aware that the Chinese PLAN regularly operates underwater drones for surveillance of our naval assets," said Vice-Admiral (Retd) Suresh Bangara who specialised in anti-submarine warfare. Using underwater would be a first for the Navy even though some have been used in the past to detect practice torpedoes and for tracking missiles without warheads. Oil companies such as ONGC and Reliance have been using AUVs to keep track of underwater pipelines and for their repair," Bangara said. India's lone submarine rescue vessel – Deep Submergence Rescue Vessel – is equipped with a drone which is used for underwater searches and for "recording ambient noises" on ocean beds.

http://www.indiandefensenews.in/2022/06/india-to-soon-deploy-underwater-drones.html

the pioneer

Sat, 11 Jun 2022

Replica of INS Vikrant Unveiled in Mumbai

Twenty five years after it was decommissioned, a 10-metre long replica of India's first aircraft carrier INS Vikrant in south Mumbai, was dedicated to the city of Mumbai by Maharashtra Governor Bhagat Singh Koshyari on Friday. Present on the occasion were Vice-Admiral Ajendra Bahadur Singh, Flag Officer Commanding-in-Chief, Western Naval Command and other senior civil and defence officials. Made in-house by Naval Dockyard, the imposing replica has been located at Colaba's Regal circle in association with the Residents Association ' My Dream Colaba' and 'CALM' and supported by Adv Makarand Narvekar. It stands shoulder to shoulder with the iconic Gateway of India and Naval Dockyard, signifying the ship's strong bond with the city of Mumbai where she was based during her entire commissioned service.

The dedication of the model is an affirmation of the strong maritime connect of Mumbai and equally rich maritime heritage of Maharashtra. An aircraft carrier of the Majestic Class, INS Vikrant was launched in September 1945 and formally inducted into the Indian Navy on 03 November 1961 in Mumbai. It may be recalled that INS Vikrant – which participated in the operations for Liberation of Goa in December 1961 and had played a key role during the 1971 Indo-Pak War that led to the liberation of Bangladesh — was decommissioned in January 1997 after 36 years of service. After it was decommissioned, INS Vikrant remained as a floating museum ship at Mumbai till 2012. Like an old saying goes, old ships never die, they fade away to be resurrected in another avatar. 'Vikrant' is set to be reborn as the prestigious Indigenous Aircraft Carrier, designed by the Indian Navy and being built by M/s Cochin ShipYard Ltd.

https://www.dailypioneer.com/2022/india/replica-of-ins-vikrant-unveiled-in-mumbai.html

The Indian EXPRESS

Fri, 10 Jun 2022

Explained: Next-Generation Corvettes, and the Combat Edge Navy Seeks Through Them

The Defence Acquisition Council (DAC) has given the Acceptance of Necessity (AoN) for several capital acquisition projects of the Indian defence forces. This includes the procurement of next-generation Corvettes for the Indian Navy at an approximate cost of Rs 36,000 crore. A look at the features of these naval vessels and their efficacy in the modern naval battlefield.

What is a Corvette?

A Corvette is the smallest class of naval ships and it falls below the warship class of a frigate. These are highly agile ships and are categorised as missile boats, anti-submarine ships, coastal patrol crafts and fast attack naval vessels. The word corvette itself is derived from French and

Dutch origin. Corvettes date back to the 18th and the 19th century when they were extensively used in the naval warfare duels that were fought at high seas. However, these were powered by sails and masts, and disappeared for a while when steam powered naval ships made their appearance. During World War II, the term Corvette was used to describe vessels which had anti-submarine roles assigned to them. Modern Corvettes can go up to 2,000 tons in displacement which helps in keeping them agile.

What kind of Corvettes does the Indian Navy possess?

The Indian Navy at present has the Kamorta Class Corvettes, which are also known as Project 28. These ships have an anti-submarine role and are manufactured at Garden Reach Shipbuilders and Engineers in Kolkata. The four Kamorta Class Corvettes that the Indian Navy possesses are named INS Kamorta, INS Kadmatt, INS Kiltan and INS Kavaratti. The first of these was commissioned in 2014 and the last one in 2020.

What new capabilities will the new generation Corvettes have?

The next-generation Corvettes will be manufactured for various roles like surveillance missions, escort operations, deterrence, surface action group operations, search and attack and coastal defence. It is worth noting that these roles will be in addition to the anti-submarine roles being already performed by the existing Corvettes in the Navy. As per the AoN accorded by the DAC, these next-generation generation Corvettes will be constructed based on new in-house design of the Indian Navy using latest technology of ship buildings and would contribute to further the government's initiative of Security and Growth for all in the region (SAGAR).

The in-service Kamorta Class Corvettes also have a high degree of indigenous equipment being used on the platform. This includes Bharat Electronic Limited (BEL) manufactured 'Shikari' sensor and processing system and Bomber and Electronic Warfare Suits also manufactured by BEL and named 'Ajanta'. These vessels also have the 'Sanket' electronic warfare systems and 'Kavach' decoy launchers.

https://indianexpress.com/article/explained/explained-next-generation-corvettes-combat-edge-navy-7959576/

INDIA TODAY

Sun, 12 June 2022

Qadam Qadam Badhaye Ja: Jammu Man Beats Paralysis to Realise Army Dream

Around 288 cadets graduated from the Indian Military Academy in Uttarakhand on Saturday, and one among them was this braveheart from Jammu, who beat paralysis to realise his Indian Army dream. Baba Danish Langer suffered a paralytic attack in 2017 triggered by Guillain Barre Syndrome (GBS). But he overcame the odds. "I am proud of my son. It's admirable how he handled adversity at such a young age. Many people give up and consider other options, but in his mind, the only option was the Indian Army," Rajesh Langer (59), father of Lt Baba Danish, told India Today. Anju Langer, Lt Baba Danish Langer's mother, said, "Since childhood, he had

wanted to join the army and serve his country." "When Danish was in class 6, his grandmother refused to let him attend sainik school, but he has now fulfilled his dreams and made us all proud," she added.

Faith, Discipline And Routine

When asked about his journey, Lt Danish said that medical science, discipline, and sticking to a routine all aided him. "With the help of God, elders, friends, mentors, and the Indian Army, I was able to fulfil my dreams," he added. Lt Danish, who overcame GBS-induced paralysis in six months, also encouraged aspirants to never give up on their dreams. "I urge all young people to give their all and never give up. Don't let anyone or anything stand in your way of achieving the life goals you've set for yourself," said Lt Danish. GBS, the condition that Lt Danish suffered, is a rare autoimmune disorder in which the immune system attacks the nerves and can affect a person's motor functioning for up to a year. It is usually treated with immunotherapy like plasma exchange.

https://www.indiatoday.in/india/story/jammu-man-braves-paralysis-to-realise-army-dream-1961490-2022-06-12

IDN INDIAN DEFENCE NEWS
Global Defence, Aerospace & Security

Mon, 13 June 2022

India in Talks for More Apache, Chinook Choppers: Boeing

The F/A-18 E/F Super Hornet fighter jet has distinct advantages in terms of capability over the competitor French Rafale-M jet to operate from the Indian Navy's aircraft carriers, said a senior official from aircraft manufacturer Boeing. India is also negotiating the purchase of additional Chinook CH-47F(I) Chinook heavy-lift helicopters and AH-64E Apache attack helicopters, according to Torbjorn (Turbo) Sjogren, vice president, International Government and Defence, Boeing. "One thing we're very confident about is the capability that readiness and the proficiency of the product. The F/A-18 and F/A-18F can operate off Indian aircraft carriers. That's a clear discriminator we've got over the French," Mr. Turbo said in a virtual interview, pointing that the twin seater trainer variant of the Rafale-M cannot operate from carriers and would be sitting on the ground. The number of trainer aircraft within the deal is not an insignificant number, he noted.

Elaborating, he said the size of the carrier, the logistics of the aircraft, in terms of how many aircraft and how to move the aircraft around the carrier, there are challenges. "We have solved that problem. Our team down in Bangalore solved the problem, and we have a solution for that... So there is some tailoring needed, more so in terms of the logistics on board," Mr. Turbo said. The Navy had originally projected a requirement of 57 aircraft under the deal, but the number is likely to be revised to 26 with in the backdrop of a new indigenous Twin Engine Carrier Based Deck Fighter being designed and developed indigenously. "We are eager to see when they define what the need is going to be and then how to do it," he said. With the indigenous carrier Vikrant set to be commissioned in August, Navy is in urgent need of carrier based jets to operate from both the carriers.

Last month, two Boeing F/A-18s were in Goa to demonstrate their compatibility and suitability to operate from Indian aircraft carriers by conducting trials from the Indian Navy's Shore Based Test Facility (SBTF). Rafale-M had carried out similar demonstration earlier this year. Indian Air Force operates 22 Apache attack helicopters and 15 Chinook heavy-lift helicopters procured from Boeing through the Foreign Military Sales programme of the U.S. government under a $3 billion deal in September 2015. Further, during the visit of U.S. President Donald Trump to India in February 2020, India signed a deal for six more Apaches to cost around $800 million to be operated by the Army. On other deal, Mr. Turbo said discussions are on for an additional seven Chinook helicopters, Mr. Turbo said. "Army is looking for more Apaches and IAF is looking for more Chinooks."

The Navy operates 12 P-8I long range maritime aircraft procured Boeing in two batches. Another case for six more P-8I aircraft for which Defence Ministry has given initial approval has been delayed with the government's review of all direct imports. There is currently significant amount of interest worldwide for the P-8Is and they are in negotiations with several countries in India's neighbourhood, New Zealand, Australia and some Southeast Asian countries. However, Mr. Turbo cautioned that at some point in time, if they do not have enough orders, the assembly lines would be shut giving the example of the C-17 transport aircraft for which there is renewed worldwide but the lines have been long shut. "We're not there yet, but I mean, that's a reality. The C-17s are a great example," Mr. Turbo said.

Without giving a specific timeline for such a scenario, he said the Indian Navy and the U.S. Navy are well aware of what that timeline is. Talking of the large portfolio of products with the Indian armed forces, Mr. Turbo said, "The performance of our products, and the teams that support our products, I think, is instrumental in terms of those campaigns going forward." He further stated that as part of this, they are also leveraging local capability and self-reliance and so there is a major focus and also an opportunity for "Boeing to utilize India more than we're doing today."

For instance, he said all the Apache fuselage worldwide are built at their Joint venture with TATA Group in Hyderabad. "There's a lot of interest in the Apache right now. Australia, Poland, Romania, a lot of European countries, as every one of those fuselages are going to be manufactured there," Mr. Turbo said adding the 1,100 suppliers, sub-suppliers that are supporting Tata are obviously critical in that regard. Boeing is also in the race for the IAF's tender for 114 jets pitching in its F-15EX as well the F-18 fighters.

http://www.indiandefensenews.in/2022/06/india-in-talks-for-more-apache-chinook.html?m=1

THE ECONOMIC TIMES

Mon, 13 June 2022

India, EU Hold Defence Consultations

India and the European Union have upgraded their ties with the launch of the first ever Security and Defence consultations encompassing cyber security, terrorism,maritime awareness, joint exercises and threat assessments. The first-ever India-European Union (EU) Security and Defence Consultations was held in Brussels last Friday with both sides focussing on cyber security, terrorism, maritime awareness, training modules, joint exercises, threat assessments among other issues, ET has learnt. The dialogue was pursuant to a decision taken at the India-EU Summit in July 2020. The wide-ranging discussions covered the evolving security situation in Europe, India's neighbourhood and the Indo-Pacific.

The consultations were co-chaired by Ministry of Defence Joint Secretary (International Cooperation) Somnath Ghosh and MEA Joint Secretary (Europe West) Sandeep Chakravorty from the Indian side and Joanneke Balfoort, Director Security and Defence Policy, from the EU side. "The two sides noted number of positive developments in the area of security and defence cooperation in recent years, including establishment of a regular maritime security dialogue, which met for the second time in February 2022, the first-ever joint naval exercises held in June 2021, and a number of joint workshops on the subject of fostering maritime security," according to a statement issued by the Indian Embassy in Brussels.

The two sides during the consultations also discussed various means of increasing India-EU cooperation on maritime security, implementation of the European code of conduct on arms export to India's neighborhood, cooperation in co-development and co-production of defence equipment, including India's participation in PESCO.

https://economictimes.indiatimes.com/news/defence/india-eu-hold-defence-consultations/articleshow/92166521.cms

The Indian EXPRESS

SUN, 12 Jun 2022

Indo-Russia Defence Ties have Stood the Test of Times

Indo-Russian defence ties have stood the test of time

Joint projects between the two countries are boosting the readiness of India's armed forces to meet security challenges

RUSSIA and India share an enduring military partnership that has been firmly in place since the 1990s. Few nations in the global arena have a military partnership that is as deep-rooted and longstanding as that between Russia and India. It has now been over 50 years since India and the erstwhile USSR entered into the 1971 Treaty of Peace, Friendship and Cooperation and over 20 years since India and Russia announced the Declaration on Strategic Partnership. The longstanding and time-tested relations between both nations is characterised by mutual trust, respect for each other's core national interests and similarity of position on various international and regional issues. These values are especially visible in Indo-Russian cooperation in the sphere of military technical cooperation, where it has evolved from a simple buyer-seller framework to one with a greater focus on joint research & development, joint production and marketing of advanced defence technologies and systems.

This partnership is best exemplified by BrahMos Aerospace, which is a joint venture between the Defence Research & Development Organisation and Russia's NPO Mashinostroyeniya (NPOM). BrahMos Aerospace was created following an Inter-Governmental Agreement between both nations in 1998. This Indo-Russian collaboration for the development, production and marketing of a supersonic cruise missile has been very successful, with the Mach 3 capable cruise missile in service with all three wings of the Indian armed forces and the Philippines recently emerging as its first export customer. The Philippines is to acquire a BrahMos Shore-Based Anti-Ship Missile System valued at approximately ₹2,812 crore.

The Indian Navy began inducting the supersonic cruise missiles into its inventory in 2005 and uses them on its warships for anti-ship and land-attack roles. In March, the navy successfully demonstrated the accuracy of an extended-range land attack Brahmos missile which was launched from the stealth destroyer *INS Chennai*. These newer missiles will allow navy warships to engage targets on land with greater accuracy from stand-off distances. Defence Minister Rajnath Singh, who

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heads the Defence Acquisition Council (DAC), approved the procurement of BrahMos Next-Generation Maritime Mobile Coastal Batteries (Long Range) for the Navy in 2019.

The Air-Launched Cruise Missile (ALCM) variant of BrahMos has been developed solely for the Indian Air Force. The integration of the large 2.5-tonne supersonic cruise missile on the fuselage of SU-30 MKI fighter aircraft was a major technological achievement for Hindustan Aeronautics Ltd, BrahMos Aerospace and DRDO. The air force also tested an extended range BrahMos ALCM in May, which will allow it to carry out precision engagements against targets at stand-off distances. The Indian Army started receiving deliveries of BrahMos cruise missiles in 2007 and operates them in Block I, Block II and Block III variants.

To keep up with future requirements, BrahMos Aerospace has selected the Lucknow node of the Uttar Pradesh Defence Industrial Corridor (UPDIC) as the location for a new manufacturing facility, that will manufacture BrahMos-NG (Next Generation) missiles from 2025 onwards.

Another showpiece of the Indo-Russian military partnership was the landmark agreement for licensed manufacture of a total of 222 Sukhoi SU-30 MKI fighter aircraft by Hindustan Aeronautics Ltd (HAL) at its Nashik factory. The Su-30MKI, which featured thrust vectoring, was the first supermanoeuvrable combat aircraft to enter serial production and India was the first country to receive the aircraft fitted with a potent phased-array radar.

The first SU-30MKIs were inducted into the IAF in September 2002. HAL received three contracts for licensed manufacture of SU-30 MKI aircraft in India in December 2000 (140 ac), March 2007 (40 ac) and December 2012 (40 ac). HAL is now awaiting a final order for 12 aircraft, which was approved by the Defence Acquisition Council (DAC) in July 2020.

The Indo-Russian partnership received a further boost with the decision to manufacture Kalashnikov AK-203 assault rifles in India. The AK-203 will be the army's main infantry rifle and India is the first country in the world to have launched production of AK-200 series assault rifles. The contract for procurement of over 6,00,000 AK-203s was concluded in December 2021 between Indo-Russian Rifles Private Ltd (IRRPL) – a JV with Advanced Weapons & Equipment India Ltd (AWEIL) & Munitions India Ltd (MIL) with a 50.5% stake and Rosoboronexport (RoE) & Concern Kalashnikov (CK) which have a 49.5% stake. IRRPL will manufacture these rifles at Korwa in Uttar Pradesh. IRRPL will also be able to export AK-203 rifles built in India.

ThePrint

Sun, 12 June 2022

India Responsible for Transgressions at LAC, Says Chinese Defence Minister Wei Fenghe

Apart from blaming India for 'transgressions' along the LAC, PLA General Wei Fenghe also reiterated China's claim on Taiwan and said Beijing does not support the war in Ukraine. China and India are neighbours and it is prudent for them to have good relations, China's Minister of National Defense General Wei Fenghe said Sunday, while blaming New Delhi for the military standoff in Ladakh. Addressing the fifth plenary session of the Shangri-La Dialogue 2022 in Singapore, Fenghe – who is also State Councilor – said in response to a question about the clash in Galwan: "China and India are neighbours. Maintaining a good relationship meets the interests of both countries and that is what we are working on.

"But on frictions along the border areas, the merits of the issue is clear. I personally experienced the start and end of the frictions as Defence minister. We have found a lot of weapons owned by the Indian side. They have also sent people to the Chinese side of the territory." General Fenghe went further to say that India and China have held 15 rounds of Corps Commander level negotiations and the two sides are "working for peace" in the region. Unpacking China's philosophy for regional order, General Fenghe said, "Our world is facing multiple crises rarely seen in history, the way forward is to uphold and practice multilateralism. Peace and development should be a shared goal of humanity." In his speech, Fenghe also spoke about China's stand on the war in Ukraine and Beijing's claim on Taiwan.

https://theprint.in/world/india-responsible-for-transgressions-at-lac-says-chinese-defence-minister-wei-fenghe/993548/?amp=

The Indian EXPRESS

Sun, 12 June 2022

Austin: China is Hardening its Positions Along LAC

China has continued to harden its positions along the Line of Actual Control (LAC) with India, US Defence Secretary Lloyd J Austin said Saturday, days after a top US Army general expressed alarm over Beijing's border infrastructure build-up. He also flagged China's "destabilising" military activity near Taiwan and its aggressive approach to the territories it claims in the South China Sea, saying this threatens to undermine the stability of the Indo-Pacific region. Speaking at the Shangri La Dialogue — a security conference organised by the International Institute of Strategic Studies in Singapore, in which top Chinese leaders are also present — Austin stated: "We are seeing Beijing continue to harden its position along the border that it shares with India."

Indian and Chinese troops have been locked in a border standoff in eastern Ladakh since May 5, 2020, when a violent clash between the two sides erupted in the Pangong lake area. China has also been building bridges and constructing other infrastructure such as roads and residential

units in the border areas with India. Austin said: “Indo-Pacific countries shouldn’t face political intimidation, economic coercion or harassment by maritime militias.”

“In the East China Sea, China’s expanding fishing fleet is sparking tensions with its neighbors. In the South China Sea, China is using outposts on man-made islands bristling with advanced weaponry to advance its illegal maritime claims,” he said. “We are seeing [Chinese] vessels plunder the region’s provisions, operating illegally within the territorial waters of other Indo-Pacific countries.” Speaking about India as a partner for the US in the region, Austin said it can be a stabilising force, considering its growing military and tech capability.

Austin also reiterated America’s commitment to maintaining the status quo in Taiwan. “We are seeing growing coercion from Beijing… We have witnessed a steady increase in provocative and destabilising military activity near Taiwan. We remain focused on maintaining peace, stability, and the status quo across the Taiwan Strait.” Taiwan and China split during a civil war in 1949, but China claims the island as its own territory and has not ruled out using military force to take it. Austin said: “China’s moves threaten to undermine security, stability, and prosperity in the Indo-Pacific. That’s crucial for this region, and it’s crucial for the wider world. Maintaining peace and stability across the Taiwan Strait isn’t just a US interest. It’s a matter of international concern.”

Austin said the US is working closely with both competitors and friends to guard against conflict. He said this includes “fully open” lines of communication with China’s defense leaders “to ensure that we can avoid any miscalculations”. Austin and China’s Defence Minister Wei Fenghe held a bilateral meeting on Friday on the sidelines of the event. Austin’s remarks come after General Charles A Flynn, Commanding General of United States Army Pacific, said in Delhi on June 8: “I believe that the activity level (by China) is eye-opening. I think some of the infrastructure that is being created in the Western Theatre Command is alarming.”

The People’s Liberation Army’s Western Theatre Command is responsible for patrolling the 3,488-km long border with India. The next day, China responded to Flynn’s comment by stating that he was fanning a fire. China’s Foreign Ministry spokesperson Zhao Lijian said in a press briefing: “Some US officials have pointed fingers and sought to fan the flame and drive a wedge between the two countries.” Calling it disgraceful, Zhao had said: “We hope the US could do more things that contribute to regional peace and stability.”

https://indianexpress.com/article/india/china-hardening-positions-india-border-us-defence-secretary-7965014/

THE ECONOMIC TIMES

Mon, 13 June 2022

China Using Private Military Companies to Expand its Footprint in Africa

The presence of Chinese Private Military Companies (PSCs) in Africa is expected to increase Beijing's interference in the country, besides violation of human rights and increased illegal activities. China has been using PSCs as a ploy to maintain a discreet military presence in Africa and avoid being seen as another colonial power. Chinese investments in Africa have multiplied with the establishment of terrestrial and maritime routes connecting China with Africa since the launch of the Belt and Road Initiative (BRI) in 2013. Besides entailing huge investments, the

BRI has also led to the deployment of about a million Chinese nationals and the positioning of over 10,000 Chinese companies in Africa.

The safety of its assets and nationals as well as securing sea routes, threatened by piracy along the African coasts, provided China with a pretext for "interference" in Africa through its PSCs. Recently, Chinese interests in Africa have been experiencing threats emanating out of conflicts with local, organized crimes such as illegal wildlife trade of which in many cases Chinese nationals are also part of, kidnapping, civil conflicts, terror attacks and piracy, Geopolitica.info reported. Further, the BRI is being seen as an opportunity by the PSCs to enhance their footprint in Africa. Notably, China continues to provide arms and equipment to African countries and has emerged as a key arms supplier to the Continent.

A 2021 report of the US Department of Defence stated that China "may have considered" military installations in 13 African countries, including Angola, Kenya, Seychelles, Namibia and Tanzania to expand its military footprint. Meanwhile, China has established a naval base in Djibouti to station a "Rapid Reaction Force" for covering Africa. The base has the capacity to house 10000 soldiers against the provision of deployment of 1000 soldiers in the Chinese-Djiboutian Agreement. In August 2021, China announced its intent to build its first naval base on the Atlantic coast at Bata NSE -3.01 % in Equatorial Guinea, to look after its oil and commercial interests along the West coast of Africa.

Despite Chinese claims that PSCs are involved in providing passive security services, such as access control and protection against theft & violence, it has been observed that often they act as 'Private Military Companies' carrying out covert activities such as spying, gathering of intelligence using 'Humint' sources and advice local forces on the information gathered by way of intelligence collection, Geopolitica.info reported. The Chinese PSCs have a poor staffing record due to the poor quality of training of their personnel, who also have language barriers and lack openness towards the locals. Instances have come to notice that Chinese companies have hired local militias for their protection through the PSCs. In 2020, a Chinese coal mine owner in Zimbabwe shot and wounded two local workers for complaining and demanding wages.

https://economictimes.indiatimes.com/news/defence/china-using-private-military-companies-to-expand-its-footprint-in-africa/articleshow/92166610.cms

the pioneer

Mon, 13 June 2022

China Accuses US of Trying to ‘Hijack' Support in Asia

China's Defence Minister accused the United States on Sunday of trying to "hijack" the support of countries in the Asia-Pacific region to turn them against Beijing, saying Washington is seeking to advance its own interests "under the guise of multilateralism." Defense Minister Gen. Wei Fenghe lashed out at U.S. Secretary of Defense Lloyd Austin, rejecting his "smearing accusation" the day before at the Shangri-La Dialogue that China was causing instabilit y with its claim to the self-governing island of Taiwan and its increased military activity in the area.

Austin had stressed the need for multilateral partnerships with nations in the Indo-Pacific, which Wei suggested was an attempt to back China into a corner. "No country should impose its will on others or bully others under the guise of multilateralism," he said. " The strategy is an attempt to build an exclusive small group in the name of a free and open Indo-Pacific to hijack countries in

our region and target one specific country - it is a strategy to create conflict and confrontation to contain and encircle others."

China has been rapidly modernizing its military and seeking to expand its influence and ambitions in the region, recently signing a security agreement with the Solomon Islands that many fear could lead to a Chinese naval base in the Pacific, and breaking ground this past week on a naval port expansion project in Cambodia that could give Beijing a foothold in the Gulf of Thailand. Last year U.S. Officials accused China of testing a hypersonic missile, a weapon harder for missile defense systems to counter, but China insisted it had been a "routine test of a spacecraft."

Answering a question about the test on Sunday, Wei came the closest so far to acknowledging it was, indeed, a hypersonic missile, saying, "As for hypersonic weapons, many countries are developing weapons and I think there's no surprise that China is doing so." "China will develop its military," he added. "I think it's natural." U.S. Secretary of State Antony Blinken last month said China represented the "most serious long-term challenge to the international order" for the United States, with its claims to Taiwan and efforts to dominate the strategic South China Sea. The U.S. And its allies have responded with so-called freedom of navigation patrols in the South China Sea and Taiwan Strait, sometimes encountering a pushback from China's military.

https://www.dailypioneer.com/2022/world/china-accuses-us-of-trying-to----hijack--support-in-asia.html

Science & Technology News

The Statesman

Fri, 10 Jun 2022

NASA Launches Study of UFOs Despite 'Reputational Risk'

NASA is launching a study of UFOs as part of a new push toward high-risk, high-impact science. The space agency announced Thursday that it's setting up an independent team to see how much information is publicly available on the matter and how much more is needed to understand the unexplained sightings. The experts will also consider how best to use all this information in the future. NASA's science mission chief, Thomas Zurbuchen acknowledged the traditional scientific community may see NASA as "kind of selling out" by venturing into the controversial topic, but he strongly disagrees. "We are not shying away from reputational risk," Zurbuchen said during a National Academy of Sciences webcast. "Our strong belief is that the biggest challenge of these phenomena is that it's a data-poor field.

" NASA considers this a first step in trying to explain mysterious sightings in the sky known as UAPs, or unidentified aerial phenomena. The study will begin this fall and last nine months, costing no more than $100,000. It will be entirely open, with no classified military data used. NASA said the team will be led by astrophysicist David Spergel, president of the Simons Foundation for advancing scientific research. In a news conference, Spergel said the only preconceived notion going into the study is that the UAPs will likely have multiple explanations. "We have to approach all these questions with a sense of humility," Spergel said. "I spent most

of my career as a cosmologist. I can tell you we don't know what makes up 95% of the universe. So there are things we don't understand." The Associated Press Health and Science Department receives support from the Howard Hughes Medical Institute's Department of Science Education. The AP is solely responsible for all content.

https://www.idahostatesman.com/news/business/article262370162.html

Fri, 10 Jun 2022

Theory Suggests Quantum Computers Should be Exponentially Faster on Some Learning Tasks than Classical Machines

A team of researchers affiliated with multiple institutions in the U.S., including Google Quantum AI, and a colleague in Australia, has developed a theory suggesting that quantum computers should be exponentially faster on some learning tasks than classical machines. In their paper published in the journal Science, the group describes their theory and results when tested on Google's Sycamore quantum computer. Vedran Dunjko with Leiden University City has published a Perspective piece in the same journal issue outlining the idea behind combining quantum computing with machine learning to provide a new level of computer-based learning systems.

Machine learning is a system by which computers trained with datasets make informed guesses about new data. And quantum computing involves using sub-atomic particles to represent qubits as a means for conducting applications many times faster than is possible with classical computers. In this new effort, the researchers considered the idea of running machine-learning applications on quantum computers, possibly making them better at learning, and thus more useful.

To find out if the idea might be possible, and more importantly, if the results would be better than those achieved on classical computers, the researchers posed the problem in a novel way—they devised a machine learning task that would learn via experiments repeated many times over. They then developed theories describing how a quantum system could be used to conduct such experiments and to learn from them. They found that they were able to prove that a quantum computer could do it, and that it could do it much better than a classical system. In fact, they found a reduction in the required number of experiments needed to learn a concept to be four orders of magnitude lower than for classical systems. The researchers then built such a system and tested it on Google's Sycamore quantum computer and confirmed their theory. The work suggests that if a usable, real-word quantum computer is ever developed, it might be capable of leaning new things on a nearly unimaginable scale.

https://phys.org/news/2022-06-theory-quantum-exponentially-faster-tasks.html

Sun, 12 June 2022

Infectious Disease Expert: What You Should Know About the New Monkeypox Outbreak

University of Chicago infectious disease expert answers common questions about Monkeypox. Scientists at the Centers for Disease Control and Prevention (CDC) are tracking cases of monkeypox that have been reported in numerous countries that do not normally have the disease, including the United States. As of June 10, 2022, the CDC is reporting 1472 confirmed monkeypox cases in 33 non-endemic countries. The list includes (in order of most cases to least cases): United Kingdom, United Kingdom, Spain, Portugal, Germany, Canada, France, Netherlands, United States, Italy, Belgium, Switzerland, United Arab Emirates, Ireland, Australia, Czechia, Slovenia, Sweden, Denmark, Israel, Finland, Argentina, Iceland, Latvia, Norway, Austria, Brazil, Gibraltar, Greece, Hungary, Malta, Mexico, Morocco, and Poland.

This new monkeypox outbreak is making headlines about this rare, transmissible virus that's related to smallpox. The global investigation into the 2022 outbreak—which differs from previous clusters of monkeypox—is still in its early stages and public health teams are learning more each day as case counts grow. Emily Landon specializes in infectious disease and serves as executive medical director for infection prevention and control at the University of Chicago Medicine. She writes: "It's important to know that the risk of acquiring monkeypox through casual contact is extremely low at this time. And our best COVID-19 safety practices like masks and regular hand washing will be incredibly important tools to help protect us against monkeypox.

Similarly, it's critical that anyone who's been exposed to monkeypox or who thinks they may have symptoms isolates and notifies public health authorities immediately. This situation is evolving quickly and our information is based on the understanding of this outbreak at the time of this post's publication. We'll likely know much more in the weeks and months to come. But for now, here's what we think you should know about monkeypox and how you can stay safe."

What is monkeypox?

Monkeypox is a zoonotic infection, which means it began in animals and was transmitted to humans. It's endemic to Africa and transmitted when someone has close contact with another monkeypox patient or from rodents carrying the disease. Contrary to its namesake, monkeys aren't reservoirs or common hosts of monkeypox. In fact, the virus is most often traced to rodents. It's from the same family as other poxviruses including smallpox (called orthopoxviridae) and was first discovered in humans in 1970.

What does monkeypox look like? Are there other symptoms?

A monkeypox rash starts as red spots and progresses over time to pus-filled, blister-like lesions that eventually scab over. It is typically found on the face or extremities like the hands, legs and feet. The lesions are generally all the same size and develop at the same rate. In the latest round of cases, many of the patients had the rash on only the genitals or anus, which means the symptoms may be mistaken for a sexually transmitted infection or STI. Sometimes a person with monkeypox will feel like they're coming down with a cold or flu days before their rash

develops. These symptoms include headaches, fevers, muscle and body aches, and fatigue. They may also have swollen lymph nodes.

How does monkeypox spread?

Monkeypox is spread through direct skin-to-skin contact with the monkeypox lesions or the fluid inside them. The virus can also be spread by breathing in or directly contacting infected respiratory droplets. There have been some cases where monkeypox was transmitted from surfaces that were contaminated with respiratory droplets or fluid from the lesions. (This is another reason we need to keep wearing the masks we've been accustomed to during the COVID-19 pandemic and why we should keep washing our hands regularly and cleaning high-touch surfaces.)

How long does it take to become sick?

It can take anywhere from five to 21 days for someone to become sick with monkeypox after they've been exposed. That's a long time and makes it especially hard to do contact tracing. The good news: A long incubation period means we can give people treatments or vaccines that can help keep them from getting sick if we're able to catch it early. That makes it important to contact your doctor or the health department right away if you may have been exposed to monkeypox. The entire illness lasts about two to four weeks.

How dangerous is monkeypox?

This outbreak involves what's known as the western African clade, which is less severe and has a fatality rate of about 1%. But many of those cases have occurred in countries where there weren't many medical resources, which means people likely had worse outcomes than they would have in other regions of the world. No one has died from monkeypox in the U.S. during previous outbreaks.

How is monkeypox treated?

Since monkeypox and smallpox are related, we can use the smallpox vaccine to prevent illness even after someone has been exposed. It's about 85% protective against monkeypox. (However, someone's immunity can weaken as they age.) There is also a new vaccine that can be used, but it is in short supply. Antiviral medications, such as cidofovir or tecovirimat, can be used to treat severe cases. Some people may also be treated with immune globulin antibodies if they can't get other kinds of treatment. Most people don't require any treatment and get over the infection on their own.

Who is most at risk for monkeypox?

Unlike previous outbreaks, some of the people who are currently being infected with monkeypox are people who identify as men who've had sexual contact with men and reported new partners in the last month. However, cases aren't limited to one sex or sexual orientation, and there are reports of household contacts being infected. This makes it challenging to diagnose monkeypox because doctors may mistake skin lesions for more common infections. There's good reason to believe other cases may have gone undiagnosed.

https://scitechdaily.com/infectious-disease-expert-what-you-should-know-about-the-new-monkeypox-outbreak/amp/

Sat, 11 Jun 2022

Scientists Create Cement Entirely Out of Waste Material

Creating renewable biocement entirely out of waste material Cement is a binder, a substance used in construction that hardens, sets, and adheres to other materials to bind them together. When sand and gravel are combined with cement, concrete is produced. Cement is classified as hydraulic or non-hydraulic, with non-hydraulic cement not setting when water is present, while hydraulic cement needs a chemical reaction between dry materials and water. Cement is one of the most widely used materials on the planet. Cement consumption in the United States was estimated to be 109 million metric tons in 2021.

Cement manufacturing has an impact on the environment at every level of the process. Some examples include airborne pollutants in the form of dust, fumes, noise, and vibration while running equipment and blasting at quarries, as well as damage to the landscape caused by quarrying. Scientists at Nanyang Technological University, Singapore (NTU Singapore) have discovered a method to produce biocement from waste, making the alternative to traditional cement greener and more sustainable. Biocement is a kind of renewable cement that uses bacteria to create a hardening reaction that binds soil into a solid block. The NTU scientists have now created biocement from two common waste materials: industrial carbide sludge and urea (from mammalian urine).

They devised a method for forming a hard solid, or precipitate, from the interaction of urea with calcium ions in industrial carbide sludge. When this reaction occurs in soil, the precipitate binds soil particles together and fills gaps between them, resulting in a compact mass of soil. This produces a biocement block that is strong, durable, and less permeable. The research team, led by Professor Chu Jian, Chair of the School of Civil and Environmental Engineering, showed in a proof-of-concept research paper published on February 22nd, 2022 in the Journal of Environmental Chemical Engineering that their biocement could potentially become a sustainable and cost-effective method for soil improvement, such as strengthening the ground for use in construction or excavation, controlling beach erosion, reducing dust or wind erosion in the desert, or building freshwater reservoirs on beaches or in the desert.

It can also be used as biogrout to seal cracks in rock for seepage control and even to touch up and repair monuments like rock carvings and statues. “Biocement is a sustainable and renewable alternative to traditional cement and has great potential to be used for construction projects that require the ground to be treated,” said Prof Chu, who is also the Director of NTU’s Centre for Urban Solutions. “Our research makes biocement even more sustainable by using two types of waste material as its raw materials. In the long run, it will not only make it cheaper to manufacture biocement, but also reduce the cost involved for waste disposal.” The NTU scientists’ research supports the NTU 2025 strategic plan which aims to address some of humanity’s grand challenges, including mitigating human impact on the environment through advancing research and development in sustainability.

Urine, bacteria, and calcium: A simple recipe for biocement

The biocement-making process requires less energy and generates fewer carbon emissions compared to traditional cement production methods. The NTU team’s biocement is created from

two types of waste material: industrial carbide sludge – the waste material from the production of acetylene gas, sourced from Singapore factories – and urea found in urine. Firstly, the team treats carbide sludge with an acid to produce soluble calcium. Urea is then added to the soluble calcium to form a cementation solution. The team then adds a bacterial culture to this cementation solution. The bacteria from the culture then break down the urea in the solution to form carbonate ions.

These ions react with the soluble calcium ions in a process called microbially induced calcite precipitation (MICP). This reaction forms calcium carbonate – a hard, solid material that is naturally found in chalk, limestone, and marble. When this reaction occurs in soil or sand, the resulting calcium carbonate generated bonds soil or sand particles together to increase their strength and fills the pores between them to reduce water seepage through the material. The same process can also be used on rock joints, which allows for the repair of rock carvings and statues. The soil reinforced with biocement has an unconfined compression strength of up to 1.7 megapascals (MPa), which is higher than that of the same soil treated using an equivalent amount of cement.

This makes the team's biocement suitable for use in soil improvement projects such as strengthening the ground or reducing water seepage for use in construction or excavation or controlling beach erosion along coastlines. Paper first author Dr. Yang Yang, a former NTU Ph.D. student and research associate at the Centre for Urban Solutions who is currently a postdoctorate fellow at Chongqing University, China, said: "The calcium carbonate precipitation at various cementation levels strengthens the soil or sand by gradually filling out the pores among the particles. The biocement could also be used to seal cracks in soil or rock to reduce water seepage."

A sustainable alternative to cement

Biocement production is greener and more sustainable than the methods used to produce traditional cement. "One part of the cement-making process is the burning of raw materials at very high temperatures over 1,000 degrees Celsius to form clinkers – the binding agent for cement. This process produces a lot of carbon dioxide," said Prof Chu. "However, our biocement is produced at room temperature without burning anything, and thus it is a greener, less energy demanding, and carbon-neutral process."

Dr. Yang Yang said: "In Singapore, carbide sludge is seen as waste material. However, it is a good raw material for the production of biocement. By extracting calcium from carbide sludge, we make the production more sustainable as we do not need to use materials like limestone which has to be mined from a mountain." Prof Chu added: "Limestone is a finite resource – once it's gone, it's gone. The mining of limestone affects our natural environment and ecosystem too."

The research team says that if biocement production could be scaled to the levels of traditional cement-making, the overall cost of its production compared to that of conventional cement would be lower, which would make biocement both greener and cheaper alternative to cement.

Restoring monuments and strengthening shorelines

Another advantage of the NTU team's method in formulating biocement is that both the bacterial culture and cementation solution are colorless. When applied to soil, sand, or rock, their original color is preserved. This makes it useful for restoring old rock monuments and artifacts. For example, Dr. Yang Yang has used the biocement to repair old Buddha monuments in China. The biocement can be used to seal gaps in cracked monuments and has been used to restore broken-off pieces, such as the fingers of a Buddha's hands. As the solution is colorless, the monuments

retain their original color, keeping the restoration work true to history. In collaboration with relevant national agencies in Singapore, the team is currently trialing their new biocement at East Coast Park, where it is being used to strengthen the sand on the beach. By spraying the biocement solutions on top of the sand, a hard crust is formed, preventing sand from being washed out to sea.

https://scitechdaily.com/scientists-create-cement-entirely-out-of-waste-material/