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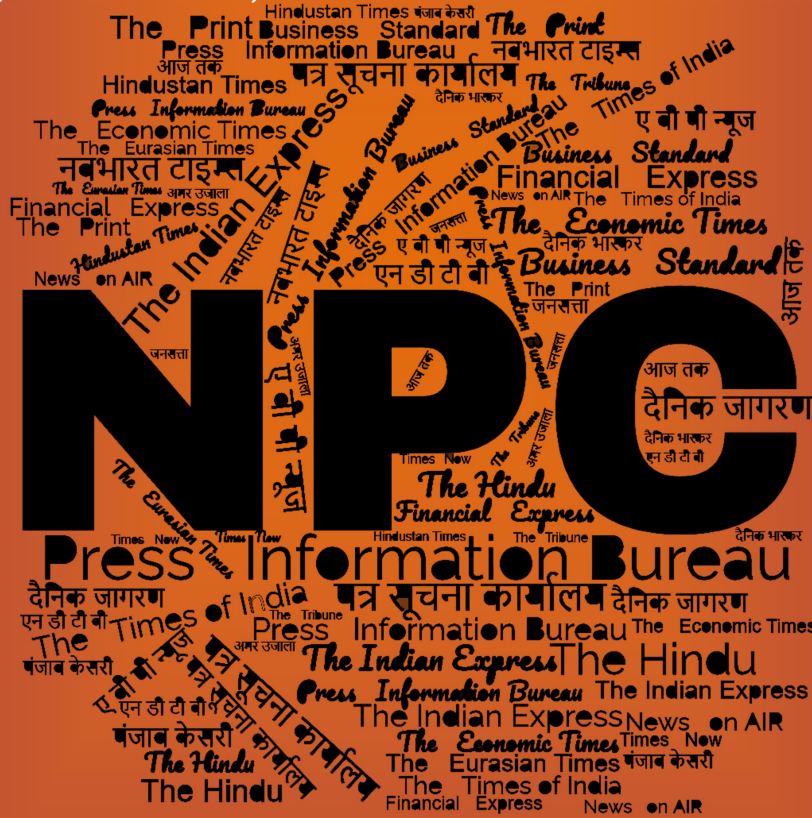
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DRDO News

DRDO Technology News



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Cruise Control: India Accelerates Development of Tactical Missiles



India's Nirbhay cruise missile, displayed above at Defexpo 2020 in Lucknow, will be equipped with small turbofan engines, enhanced radio frequency seekers, and other subsystems to transform it into the proposed Long-Range Land Attack Cruise Missile. (Janes/Rahul Udoshi)

India's Defence Research and Development Organisation (DRDO) recently conducted a flight test of its Indigenous Technology Cruise Missile (ITCM) from the Integrated Test Range (ITR) in Chandipur off the northeastern coast of Odisha.

The ITCM is a technology demonstrator programme to validate the capability of its indigenously developed small turbofan engines (STFEs) – also known as Manik engines – upgraded radio frequency (RF) seekers, and other subsystems. The ITCM is based on the Nirbhay cruise missile,

which is also powered by STFEs. The developer of the STFE is the DRDO's Gas Turbine Research Establishment (GTRE).

A DRDO official told Janes on 3 March that the ITCM test, which took place in mid-February, was successful in demonstrating the capabilities of the STFE. “The ITCM was tested three times before this test, resulting in partial success. The last test in October 2022 was aborted due to technical issues. However, the [most recent] test validated the ability of [the] STFE,” he said.

The official added that the successful test of the STFE has cleared the way to integrate the engine into the Long-Range Land Attack Cruise Missile (LRLACM), which is under development. “The LRLACM is a replacement for the Nirbhay missile and will be developed for all land, air, and marine formations,” he said.

“[However], before a rocket engine is actually put to use in the [LRLACM] missile, it has to be tested with a special flight test vehicle like [the] ITCM,” the DRDO official added.

<https://www.janes.com/defence-news/news-detail/cruise-control-india-accelerates-development-of-tactical-missiles>

Defence News

Defence Strategic : National/International

 **The Indian EXPRESS**

Fri, 10 Mar 2023

Navy’s Major Theatre-level Operational Readiness Exercise Tropex Concludes

The Navy’s major theatre-level operational readiness exercise ‘Tropex’ for the year 2023 which was being conducted across the Indian Ocean Region for the past four months, concluded earlier this week in the Arabian Sea, the Navy said Thursday.

Tropex-2023 witnessed the participation of approximately 70 Navy ships, six submarines and over 75 airborne assets. These exercises also witnessed significant participation from the Army, the Air Force and the Coast Guard — to strengthen interoperability and jointness.

As part of the final joint operations, Defence Minister Rajnath Singh spent a day at sea onboard the recently commissioned indigenous aircraft carrier Vikrant on March 6. He reviewed the Navy’s operational preparedness and material readiness.

Deck operations of indigenous Light Combat Aircraft and live weapon firing were conducted as part of the demonstration of operational manoeuvres. The overall exercise included a pan-India coastal defence exercise sea vigil, which was conceptualised to validate various post-26/11 maritime security measures and the amphibious exercise ‘Amphex’.

While addressing the fleets, the defence minister emphasised that the country looks up to the Navy to ensure that the economic lifelines and military capabilities of our adversaries are disrupted to the extent where their warfighting endeavours can no longer be sustained.

The Ministry of Defence, in a statement, quoted the minister as saying that the Navy is wholly capable of safeguarding India's national interests in the maritime domain and will thwart the diabolical designs of any potential adversaries who seek to threaten India's peaceful existence.

Set in the Indian Ocean, including the Arabian Sea and the Bay of Bengal, the theatre of operations for the exercise extended approximately 4,300 nautical miles north to south up to 35 degrees south latitude and 5,000 nautical miles from Persian Gulf in the West to North Australia coast in the East, spanning an area of over 21 million square nautical miles.

Officials said that the coastal security being a major sub-set of coastal defence construct, the sea vigil component of the Tropex saw the activation of the entire coastal security apparatus across India. The sea vigil was undertaken along the entire 7,516-km coastline and Exclusive Economic Zone of India and involved all the coastal states and Union Territories along with other maritime stakeholders, including the fishing and coastal communities.

<https://indianexpress.com/article/cities/pune/navys-major-theatre-level-operational-readiness-exercise-tropex-concludes-8486839/>



Thu, 09 Mar 2023

FRINJEX-23 Joint Military Exercise Concludes in Thiruvananthapuram

FRINJEX-23, the maiden joint exercise by the French and Indian Armies, concluded at the Pangode Military Station on Wednesday.

The French contingent, led by Major Kalfon, is part of the French Marine Regiment on board the warship FS DIXMUDE, which is currently visiting Kochi. The Indian Army contingent was led by Major Atul Kokar. Brigadier Lalit Sharma, Station Commander of Pangode Military Station, felicitated the members of French contingent and presented them with mementos.

'FRINJEX' will fortify the long-standing bond of friendship and enhance the avenues of defence co-operation between Indian and France, the Army said in a statement. The exercise was aimed at enhancing inter-operability, coordination and cooperation between both forces at a tactical level.

The troops took part in a Yoga session, night training exercise and joint technology and weapons display during the two-day event which was based on the theme 'Humanitarian assistance and disaster relief operations in a contested environment.'

<https://www.thehindu.com/news/national/kerala/frinjex-23-joint-military-exercise-concludes-in-thiruvananthapuram/article66597100.ece>

Cross-border Terror Spike Expected with onset of Summer as Outfits Meet in PoK: Defence Sources

With summer on the way and the passes around the Line of Control opening, the terrorist leadership in Pakistan and Pakistan Occupied Kashmir (PoK) has been planning to step up ops for the next few months, defence sources told Times Now.

The Hizbul Mujahideen (HM) and the Jaishe Mohammed (JeM) organized a terror meet in Mangla, Mirpur, in POK in late January. In attendance was an officer of the ISI, the Pakistan military intelligence agency, and between 12-15 terrorists. The officer's rank was equivalent to an Army colonel.

Another meeting took place on February 11 in Islamabad on the death anniversary of Maqbool Bhat, the separatist leader. Senior leaders from Pakistan's military intelligence agency attended the meeting.

A reshuffle in the terror setup has also begun before the arrival of summer. Reyaz Samani, a resident of Samani, Bhimber in POK has been appointed launching commander of the Kotli sector and also, in charge of the Samani section.

Malik is part of the Al Badr, a smaller terrorist outfit, compared with the Lashkare Toiba. His predecessor, Ayub al-Badri has been appointed camp commander of the Al-Badr camp in Oghi, in Manshera, established in December 2022.

This is more evidence of the fact that while infiltration has come down, partly because of the weather, the terror infrastructure is still in place.

<https://www.timesnownews.com/india/cross-border-terrorism-spike-expected-with-onset-of-summer-as-outfits-meet-in-pok-defence-sources-article-98521836>

Business Standard

Trade, Critical Minerals, Defence to be focus of Modi-Albanese Talks

Prime Minister Narendra Modi and his Australian counterpart Anthony Albanese will hold extensive talks on Friday with a focus on boosting overall bilateral ties in areas of trade and investment, defence and critical minerals.

The two leaders are also expected to review the situation in the Indo-Pacific amid growing concerns over China's increasing military assertiveness in the region, people familiar with the matter said. The Australian prime minister arrives in Delhi this evening after concluding his engagements in Ahmedabad and Mumbai.

On Thursday morning, Modi and Albanese watched the fourth Test match between India and Australia in Ahmedabad.

"As two cricket-loving nations, Australia and India share a fierce but friendly rivalry. At the heart of this contest is genuine respect, reflecting the affection and friendship between our peoples," Albanese tweeted.

Later he visited Mumbai where his engagements included an interaction at the India-Australia CEO's forum.

Days ahead of his visit to India, Albanese said a stronger India-Australia partnership is good for regional stability and that it also means more trade and investment.

It is his first visit to India after becoming the prime minister in May last year.

The last visit to India by an Australian prime minister was in 2017.

The people cited above said bilateral ties in areas of trade and investment, defence, critical minerals and education will be the focus of the talks between the two prime ministers.

Albanese's visit comes after a series of high-level engagements and exchange of ministerial trips between two sides in 2022 and in 2023.

External Affairs Minister S Jaishankar travelled to Australia on February 18 while his counterpart Penny Wong visited New Delhi from February 28 to March 3.

The India-Australia bilateral economic ties are on an upswing. The Economic Cooperation Trade Agreement (ECTA) has entered into force from December 2022.

It is the first free trade agreement signed by India with any developed country in a decade.

The ECTA has resulted in immediate reduction of duty to zero on 96 per cent of Indian exports to Australia in value and zero duty on 85 per cent of Australia's exports (in value) to India.

The bilateral trade was USD 27.5 billion in 2021. Australia is the 17th largest trading partner of India and India is Australia's ninth largest trading partner, according to official data.

With ECTA, there is potential for bilateral trade to reach around USD 50 billion in five years.

India is one of the top sources of skilled immigrants to Australia. The Indian community in Australia continues to grow in size and importance.

The cooperation in education is also on an upward trajectory.

The two sides firmed up a mechanism for mutual recognition of educational qualifications on March 2.

It is expected to facilitate mobility of students between India and Australia.

It is learnt that Deakin University and University of Wollongong are planning to open campuses in India.

There are more than one lakh Indian students pursuing various higher education courses in universities across Australia, making them the second largest cohort of foreign students in that country.

https://www.business-standard.com/article/international/trade-critical-minerals-defence-to-be-focus-of-modi-albanese-talks-123030900916_1.html

Defence Minister Rajnath Singh Holds Telephonic Conversation with Australian Counterpart

Defence Minister Rajnath Singh on Thursday held a telephonic conversation with Australian Deputy Prime Minister and Defence Minister Richard Marles to strengthen defence cooperation between the two countries, according to a press communique of the Defence Ministry.

Defence Minister Rajnath Singh took to his official Twitter handle after his talk with his Australian counterpart. He tweeted, “Spoke to the Deputy Prime Minister and Defence Minister of Australia, Richard Marles. India and Australia share a comprehensive strategic partnership and the call today was an opportunity to reiterate our commitment towards further strengthening of our defence cooperation.”

Both the Ministers reaffirmed their commitment towards further strengthening the bilateral defence relationship. The tele-conversation was reflective of the trust and friendship the two countries share especially in matters related to defence and security.

India and Australia are pursuing a Comprehensive Strategic Partnership and the defence cooperation between the two countries has been consistently deepening in recent years. The conversation was held when Australian Prime Minister Anthony Albanese is on his India visit.

On Thursday, the Australian Prime Minister Anthony Albanese watched the first day of the final test match of the Border Gavaskar Trophy at Gujarat stadium. He compared the cricket match with the India-Australia ties and said that both countries are cooperating to make a better world as the cricket teams of both countries are competing to be the best in the world.

After leaving the Narendra Modi Stadium in Ahmedabad, PM Albanese tweeted, “As two cricket-loving nations, Australia and India share a fierce but friendly rivalry. At the heart of this contest is genuine respect, reflecting the affection and friendship between our people.”

“On the field, Australia and India are competing to be the best in the world. Off the field, we are cooperating to build a better world. Prime Minister @narendramodi and I had the honour of opening the fourth test in Gujarat today. Good luck to all the players (but go Australia!),” he added.

Prime Minister Narendra Modi and the Australian PM graced the fourth and final Test of the Border-Gavaskar Trophy in Ahmedabad to celebrate ‘75 years of friendship’ between both countries.

Meanwhile, PM Modi tweeted, “Cricket is a common passion in India and Australia! Glad to be in Ahmedabad with my good friend, PM @AlboMP to witness parts of the India-Australia Test Match. I am sure it will be an exciting game!” The Australian PM who arrived in India on Wednesday, on the same day took part in Holi celebrations along with Gujarat Chief Minister Bhupendra Patel and the Governor of Gujarat Acharya Devvrat at Raj Bhawan in the state capital Gandhinagar.

“Honoured to celebrate Holi in Ahmedabad, India. Holi’s message of renewal through the triumph of good over evil is an enduring reminder for all of us,” tweeted Australian PM Anthony Albanese with colourful pictures of Holi celebrations with flowers and colours. The Australian Prime Minister on the same day visited the Sabarmati Ashram in Ahmedabad and paid tributes to Mahatma Gandhi.

The Australian PM, upon his arrival in India, tweeted: “An incredible welcome to Ahmedabad, India. The beginning of an important trip for Australia-India relations.”

<https://theprint.in/world/defence-minister-rajnath-singh-holds-telephonic-conversation-with-australian-counterpart/1430494/>



Fri, 10 Mar 2023

India, Australia Committed to Open and Inclusive Indo-Pacific: Albanese

Australian Prime Minister Anthony Albanese on Thursday called India a top-tier security partner for his country while announcing that Australia will host this year’s Malabar exercise for the first time even as he stressed that the Indian Ocean was key to the security and prosperity of both countries, which are committed to upholding the rules-based international order in the Indo-Pacific.

“We both depend on free and open access to sea lanes in the Indo-Pacific for our trade and economic well-being. And we share an unwavering commitment to upholding the rules-based international order and ensuring the Indo-Pacific is open, inclusive and prosperous,” Albanese said. He made those comments during a visit to India’s first indigenous aircraft carrier, INS Vikrant, in Mumbai. Navy chief Admiral R Hari Kumar received him on board.

Albanese’s comments come against the backdrop of a firm Chinese push for greater maritime influence in the far seas. “My visit reflects my government’s commitment to place India at the heart of Australia’s approach to the Indo-Pacific and beyond,” he said.

India and Australia are part of the Quadrilateral Security Dialogue, or Quad, along with the US and Japan, and the foreign ministers of the Quad countries met in Delhi last week on the sidelines of the Raisina Dialogue to review the grouping’s initiatives across the Indo-Pacific in key areas such as maritime security, health, infrastructure projects, and connectivity. They also discussed China’s aggressive actions across the region, including the situation in the South China Sea and Taiwan Strait.

Albanese said Australia will host the Malabar exercise, which involves the Quad navies, for the first time later this year. The Malabar exercise began as an annual bilateral naval exercise between India and the US in 1992, but has increased in scope and complexity over the years. Wary of the Quad, China has been monitoring its activities closely. The Quad was revived in late 2017 by India, the US, Australia and Japan, increasing Beijing’s suspicions as the four countries upgraded the forum to the ministerial level in 2019.

The Australian PM said India will also for the first time participate in the Talisman Sabre exercise, which is a biennial combined Australian and US training activity.

“It will be a great privilege to welcome India’s navy to Australia in August and I thank them again for hosting me here today,” he said.

Albanese said he was delighted to meet the talented and highly professional men and women on board the aircraft carrier Vikrant. “It made me reflect that strong defence relationships are forged over time and by many. But arguably, what lifts defence relationships to new levels is the resolve and foresight of those who see the relationship not only for what it is, but what it could be. Prime Minister Modi is one such person,” Albanese said, while thanking the Indian PM for driving forward the defence and security partnership.

He said that partnership was of increasing strategic importance as the two countries navigated the challenges of the region together.

“And there has never been a point in both of our country’s histories where we’ve had such a strong strategic alignment...I’m pleased to report that there’s never been a busier or more productive time in our defence and security partnership. Last year, we conducted more exercises, operations and dialogues than ever before.” he said.

In his address, the Australian PM also made a mention of the two countries deploying maritime patrol aircraft to each other’s territories for the first time, and the inaugural Australia-India General Rawat Defence Officer Exchange Programme that is currently on in India.

The pioneering exchange programme will ensure defence personnel of the two countries develop the familiarity and trust that underpins a close and long-lasting relationship, he added.

Defence minister Rajnath Singh addressed the navy’s top brass on board INS Vikrant on March 6, the inaugural day of the biannual naval commanders’ conference.

The holding of the top navy meet on board the aircraft carrier brought into sharper focus the country’s steps towards achieving self-reliance in the defence manufacturing sector. The 45,000-tonne Vikrant was built at Cochin Shipyard at a cost of ₹20,000 crore, and commissioned into the navy six months ago.

<https://www.hindustantimes.com/india-news/india-australia-committed-to-open-and-inclusive-indo-pacific-albanese-101678391903589-amp.html>



Fri, 10 Mar 2023

Strong Signal to China: Australia to Host Ex-Malabar

In a strategic signaling to China, the Australian Prime Minister Anthony Albanese has officially announced that his country for the first time will host Exercise Malabar. The exercise is set to be in Perth in August, though the modalities are still being worked out. And, for the first time India is all set to participate in Australia’s Talisman Sabre exercise.

The two announcements were made ahead of the bilateral talks in New Delhi on Friday with Prime Minister Narendra Modi where Indo-Pacific, forthcoming QUAD Leaders Summit, Russia-Ukraine war and other issues will be discussed.

The Australian leader who is visiting India at the invitation of Prime Minister Modi made these remarks on board the indigenous, newly commissioned aircraft carrier INS Vikrant and stated that his visit reflects his government's commitment to place at the heart of Australia's approach to the Indo-Pacific and beyond.

What is the aim of Ex Malabar?

The focus of this is on interoperability among the QUAD navies and to also send a message to China that India is not alone in the region. According to experts it is 'Strategic Signaling' of collectivism. And for the first time in 2020 Australia had participated in this naval drill which is to showcase collective capabilities of the navies of QUAD member countries in the maritime domain where China is seen to expand its presence. This drill can also be a counterweight to the political and military influence of China in the region.

Background History

Malabar series of maritime exercises started in 1992 but only in bilateral format between the Indian and the US navies, several years later in 2015 Japan joined as permanent member and in 2020 the Royal Australian Navy participated in the drill.

The 27th edition of the drill comes at a time when India is holding the G20 presidency and the QUAD Leaders are scheduled to meet in Australia in May-June. The members of the QUAD share similar values of open, free and fair Indo-Pacific.

Over three decades the exercise has become more complex, has grown in scope and size and in the last few years Anti-Submarine Warfare training has emerged as a major focus area. This comes at a time when the Chinese Navy has been expanding its presence rapidly in the Indian Ocean.

Defence Cooperation

On board the aircraft carrier the visiting leader talked about the strong defence relationship between the two countries and also thanked Prime Minister Modi for inviting him to visit INS Vikrant and driving forward the defence and security partnership between the two countries.

He also stated that for Australia, India is a top security partner and the Indian Ocean is central to the security and prosperity of both countries.

Both India and Australia are committed to upholding rules-based international order and to ensure that the Indo-Pacific is open, prosperous and inclusive as both countries for their trade and economic well being depend on free and open access to sea lanes in the Indo-Pacific.

Both countries last year had conducted more exercises, dialogues and operations than ever before, the Australian leader said. For the first time the two navies undertook Maritime Patrol Aircraft deployments to each other's territories.

It has been reported earlier that last November the two sides conducted very complex exercises in Indo-Pacific: Ex-Endeavour and Ex-Austrahind. And these were capped off by Ex-Malabar – where the focus was on interoperability with the navies of India, Japan and the US.

The inaugural Australia-India General Rawat Defence Officer Exchange Program is already underway in India – a pioneering exchange programme which has been created by PM Modi and this according to PM Albanese will ensure that the military personnel of both sides will develop familiarity.

<https://www.financialexpress.com/defence/strong-signal-to-china-australia-to-host-ex-malabar/3004085/>



Thu, 09 Mar 2023

Defence Technology: Role in Military Intelligence

Lt Col Manoj K Channan (Retd)

Defence technology is a broad term that encompasses the use of technology in military operations, including research, development, acquisition, and deployment of systems and equipment used by armed forces to protect national interests. Defence technology covers various fields, from cybersecurity to advanced weaponry, and plays a critical role in modern warfare.

One of the most critical aspects of defence technology is its role in military intelligence. With advancements in technology, it is now possible to collect vast amounts of data, process it quickly and accurately, and provide actionable intelligence to military leaders. This information is critical in understanding enemy movements and capabilities and identifying potential threats.

Another critical area of defence technology is the development of advanced weaponry. From traditional weapons like guns and bombs to more advanced systems like crewless aerial vehicles (UAVs) and autonomous weapons systems, technology is revolutionizing the way militaries fight wars. These weapons provide greater precision, range, and lethality, making them more effective in combat. Additionally, using technology in weapons systems allows for greater control and situational awareness, reducing the risk of civilian casualties.

Defence technology also includes the development of cybersecurity measures to protect military and government networks from cyber-attacks. Cybersecurity is becoming increasingly critical as militaries rely more on digital technologies and cyber-attacks. Developing advanced cybersecurity technologies, such as encryption and firewalls, can help prevent attacks and protect sensitive information from being compromised.

Defence technology also includes the development of logistics and support systems. These systems ensure that troops are adequately equipped, supplied, and supported to prevail in the field upon their adversary. In addition, the use of technology, logistics and support systems is optimized to ensure that troops have what they need when and where they need it.

Defence technology is critical in modern warfare, from military intelligence to advanced weaponry, cybersecurity, logistics and support systems. Rapid technological advancement means that defence technology will continue to evolve, with new technologies and systems developed to provide militaries with a strategic advantage on the battlefield.

What are the critical developments in defence technology since the Ukraine War started?

The Ukraine War, which began in 2014, has highlighted the critical importance of defence technology in modern warfare. Since the start of the conflict, several critical developments in defence technology have emerged. Some of these include:

Autonomous Weapons Systems. Autonomous weapons systems are crewless vehicles operating independently or with minimal human intervention. These systems have become increasingly important in the Ukraine conflict, with both sides using drones for reconnaissance and targeting. Autonomous weapons systems offer several advantages, including reduced risk to human personnel and increased accuracy in targeting.

Cybersecurity. Cybersecurity has become a significant concern in modern warfare, and the Ukraine conflict is no exception. Both sides have used cyber-attacks to disrupt and disable critical infrastructure, including power grids and communication networks. As a result, cybersecurity has become a critical component of modern defence technology.

Artificial Intelligence (AI). AI has become increasingly crucial in defence technology, with applications ranging from military intelligence to autonomous weapons systems. AI has been used in the Ukraine conflict to analyse satellite imagery, track troop movements, and identify potential targets.

Electronic Warfare (EW). EW refers to using electronic systems to disrupt, deceive, or deny an enemy's ability to communicate or operate effectively. Both sides used EW to disrupt communication networks and enemy targeting systems.

Crewless Underwater Vehicles (UUVs). UUVs are autonomous or remotely operated underwater exploration and surveillance vehicles. In the Ukraine conflict, UUVs are used to detect and neutralize underwater mines, as well as for surveillance purposes.

Hypersonic Weapons. Hypersonic weapons are missiles travelling at speeds greater than Mach 5. Russia has reportedly tested hypersonic missiles, which could give them a significant strategic advantage.

The Ukraine conflict has highlighted the importance of defence technology in modern warfare. Autonomous weapons systems, cybersecurity, AI, EW, UUVs, and hypersonic weapons are among the critical developments in defence technology that have emerged since the start of the conflict. As the pace of technological advancement continues, defence technology will continue to play a critical role in future conflicts.

How well is India prepared for a conflict considering the defence technology capabilities prevalent?

India has invested heavily in defence technology over the past few years, focusing on modernizing its armed forces and developing indigenous capabilities. However, despite these efforts, India must still prepare for a conflict.

One of the main challenges that India face's is outdated equipment and technology. Many of India's military systems are outdated and require significant modernization to keep up with emerging threats: this includes everything from fighter jets and tanks to communication and surveillance systems. While India has made progress in this area, there is still a long way to go to achieve technological parity with some of its more advanced adversaries.

Another challenge that India faces is the issue of logistics and supply chain management. The ability to supply troops with equipment, ammunition, and food is critical in any conflict, and India's logistics systems have been criticized for needing to be faster and more efficient. While India has been improving its logistics systems, more work is needed to ensure that troops have what they need when needed.

India has invested in advanced defence technologies, such as crewless aerial vehicles, missile defence systems, and cybersecurity. However, many of these technologies are still in the development phase, and it may be several years before they are fully operational and integrated into India's military capabilities.

India has made progress in developing its defence technology capabilities, but there is still work to be done to ensure that it is fully prepared for a conflict. Upgrading outdated equipment and technology, improving logistics and supply chain management, and continuing to invest in advanced defence technologies are all critical components of India's efforts to enhance its military capabilities.

To access niche Defence Technology what improvements need to be made in the procurement procedures?

With access to niche defence technology, several improvements can be made in the procurement procedures. Some of these include:

Streamlining procurement procedures. Defence procurement procedures can be lengthy and bureaucratic, discouraging smaller companies and start-ups from participating. Streamlining these procedures by simplifying documentation requirements and reducing processing times can make it easier for smaller companies to participate and provide innovative niche technologies.

Emphasizing technology over cost. Defence procurement processes typically focus on the lowest bidder, which can result in the selection of less capable technologies. By prioritizing technology over cost, procurement procedures can encourage selecting more advanced and niche technologies, even if they may be more expensive.

Encouraging partnerships and collaborations. Encouraging partnerships and collaborations between larger defence contractors and smaller niche technology companies can help bridge the gap between established defence technologies and emerging niche technologies. This can help to accelerate the development and deployment of innovative niche technologies.

Increasing transparency and accountability. Lack of transparency and accountability in procurement processes can lead to corruption and favouritism, which can discourage smaller companies and start-ups from participating. Increasing transparency and accountability in procurement processes can help to create a level playing field and encourage greater participation from smaller companies and start-ups.

Developing long-term procurement plans. Developing long-term procurement plans that take into account emerging threats and technological advancements can help to ensure that niche technologies are identified and prioritized in procurement processes. This can help to avoid the short-term focus that often characterizes procurement processes and encourage the adoption of more advanced and niche technologies.

Improving procurement procedures can help to facilitate access to niche defence technologies. Streamlining procedures, prioritizing technology over cost, encouraging partnerships and

collaborations, increasing transparency and accountability, and developing long-term procurement plans are all steps that can be taken to improve procurement processes and facilitate access to niche defence technologies.

Will the Make II procedure under Make in India be the right way forward for Defence Technology adaptation?

The Make II procedure under the Make in India initiative is a step in the right direction for defence technology adaptation. The procedure aims to promote the development of indigenous defence manufacturing capabilities by encouraging private sector participation in defence production. Under Make II, private sector companies can submit proposals for developing and manufacturing defence equipment, with the government providing funding and support.

Advantages to the Make II Procedure

1. It helps to promote the development of indigenous defence manufacturing capabilities, which is critical for reducing dependence on imports and enhancing national security.
2. It encourages private sector participation in defence production, which can help to bring in new ideas and technologies and promote innovation.
3. It can reduce costs and increase efficiency by leveraging the expertise and capabilities of the private sector.

Challenges with the Make II Procedure

One of the main challenges is the issue of intellectual property rights. Private sector companies may be hesitant to participate in defence production if they do not have sufficient protection for their intellectual property. Therefore, the government must ensure adequate protection for private-sector companies to encourage participation.

Another challenge is the issue of bureaucracy and red tape. The Make II procedure involves a complex and lengthy evaluation, selection, and implementation, which can discourage private-sector companies from participating. The government must streamline the process and reduce bureaucratic hurdles to encourage greater private-sector participation.

The Make II procedure under the Make in India initiative is a step in the right direction for defence technology adaptation. It promotes the development of indigenous defence manufacturing capabilities, encourages private sector participation, and can help to reduce costs and increase efficiency.

However, the government will need to address some of the challenges associated with the Make II procedure, such as the issue of intellectual property rights and bureaucratic hurdles, to ensure its success.

Space is a new frontier for warfare in terms of anti-satellite weapons, how do the developed Nations compare with India in this domain?

Space has become a new frontier for warfare, and anti-satellite (ASAT) weapons have emerged as a critical component of modern military capabilities. Several developed nations, including the United States, Russia, and China, have invested heavily in ASAT capabilities, and India has also made significant strides in this domain.

The United States is widely considered to have the most advanced ASAT capabilities in the world, with a range of systems that can destroy satellites in orbit. The US has been investing in ASAT technologies since the 1950s and has developed various systems, including ground-based missiles, laser systems, and kinetic kill vehicles.

Russia also has a significant ASAT capability, with a range of systems that can be used to destroy satellites in orbit. Russia has invested in ASAT technologies since the 1960s and has developed various systems, including ground-based missiles and co-orbital systems.

China has been investing heavily in ASAT technologies in recent years and is considered a rising player in this domain. China has developed ground-based missiles and has conducted successful tests of co-orbital ASAT systems, including a test in 2007 that destroyed one of its satellites.

India has also made significant strides in developing ASAT capabilities. In March 2019, India successfully tested an ASAT missile, making it the fourth country in the world, after the US, Russia, and China, to have this capability. India's ASAT system is a ground-based missile that can destroy satellites in low-earth orbit.

Several developed nations, including the United States, Russia, and China, have invested heavily in ASAT capabilities, with the US being the most advanced in this domain. India has also made significant strides in this domain, with the successful test of its ASAT missile in 2019. However, while ASAT technologies can enhance military capabilities, they also raise concerns about the militarization of space and the risks of debris generated from ASAT tests and operations.

To sum up, the government, Service HQs, academia and industry have to be synergised to ensure that India remains ahead of the technology curve and is prepared for the next war in all its manifestations to include non-military means.

<https://www.financialexpress.com/defence/defence-technology-role-in-military-intelligence/3003439/>

The Tribune

Fri, 10 Mar 2023

Woman in Command Role

In a watershed moment for women in the armed forces, the Indian Air Force has taken the lead in entrusting a woman officer with the command of a frontline combat (missile) unit — the first line of defence to tackle air intrusion from the western front — in Punjab. Scripting history and making the region particularly proud is Group Captain Shaliza Dhama, who hails from Ludhiana. She was commissioned in 2003 as a helicopter pilot and has earned impeccable credentials over the years. With more than 2,800 hours of flying experience, the gritty Group Captain is a Qualified Flying Instructor and has served as Flight Commander (the second-in-command) of a helicopter unit in the western sector.

This is a remarkable achievement in view of the formidable barriers to gender parity that the women soldiers — barring the medical, legal and education units — have faced at every stage in the defence forces. Right from recruitment and getting permanent commission to securing

command positions, they have had to fight the discrimination that has excluded them from equality in these roles. The Supreme Court has, notably, come to their defence every time. Regarding their deployment in top positions, in February 2020, the court described the government's stance of resistance as 'disturbing'. The government had argued that since most soldiers were men from rural backgrounds, they were not 'mentally schooled to accept women officers in command'. The SC rightly countered it by emphasising on 'the need for change in mindsets to bring about true equality in the Army'.

Thus, though the IAF could put aside the doubts cast on women's combat abilities as many as 30 years after they were first inducted into the force, it must be commended for recognising the dignity and fitness of the women officers. The other two services are also moving beyond the tokenism that has marked the women defence officers' careers till now. The Army has recently cleared the path for its women in command roles with the selection of more than 100 of them as Colonels. And the Navy has given its women positions on frontline ships. A big salute to them all.

<https://www.tribuneindia.com/news/editorials/woman-in-command-role-486481>

THE ECONOMIC TIMES

Thu, 09 Mar 2023

Australian Military Officers Visit India under Gen Rawat Memorial Exchange Programme

A 15-member Australian military contingent including four women officers on Thursday visited Indian Army's Shatrueet brigade in Agra as part of young officers' exchange programme instituted in memory of India's first Chief of Defence Staff Gen Bipin Rawat. An equal number of Indian officers from the Army, the Navy and the Indian Air Force were also part of the trip.

Gen Rawat India-Australia Young Defence Officers' Exchange Programme was unveiled following a virtual summit between Prime Minister Narendra Modi and his then Australian counterpart Scott Morrison in March last year.

Gen Rawat, his wife Madhulika Rawat and 12 other military personnel were killed in a helicopter crash near Coonoor in Tamil Nadu on December 8, 2021.

Official sources said the 15-member Australian contingent comprised four female officers.

They said both Indian and Australian officers were taken through a series of training demonstrations related to fighting in built-up areas by paratroopers of the elite formation.

This platform has given the young officers a unique exposure to foster defence ties and cooperate by understanding the cultural and professional aspects, said an official.

The young officers also interacted with paratroopers of Shatrueet brigade to understand the unique role of the strategic airborne formation of Indian Armed Forces.

The sources said the programme provides a valuable opportunity for the Australian officers to observe the training and practices of India's military and foster greater understanding and cooperation.

The visit to India by the Australian defence delegation is another example of the building momentum between Australia and India as comprehensive strategic partners.

"The exchange programme reflects the shared vision of both nations to enhance bilateral defence ties, cooperation and collaboration through strong people-to-people links," said another official.

As India's first Chief of Defence Staff, Gen Rawat was spearheading an initiative to bring convergence in the functioning of the Army, the Navy and the Indian Air Force and bolster the country's overall military prowess.

<https://economictimes.indiatimes.com/news/defence/australian-military-officers-visit-india-under-gen-rawat-memorial-exchange-programme/articleshow/98522654.cms>



Thu, 09 Mar 2023

Boeing to Collaborate with Defence Tech Firm on AI for Defence Programmes

Aircraft manufacturing giant Boeing and defence technology company Shield AI are set to collaborate on Artificial Intelligence (AI) and autonomy for current and future defence programmes. According to a statement released by Boeing on Wednesday (March 8), the two companies have signed a memorandum of understanding "to explore strategic collaboration in the areas of autonomous capabilities and artificial intelligence".

The agreement, signed at the Air Force Association Warfare Symposium in Colorado, will be managed by Boeing Phantom Works. Steve Nordlund, vice president and general manager for Boeing's Air Dominance organisation, said on Wednesday that the company has continued to leverage "talent from across the enterprise to make great strides in autonomous capabilities and programmes in recent years."

Nordlund added the collaboration with Shield AI would accelerate Boeing's ability to deliver these capabilities to the warfighter.

According to Wednesday's statement, Shield AI has created Hivemind, an artificial intelligence pilot that has flown a variety of aircraft. The defence technology said the AI pilot can enable swarms of drones and aircraft to operate autonomously without GPS, communications or a human pilot in the cockpit.

Shield AI's President and Co-founder Brandon Tseng said that an AI pilot is the most strategic deterrent technology since the introduction of stealth aircraft and has proven successful in flying air-combat scenarios. Tseng, a former Navy SEAL, said that integrating Boeing aircraft with his company's AI pilot would redefine what large aircraft, crewed or uncrewed, could do.

"As the world leader in aerospace technology, Boeing has been exceptionally easy to engage with, so we are excited to expand our scope of work to co-develop, productise and bring to market the world's best AI pilot for large aircraft," Tseng added.

<https://www.wionews.com/business-economy/boeing-to-collaborate-with-defence-tech-firm-on-ai-for-defence-programs-570252>



Fri, 10 Mar 2023

China Developed J-20 Stealth Fighter using USAF's F-22 Raptor's Technology – Now it Seeks to Challenge it!

By Sakshi Tiwari

China has been working to close the gap between the capability of its J-20 stealth fighter and the US Air Force F-22 Raptor. However, military experts and officials in the west have asserted for many years that China stole US military secrets to develop the J-20 'Mighty Dragon.'

In a recent interview, military experts told Fox News that if more isn't done to protect key weapons information, China might keep pace with the US and challenge the military.

According to former Acting Under Secretary of Defense for Strategy, James Anderson, the key issue in this situation is that "we know [China's] J-20 is more advanced than it otherwise would be because of the espionage activities."

"Over the years, they have substantially benefited from their theft," he claimed, adding, "it's impossible to say how the J-20 compares to the American F-22 Raptor fighter, but they've put it to good use and developed an advanced fifth-generation fighter."

These comments come when media reports have indicated that the PLA Air Force and Chinese engineers are working on novel technologies, such as the 2D thrust vectoring control nozzle used by the American F-22 Raptors to close the capability gap with the US Air Force.

China started working on the J-20 in 2008 as part of a strategy to create a brand-new fighter that could compete with US models. The aircraft made its first flight in 2011 and entered service in 2017. However, soon after its induction, US officials and military experts accused China of creating a fighter eerily similar to the US F-22 Raptor. China was fast accused of espionage.

Not just the F-22 Raptor, in 2019, the then National Security Adviser of Donald Trump's administration, John Bolton, alleged that China stole stealth technology and other classified information related to another US stealth fighter, i.e., the F-35 Lightning II. Many terabytes of data related to the F-35 program have been allegedly stolen by Chinese hackers, including information on the F-35's radar design – such as the number and types of modules used by the system – and its engine, including the method used for cooling gases, leading and trailing edge treatments, and aft deck heating contour maps.

China Closing An 'Insurmountable' Gap

The technology and capabilities of the aircraft began to be compared to those of American fighter jets in stories in 2015. According to an Associated Press story, “some of its technology, it turns out, may well have come from the US itself.”

Military experts that Fox Digital spoke to alleged that owing to ongoing intellectual property theft, China now has a fifth-generation stealth fighter comparable to the US F-22. This has narrowed the formerly seemingly insurmountable technological gap between the two militaries. As tensions between the two countries rise and officials contemplate a potential invasion of Taiwan, including a US military response, the disparity between Chinese and American military technology has reduced.

According to James Hess, a professor at the American Public University System’s (APUS) School of Security and Global Studies, the US must finally deal with China’s “philosophical difference” and willingness to put its interests first.

“You may even look at Chinese history with an overarching culture of things that have improved society rather than worrying about it,” said Hess. “There is undoubtedly a cultural component to this, as seen by the absence of enforcement.”

“There’s an author who said, ‘to steal a book is an elegant offense,’ so you have that mentality that knowledge is not necessarily looked at as theft of knowledge ... is not looked at as a capital offense by any means,” he continued. “It’s looked at as kind of good thing, that this is a positive thing you’re doing.”

To recruit American contractors, academics, and government employees, Anderson alleged that China employs various espionage techniques, from “low-tech” honey traps, spies, and bribery to more sophisticated ones like cyber-activity to gather vital information on military systems.

“Unfortunately, they’ve had some success there,” Anderson said, adding that they spent “well over a decade” repeatedly going after the Joint Strike Fighter, which they’ve exploited in the design and construction of the J-20.

“It saves the Chinese time and money. In effect, we end up subsidizing a portion of their research and development budget because they are successfully stealing some of our secrets,” Anderson said. “Ultimately, this puts our men and women at greater risk on the battlefield.”

These assertions come when China has ramped up the production and deployment of its J-20 fighter jets. Chinese J-20s are already set to outnumber the US F-22 Raptors.

The head of the London-based International Institute for Strategic Studies stated China’s most sophisticated J-20A stealth fighters’ inventory is expected to surpass the US Air Force’s F-22 Raptor this year, as previously reported by EurAsian Times.

According to past estimates, China has built more than 150 J-20 warplanes. On the other hand, the US Air Force initially intended to purchase 750 F-22s to create a sizable fleet of stealth fighters for the twenty-first century.

However, just 186 fighters were produced before its production lines were closed in 2012. The number of F-22 Raptors that are combat-capable at any given time comes down several notches, giving China a numerical advantage. On its part, China has deployed the J-20 fighter jet in all five theater commands.

The F-22, on its part, registered its first kill last month when it fired a missile to shoot down an alleged Chinese spy balloon after days of tracking it. In addition to that, the Raptors have now been sent to Japan to replace the older F-15 fighters. Amid rising regional tensions between the two adversaries, the two rival fifth-generation fighters now sit just miles apart.

<https://eurasianimes.com/china-developed-j-20-stealth-fighter-using-usafs-f-22-raptors/>

Science & Technology News



Press Information Bureau
Government of India

Ministry of Science & Technology

Thu, 09 Mar 2023

Dr Jitendra Singh Announces an Exclusive Women's Portal for Research Grants and Funds. The Portal will become Functional with effect from 1st of April.

Special Call inviting proposals from Women Scientists will open the same day

CSIR to provide exclusive Research Grants for Women Scientists: Dr. Jitendra Singh

Dr. Jitendra Singh says PM Modi considers women-led development a central dimension of India's progress

“As we move towards Amrit Kal, this is another visionary step towards the Prime Minister Modi's efforts to put Nari Shakti at the forefront of India's development journey”

Dr. Jitendra Singh addresses the International Women's Day celebration of CSIR

To mark the International Women's Day, Union Minister of State (Independent Charge) Science & Technology; Minister of State (Independent Charge) Earth Sciences; MoS PMO, Personnel, Public Grievances, Pensions, Atomic Energy and Space, Dr Jitendra Singh today announced an exclusive women's portal for research grants and funds. The portal will become functional with effect from 1st of April.

The Minister was addressing the International Women's Day celebration programme organized by the Council of Scientific & Industrial Research (CSIR) here. He informed that the Council CSIR has decided to start exclusive Research Grants for Women Scientists under CSIR-ASPIRE and an exclusive portal in this regard will be available from April 1, 2023. The Special Call inviting proposals from Women Scientists will open the same day.

Pertinent to mention that the proposal for inviting research grant proposals from Women Scientists under Extramural Research Scheme, was approved during the 200th meeting of the Governing Body of CSIR on 17th December, 2022 under the chairmanship of Dr Jitendra Singh.

Only women scientists across the country will be eligible to apply for research grants to carry out R&D in major disciplines of science and engineering viz Life Sciences, Chemical Sciences, Physical Sciences, Engineering Sciences and inter/trans disciplinary sciences.

The funds will be provided for staff (JRF/SRF/RA), contingency and minor equipment. The total budget of a research proposal including research fellow's stipend should generally not exceed the limit of 25-30 lacs.

Dr. Jitendra Singh said, this initiative is aligned to the Prime Minister Shri Narendra Modi's initiative to empower women and promote 'Nari Shakti' in the country.

"As we move towards Amrit Kal, this is another visionary step towards the Prime Minister Modi's efforts to put Nari Shakti at the forefront of India's development journey," he said.

CSIR has been taking several initiatives towards Women empowerment, including 15% discount on CSIR technologies for women entrepreneurs offered by CSIR- Central Leather Research Institute and a slew of training programmes across the whole spectrum of CSIR domain. In August last year, for the first time in the history of CSIR, senior electrochemical scientist Ms. Nallathamby Kalaiselvi became the first woman Director General to head the premier scientific R&D body that constitutes 38 research institutes across the country.

Dr. Jitendra Singh said, Prime Minister Modi considers women-led development a central dimension of India's progress and necessary for strengthening India.

"In the last nine years, under Prime Minister Narendra Modi, the government has launched numerous welfare schemes that have aimed to empower women and make them lead India's development journey. His efforts are enabling women to overcome social barriers and fulfil their aspirations," he said.

Dr. Jitendra Singh said 68% of 2 crore PM Awas-Gramin beneficiaries are women and over 23 crore MUDRA loans have been granted to Women beneficiaries. For the first time, sex ratio in India has improved to 1,020 women per 1,000 men, according to the NFHS-5 survey, he said.

"PM Modi has made unshackling women and freeing them from the drudgery of everyday life a key objective of policy making. Every flagship welfare scheme launched by the Modi government has improved the lives of women across the country," he said.

Dr. Jitendra Singh said, in the last 9 years, there has been a massive increase in Women Police Personnel. In 2018, PM Modi announced a landmark decision to allow Permanent Commission for Women in the Armed Forces. There are more than 10,000 Women Officers serving in the Armed Forces, the majority in the Medical Services.

"Now Women are breaking the glass ceiling in every sphere. Only recently, the Indian Air Force posted Group Captain Shaliza Dhami as the first woman officer to command a missile squadron in the Western sector facing Pakistan. Women CRPF combatants have been inducted into the elite anti-Maoist COBRA Unit. Women officers have also started taking command of various Army units. The Navy has also started inducting Women Officers on frontline warships," he said.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1905306>

THE WALL STREET JOURNAL.

Wed, 08 Mar 2023

The Scientific Breakthrough that could Make Batteries Last Longer

U.S. scientists say they have produced the first commercially accessible material that eliminates the loss of energy as electricity moves along a wire, a breakthrough that could mean longer-lasting batteries, more-efficient power grids and improved high-speed trains.

Materials that can conduct electric currents without any loss—so-called superconductors—have been wildly impractical because they typically need to be extremely cooled, to around minus 320 degrees Fahrenheit, and subjected to extreme pressure to work.

Now, a group of researchers at the University of Rochester report that they have created a new superconductor that can operate at room temperature and a much lower pressure than previously discovered superconducting materials.

The breakthrough has the potential to create lossless electrical grids, and better and cheaper magnets for use in future nuclear fusion reactors, among other things, according to Ranga Dias, assistant professor of mechanical engineering and physics at the University of Rochester, who led the breakthrough work. That is because perfect conductors that work in everyday, ambient conditions don't require expensive, large cooling systems.

“We could magnetically levitate trains above superconducting rails, change the way electricity is stored and transferred, and revolutionize medical imaging,” Dr. Dias said.

Superconductors demonstrate what physicists call the Meissner effect, when a material expels its magnetic field. If you put a superconductor near a magnet, it will levitate, he added.

In 2020, his group reported that they had created a superconductor made up of a hydrogen, sulfur and carbon combination that operated at roughly room temperature. The catch was it only worked after being baked by a laser and crushed between the tips of two diamonds to a pressure greater than that found in the center of the Earth, in a device known as a diamond anvil cell.

For the new study, which was published Wednesday in the journal *Nature*, the researchers tweaked their superconductor recipe—adding nitrogen and a rare-earth metal known as lutetium to the hydrogen instead of sulfur and carbon—and once again heated and squeezed it in the diamond anvil cell.

They named the resulting material “reddmatter,” after observing how the material's hue changed from blue to pink to red as it got compressed. The moniker, Dr. Dias said, was inspired by the fictional, black hole-forming substance from the 2009 Hollywood blockbuster ‘*Star Trek*.’

The Rochester lab found that “reddmatter” could exist at 69 degrees Fahrenheit and 145,000 pounds per square inch, or psi, of pressure—about 1/360th of the pressure in Earth's core. That is about a 10-degree Fahrenheit increase in temperature and a drop to about 1/1000th of pressure compared with its predecessor from 2020.

“These results are a breakthrough for the scientific community that was enabled by [Dr. Dias’s] keen chemical intuition,” said Stanley Tozer, a research scientist at the National High Magnetic Field Laboratory at Florida State University in Tallahassee, who wasn’t involved in the research.

While still a far cry from the pressure people experience at sea level—which is about 15 psi—the new pressure is within “a range where engineers can jump on and make a commercially viable product,” Dr. Tozer said, adding, “it just makes superconductivity commercially accessible.” Engineers and material scientists can achieve pressures around 145,000 psi using specialized techniques and instruments involved in chip manufacturing and synthesizing diamonds, for instance. “We will have devices with superconducting components in them in the next five years,” said Ashkan Salamat, a study co-author and physicist at the University of Nevada, Las Vegas. That means our phones and laptops will need less electricity to run, and not lose energy as heat—giving them longer battery life. The same components could be incorporated into electric-car batteries.

Dr. Salamat said superconductors that work at everyday temperatures and pressures could also help tackle issues like climate change.

“A superconducting grid can store solar or wind energy, for example, for an indefinite period of time and transfer it over large distances without a loss,” he said. The U.S. Energy Information Administration estimated that 5% of electricity, on average, was lost during transmission and distribution in the country between 2017 and 2021. More efficient energy storage and transfer means less energy use overall, which reduces carbon emissions. Superconductors could also pave the way to cheaper, better machines that can conduct nuclear fusion—which has long been seen as a potential source of clean, virtually limitless energy, Dr. Salamat said.

Nuclear fusion reactions, which combine atoms and release a tremendous amount of energy in the process, don’t generate any radioactive waste or greenhouse gases. Many fusion machines rely on magnetic fields to confine the reactions—and superconductors can create some of the strongest fields. The problem is the bulky, expensive cooling apparatuses needed to keep those superconductors cool. Dr. Dias said a superconductor like “redmatter,” which creates an enormous magnetic field at room temperature, could be a game changer in the next decade or so for efforts to construct fusion reactors.

Noninvasive medical imaging, too, could benefit from superconductors that work at near-ambient conditions, Dr. Salamat said. Most magnetic resonance imaging, or MRI, machines rely on superconducting magnets, which are made by passing an electrical current through coils of superconducting wire, creating a magnetic field. Those coils are chilled using liquid helium—a scarce and expensive resource that limits where MRI systems can be housed, Dr. Salamat said. A room-temperature superconductor could enable smaller, more portable MRI machines that don’t need to be kept cool.

“Now, these are very big engineering feats and won’t happen tomorrow. But these are coming in the next decade or so as a consequence of this discovery and others like it,” he said.

While Dr. Dias’s research shows promise, some of his group’s past work has been a target of scrutiny by other scientists. Their 2020 study, detailing another room temperature superconductor, was retracted by Nature last year after other researchers were unable to replicate the results and questioned the validity of the data showing the Meissner effect in the material.

Dirk van der Marel, a University of Geneva physicist who wasn't involved in the new research or Dr. Dias's other work, was among those who raised issues about the 2020 data.

Dr. Dias said the retracted paper has been resubmitted to Nature after he and his colleagues collected new data in front of other scientists at the Argonne and Brookhaven National Laboratories, in Illinois and New York, respectively. He added that his group made all their data around "redmatter" available during the peer-review process for the new paper.

Although Dr. van der Marel said the new study appeared to properly demonstrate the effect in "redmatter," he said he feels "extremely uncomfortable about the whole thing."

"Similar issues could lurk" in the data, he added.

The idea that superconductivity is achievable at room temperature with materials rich in hydrogen has been corroborated by other groups, said Russell Hemley, a professor of physics and chemistry at the University of Illinois Chicago, who wasn't involved in the new research but has collaborated with Dr. Dias on other projects.

"So these results shouldn't be in doubt, even if there were concerns about some of the way in which the data has been presented in their earlier paper." Dr. Hemley said.

For his part, Dr. Dias said his group is already looking to tweaking their "redmatter" recipe to try to achieve superconductivity at even warmer temperatures and lower pressures.

One idea is throwing other rare-earth elements that are similar to lutetium into the mix, though these rare elements are expensive, Dr. Dias said. He hopes to try a different approach—maybe aluminum with a dash of something else—which is cheaper to make and can mimic lutetium's effects.

The group will start using machine-learning to select their next superconductor recipes. They are training algorithms with data from this new work and previous experiments to help the AI better predict what combinations of hydrogen and other elements may yield superconducting materials.

"It is remarkable that Mother Nature allows us to use different pathways to get to these remarkable superconducting states," Dr. Salamat said, who added that dropping the pressure down to zero is the group's next goal.

Dr. Dias said he's confident that achievement is coming: "It is just a matter of time."

<https://www.wsj.com/articles/superconductor-breakthrough-energy-redmatter-90dfa165>

