

October  
2022

# समाचार पत्रों से चयित अंश Newspapers Clippings

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Technologies, Defence Technologies, Defence Policies,  
International Relations and Science & Technology

खंड : 47 अंक : 193

12 अक्टूबर 2022

Vol.: 47 Issue: 193

12 October 2022



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**Press Information Bureau**  
Government of India

*Tue, 11 Oct 2022 9:37 PM*

### **Visit of Air Mshl Vibhas Pande AOC-In-C, Maintenance Command**

Air Marshal Vibhas Pande, Air Officer Commanding in Chief (AOC-in-C), Maintenance Command, visited Air Force Station Tughlakabad, a premier Base Repair Depot (BRD) under Maintenance Command, on 10 Oct 22. AOC-in-C, MC was received by Air Cmde Rishi Seth, Air Officer Commanding (AOC), Air Force Station Tughlakabad. On his arrival, a ceremonial Guard of Honour was presented to the AOC-in-C. The AOC-in-C visited various production wings, calibration facilities, logistics sites and other vital installations. While addressing the Depot personnel, he appreciated the involvement and enthusiasm of all the personnel in ensuring support to operational Units and efforts on indigenisation towards achieving 'Atmanirbharta' or 'self-reliance

<https://pib.gov.in/PressReleasePage.aspx?PRID=1866948>

**R. REPUBLICWORLD.COM**

*Tue, 11 Oct 2022*

### **India is Making Great Strides in Aatmanirbharta in Defence: Here's the Production Line**

Following a history of repeated confrontations with hostile neighbours like Pakistan and China that are actively engaged in waging proxy wars against the state of India, the Nation has seen a significant rise in weapon procurements in recent times. The need of developing indigenous weapons and military equipment including warfighting vehicles was felt immediately after the deadly Galwan valley clash with the Chinese People's Liberation Army (PLA) in May 2020. The clash led to a military standoff between the two nations, which still has not concluded. According to the Global Firepower Index, which releases military strength rankings, the Chinese military ranks 3rd in the power index. It has a strength of 2 million active personnel and a defence budget of \$250 billion. In contrast, India ranks 4th with a strength of 1.4 million active personnel and a defence budget of \$49.6 billion.

## **India's feats in indigenous defence production**

The most relevant development as a step towards indigenous defence production came in 1983 when the government sanctioned the Integrated Guided Missile Development Program (IGMDP). The program resulted in the development of missiles Prithvi (surface-to-surface), Akash (surface-to-air), Trishul (the naval version of Prithvi), Nag (anti-tank), and Agni series of Ballistic missiles. Under the fresh 'Aatmanirbhar Bharat' campaign, an Indian version of the Israeli Tavor rifle is being developed that is known as the Indian Tavor X-95 rifle. Moreover, to enhance the communication among the forces engaged in the operation areas, the army has made a decision to acquire the SDR-TAC. The SDR-TAC, jointly designed and developed by the Defense Electronics Applications Laboratory (DEAL) of the Defense Research & Development Organization (DRDO) will bring strategic depth to the Armed Forces.

Furthermore, in order to enhance India's firepower, the Combat Vehicles Research and Development Establishment (CVRDE) of the Defense Research and Development Organization (DRDO) developed India's main battle tank called Arjun. The latest version of the tank known as Arjun- Mark-1A is more suitable for desert terrain and comes with much more effective and lethal features. As per reports, 72 new features have been added to the new variant. Reportedly, the Arjun Mark-1A will have a better target acquisition system for the daytime. The tank has been dubbed the 'Hunter Killer'. 'Pinaka' multi-barrel rocket launcher system is yet another product developed by the DRDO. The system has an effective range of 40-60 Km and can fire a salvo of 12 HE rockets in 44 seconds. Moreover, in a boost to the prowess of the Indian Navy, an indigenous aircraft carrier, INS Vikrant was launched on 02 September 2022. It is a significant milestone achieved by the country on the account of the Aatmanirbhar Bharat campaign. Launched at the Cochin Shipyard Limited (CSL), the carrier is imbued with the art automation feature, and is the largest ship constructed in the country so far.

Similarly, in a bid to boost the capabilities of the Indian Armed Forces, a multirole fighter jet 'Tejas' was developed by the Aeronautical Development Agency (ADA) in collaboration with HAL's Aircraft Research and Design Centre (ARDC) for the Indian Air Force and Indian Navy. HAL Tejas is a single-engine, delta wing, light multirole fighter capable of carrying a 3.5-ton payload, states the Hindustan Aeronautics Limited website. Furthermore, the recently inducted multirole Light Combat Helicopter (LCH) Prachand, is yet another feat accomplished by the Indian defence sector. Designed and manufactured by Hindustan Aeronautics Limited, the helicopter is set to boost the operational capabilities of the Indian Army Aviation Corps and the Indian Air Force. One significant feature of the chopper is its flight ceiling, which is the highest among all attack helicopters in the world.

The development of Arihant-class submarines is yet another task being undertaken under the Atmanirbhar Bharat Campaign to give a boost to India's maritime security looked after by the Indian Navy. It is a class of nuclear-powered ballistic missile submarines being developed for the Indian Navy under the Advanced Technology Vessel (ATV) project to design and build nuclear-powered submarines. The vessels are classified as 'strategic strike nuclear submarines' by India. Moreover, INS Arihant holds the distinction of being the first ballistic missile submarine to have been built by a country other than the five permanent members of the UNSC.

## **New defense-related procurements**

Among the new procurements to ramp up India's defence capabilities comes the Ak-203 assault rifle. The rifle uses 7.62x39mm ammunition and is set to replace the INSAS rifle which uses

5.56mm ammunition. According to Indian Army veteran, Major Gaurav Arya, the purpose of the INSAS rifle is to wound the enemy rather than kill him. Till now, 70 AK-203 rifles have been delivered to India since Jan 2022. The real purpose of the procurement of arms and ammunition by India is not warfighting but its usage as a tool of deterrence. India has so far been successful in the usage of its soft power in global diplomacy but with new challenges to the nation's security, the country has started realizing the significance of developing its hard power to keep adversaries at bay.

India is currently surrounded by two nuclear-armed nations with a history of conflicts with them. In order to ensure peace and security from any hostile development, India has an urgent need to enhance its military capabilities. The right way forward is the upgradation and strengthening of the arms and equipment to counter any misadventure from the foes.

<https://www.republicworld.com/india-news/general-news/india-is-making-great-strides-in-atmanirbharta-in-defence-heres-the-production-line-articleshow.html>



*Tue, 11 Oct 2022*

## **Bharat Forge Delivers Made-in-India Kalyani M4 for Indian Army's UN Peacekeeping Ops**

Bharat Forge delivered 16 made-in-India Kalyani M4 trucks to the Indian Army for UN peacekeeping operations. The Kalyani M4 is a Quick Reaction Fighting Vehicle (Heavy) and can transport an infantry platoon that is fully equipped for battle. The Kalyani M4 also has the capability to defend its occupants from high kinetic energy threats like powerful mine bursts and grenades. The Kalyani M4 completed a series of severe vehicle trials held in the deserts of Rann of Kutch and the sub-zero landscapes of Leh and Ladakh. Speaking about the recent delivery, Baba N. Kalyani, Chairman, and Managing Director, Bharat Forge said, "We are delivering the Made in India Kalyani M4 for UN Peacekeeping missions. This encourages us to work for the benefit of our armed forces and it reinforces our commitment to harness our Prime Minister's vision for Atmanirbharat and self-reliance in the defence sector."

Amit Kalyani, Deputy Managing Director, Bharat Forge added, "Keeping crew safety and vehicle performance as paramount factors, Kalyani M4 has been ergonomically and aesthetically designed to allow the crew to perform their duties in an optimum manner." With a fighting radius of almost 800 kilometres, the Kalyani M4 can quickly increase the necessary battle power in all sorts of terrain. The Army's northern command also recently added the Kalyani M4 to its fleet of armoured vehicles. The company claims that, three 10 kg TNT explosives placed underneath the wheels and a 50 kg IED blast to one side won't damage the vehicle.

<https://www.financialexpress.com/defence/bharat-forge-delivers-made-in-india-kalyani-m4-for-indian-armys-un-peacekeeping-ops/2706924/>

## **Rolls-Royce, Safran & GE Offer to Power India's 5th-Gen AMCA Stealth Fighter Jet, but Export Restrictions Inevitable**

India is developing its fifth-gen fighter jet, codenamed Advanced Medium Combat Aircraft (AMCA). With the induction of the stealth fighter slated for 2035 and the decision on the engine yet to be taken, several foreign manufacturers have offered to power the AMCA aircraft. To that end, a delegation from the Defense Research and Development Organization (DRDO) met the representatives from the UK-based Rolls Royce last week to discuss the Advanced Medium Combat Aircraft (AMCA) Engine, Financial Express reported. The DRDO officials were visiting the Rolls Royce plant in the UK. The British company currently manufacturing engines for sixth-generation fighters like British Tempest and Japan's F-X is eager to collaborate with India for its fifth-generation engine needs.

It has offered to jointly develop and produce engines for the nation's fifth-generation fighter aircraft program. Rolls Royce had first expressed interest in developing an engine for AMCA in 2021. After a fruitful meeting between the two sides, the Indian High Commissioner to the United Kingdom tweeted: "An instructive and impressive day visit to Rolls Royce facilities near; give possibilities to build on existing and historical partnerships in cutting-edge areas of technology." Rolls Royce has reportedly offered a Eurojet EJ200 version with a thrust of 110-120KN. If the talks between the two go through, a joint venture will be established between Rolls Royce and DRDO. Under the JV, the Intellectual Property Right (IPR) for the High Thrust Low bypass engine (110kn+) will be retained by India, according to Kishore Jayaraman, Head of Rolls Royce India and South Asia.

The French company Safran has also submitted a proposal to the Indian government to co-develop with DRDO's Gas Turbine Research Establishment (GTRE) a new state-of-the-art 110-kilo Newton thrust engine for India's AMCA fighter project. Like its European rival Rolls Royce, Safran also has skin in the game. It is one of the main contributors to the 36 Rafales that India acquired in 2016. The SAFRAN-DRDO joint venture is planned with complete ToT and is based on the M88 engine base type. Besides French and British companies, American engine major General Electric (GE) has also entered the game. Earlier this year, it had offered to develop the jet engine for India's under-development AMCA aircraft, three years after suspending joint development of aircraft engines under the Defense Trade and Technology Initiative (DTII) in October 2019.

The American corporation GE is the supplier of F404IN20 engines for the Light Combat Aircraft (LCA) Tejas Mk-1. The company's F414-INS6 engines were also selected to power the MK-2 version of the LCA, and the company's CFM56 engines power the Indian Navy's P-8I. The CT7-8 engines power the Indian Air Force's VVIP squadron of AW101. Procuring advanced and cutting-edge technology from foreign partners will allow India to wield formidable aircraft. However, it does not automatically translate to independent



manufacturing capability and would inadvertently limit the export of the AMCA to other countries.

### **Imported Engines could be an Antidote**

While the French manufacturer has promised the Transfer of Technology (ToT) for India's AMCA, the British Rolls Royce has proposed the transfer of Intellectual Property rights (IPR). However, ToT and IPR ownership generally do not indicate the ability to manufacture independently, forget about exporting. Even though Tejas is India's indigenous fighter jet, there are many foreign components in it. Currently, 50 to 65% of the components of the Tejas are indigenous, and the rest have been imported from foreign companies. India originally intended to use the state-run DRDO's Kaveri engine, which was built domestically. Later, India ended up choosing the US-made GE F404 engine. These foreign components give Tejas superior capabilities over its international rivals. They do, however, have a drawback.

India cannot independently export the Tejas fighter plane to any country due to its reliance on foreign components. The nations that helped build the Tejas may object to its sale to any of their adversaries. Transfer of Technology and Intellectual Property Rights are meaningless unless India has the industrial base of manufacturing all the components that will go into the engine. The country is now years away from acquiring such a capability. The Original Equipment Manufacturers (OEMs) can sanction the supply of components bringing production to a halt anytime, or the OEM can refuse export permission. Also, an incomplete clause built into such contracts would not allow the importing country to get the components manufactured from any other source if the OEM discontinues supply.

Squadron Leader Vijander K Thakur (ret'd) told EurAsian Times, "India could acquire the technology to manufacture critical components such as turbine blades for a hot engine. It should also require design ToT. We built the Vikas rocket motor with help from France under a similar arrangement. Getting the vendor to part with critical manufacturing technology will require hard bargaining for which India must be prepared." However, according to reports, IPR would guarantee that engines may be sold to other parties and that the United Kingdom does not have veto power over India in case of geopolitical fallout. Officials from the company claim that Rolls-Royce believes it can work well with AMCA to produce engines in India. This area shows the ability to jointly develop, produce, and create things in the future. Additionally, it is congruent with India's *Atmanirbhar* (*self-reliant*) philosophy and commitment to local design and manufacture.

This becomes especially relevant given that India is striving to relinquish the image of a net defense importer and aspiring to export indigenously developed weapons. Although Safran and Rolls-Royce are the main rivals, Safran has not yet met the specifications for Rafale jet engines. The transfer of aircraft engine technology is included in the offset requirement of the Rafale deal. Indian AMCA is envisioned as a twin-engine stealth aircraft with an internal weapons bay and diverter-less supersonic intake, which has been produced for the first time and for which the design is now complete. It will be a 25-ton aircraft with an internal payload of 1,500 kilograms and an external payload of 5,500 kilograms in addition to 6,500 kilograms of internal fuel. The AMCA is scheduled to make its first flight in 2024-25, with series production starting in 2030.

<https://eurasianimes.com/rolls-royce-safran-ge-offer-to-power-indias-5th-gen-amca/>

Tue, 11 Oct 2022

## India's Armenian Moment

*By Ashok Kumar, VSM (Retd)*

The recent decision of the Indian Government to export arms and ammunition to Armenia during the Armenia-Azerbaijan conflict in Nagorno-Karabakh has not to be merely taken as an exercise to enhance the defence exports wherein it is targeting approximately 35,000cr export by the year 2025. In the year gone by, India exported defence related equipment a little over 10,000cr and the same is being relentlessly progressed further. Requisite barriers are being removed, private sector is being encouraged for defence manufacturing and exports and defence related imports are also being reduced. In the light of these indicators, it may seem obvious to some that the recent decision of Indian Government to export defence equipment close to 2000cr on a Government to Government model to include indigenous PINAKA Multi barrel rocket launchers, anti tank launchers and a wide range of ammunition and other warlike stores is merely a defence export enhancing activity but detailed analysis will indicate that India has decided to come out of its conventional shackles and is willing to take stakes at the international stage to further its national interests.

Armenia came into being as an independent state on 21 Sep 1991 after the collapse of the USSR in 1991. As a country, it has been balancing its relationship between Russia on one hand and with the USA and the West on the other hand. It has been a founding member of Collective Security Treaty Organisation (CSTO) with Russia but at the same time, it has also been part of certain NATO groupings but not being part of NATO as yet. While Azerbaijan has also tried to balance its relations with the West and Russia, Turkey as well as Pakistan- strong opponents of India- have been strong supporters of Azerbaijan. Despite positive overtures of India for better and positive relationship with Pakistan as well as Turkey, both have continued their open criticism of India in regional as well as international forums on a regular basis.

Provision and supply of warlike stores, arms and ammunition to Armenia at the time of active conflict relates to a different kind of international messaging by India. While Indian defence establishments as well as private sector working in the defence domain have exported defence and warlike stores to close to 40 countries in the world, this export is not only special in terms of its value and timings but also in terms of the nature of the equipment. India has already exported its Swathi radar to Armenia earlier that too during the conflict between Armenia and Azerbaijan but the said radar was a weapon locating radar and no major fire power delivery weapon systems were included. As against that, the current consignment includes major fire power systems along with ammunition which may have a favourable outcome for Armenia in the ongoing conflict. This export, thereafter, has following major connotations:

- India has been primarily participating in troop deployments under UN mandate. It has turned down even USA's request in 2003 to participate in the Iraq stabilisation force without a UN mandate.
- India has been assisting its neighbours based on their request like it did in the case of Sri Lanka and Maldives. The support was both in terms of troops and the equipment.
- Like all other major defence equipment exporting countries including USA and Russia, India may export



the defence equipment even to opposing countries but it is yet to reach that stage. • Armenian defence export is indicative of India being on the side of Armenia in an open manner while an active conflict continues between Armenia and Azerbaijan. By implication, India has chosen to oppose Azerbaijan and its all weather supporters to include Turkey and Pakistan.

• The Indian approach to being an ‘inward looking’ country has finally changed. Not only in the political and diplomatic domain, India has been leveraging its military capability as well to further its national interest that too on the international stage. • Armenia has been supportive of the Indian stance on Kashmir and considers the entire state of J&K as part of India. This assistance to Armenia at its critical need time will further cement this bond. • Turkey has been opposing India and Indian policies off late due to its open support to Pakistan. The century-old relations have soured in recent years as it has opposed abrogation of Article 370 in J&K taking the Pakistani side not only in open forums but also in the United Nations. The recent meeting between the PMs of both countries during the recently concluded SCO summit has not resulted in improved relations to the level desired. Armenian defence export by India is, therefore, also a strong message to Turkey to mend its ways. Similar messaging has been given by India by supporting Syria too.

• Pakistan is also dead against Armenia and is siding with Azerbaijan. With recent support from the US, Pakistan has been emboldened and is opposing India on all the forums despite facing severe economic and existential challenges. India’s defence export to Armenia is also a message for Pakistan as well as those opposed to Indian interests. India is now willing to take sides rather than following the ‘Non aligned’ approach and the side it chooses is based on its national interest alone. India has already demonstrated its diplomatic ability to tread a path aligned to its national interest whether it is in the case of China on the LAC in the Eastern Ladakh, standing with Russia during the Russia-Ukraine conflict as a reliable friend for a country which had openly supported India during the 1971 operations as well as during UN votes.

While India has shown its willingness to improve its engagement with USA further, US sale of F-16 related spares under the garb of counter terrorist operations well as statement of US Ambassador to Pakistan related to POK have not gone well with India. The best part is that the Indian nation has matured now to state the facts more directly even with the USA. Armenian defence export by India has propelled India at international level in the military domain. It will not be surprising if India of tomorrow becomes a part of some security alliance with some countries to preserve and further its national interests. India’s Armenian moment declares the unambiguous arrival of India on the international stage.

[https://www.financialexpress.com/defence/indias-armenian-moment/2707091/?utm\\_source=defence\\_landing\\_page&utm\\_medium=article\\_listing\\_widget&utm\\_campaign=Tags](https://www.financialexpress.com/defence/indias-armenian-moment/2707091/?utm_source=defence_landing_page&utm_medium=article_listing_widget&utm_campaign=Tags)

## India-Australia Defence Ties Contributed Significantly to Free, Open Indo-Pacific: Jaishankar

The United States, India and several other world powers have been talking about the need to ensure a free, open and thriving Indo-Pacific in the backdrop of China's rising military manoeuvring in the region. "Spent an instructive morning with the Australian Armed Forces. Our defence and security collaboration contributes significantly to a free and open Indo-Pacific," he tweeted along with a picture. Addressing a joint press conference here with his Australian counterpart Penny Wong, Mr. Jaishankar on Monday said he had a "very useful, very productive and very comfortable discussion" on a range of bilateral and global issues. Mr. Wong said that Australia and India have recognised that the Indo-Pacific region is being "reshaped" both economically and strategically and underlined that the partnership with India is a "critical part" of shaping the region.

"We can only build and sustain the region we want by working with others, including by working in partnership with India and for Australia, this partnership is a critical part of shaping the region we want," Mr. Wong said on Monday. China claims nearly all of the disputed South China Sea, though Taiwan, the Philippines, Brunei, Malaysia and Vietnam all claim parts of it. Beijing has built artificial islands and military installations in the South China Sea. Mr. Jaishankar received a warm 'Tiranga welcome' on his visit to Australia on Sunday as India's tricolour lit the country's old Parliament House in Canberra. This is his second visit to Australia this year. The first visit was in February 2022 when he attended Quad Foreign Ministers' Meeting in Melbourne.

<https://www.thehindu.com/news/national/india-australia-defence-ties-contributed-significantly-to-free-open-indo-pacific-jaishankar/article65996013.ece>

## South Korea Says it has 'Ability to Intercept' North's Missiles

South Korea said Tuesday it's capable of detecting and intercepting the variety of missiles North Korea launched in a barrage of recent simulated nuclear attacks on its rivals, though it maintains the North's advancing nuclear program poses a grave security threat. North Korea said Monday its two weeks of firing drills involved nuclear-capable ballistic missiles, warplanes and other assets to practice possible attacks on South Korean and U.S. targets. North Korea said the drills were meant to issue a warning to Seoul and Washington, which staged provocative joint naval drills involving a U.S. aircraft carrier. The North Korean launches, part of its record-breaking run of weapons tests this year, were seen as an attempt by leader Kim Jong Un to acquire a more

intimidating arsenal to pressure its rivals to accept the North as a legitimate nuclear state and lift economic sanctions on the North.

Moon Hong Sik, acting spokesperson at the South Korean Defense Ministry, described North Korean nuclear threats as “very grave and serious.” But he told reporters that the South Korean missile defense system is capable of detecting and intercepting the weapons systems that North Korea said it mobilized in its drills. Moon said South Korea is still pushing to introduce spy satellites, various surveillance drones and additional sea-based reconnaissance assets to better monitor North Korea. Despite Moon’s comments, some observers have said a portion of the North’s newly developed weapons — such as a highly maneuverable KN-23 missile modeled on Russia’s Iskander missile and a developmental hypersonic missile — may overcome South Korean and U.S. missile defenses. They also say if North Korea launches multiple missiles from different sites simultaneously, it would be more difficult for the allies to spot liftoffs in advance and shoot them down.

South Korean President Yoon Suk Yeol reiterated his vow to strengthen South Korea’s defense in conjunction with its alliance with the United States and their trilateral security cooperation with Japan. He said the recent weapons demonstrations showed that the North’s nuclear threat is “getting serious every day.” “North Korea has been consistently developing and advancing nuclear weapons capabilities and is now threatening not only (South Korea) but the entire world, but I think there is nothing North Korea could gain through nukes,” Yoon told reporters at his office in Seoul. He tried to reassure the public, calling for South Koreans to “not worry too much and do your best with economic activities and livelihoods.” Outside concerns about North Korea’s nuclear program have grown since the North last month adopted a law authorizing the preemptive use of nuclear weapons in certain situations. South Korea’s military has since warned North Korea that it would self-destruct if it uses its bombs.

In August, Kim Yo Jong, the powerful sister of Kim Jong Un, ridiculed what she called the U.S. and South Korean militaries’ misidentification of the exact site for the North’s two previous missile tests. “If the data and flight trajectory (of the missiles) are known, (South Korea) will be so bewildered and afraid,” she said. According to North Korean announcement on its seven rounds of launches, the weapons mobilized in the drills include a new type of intermediate-range ballistic missile that traveled about 4,500 kilometers (2,800 miles), a distance sufficient to reach the U.S. Pacific territory of Guam and beyond. Some experts say the new missile may aim to target a faraway site like Alaska or Hawaii. Another missile that North Korea said was launched from a silo under an inland reservoir was likely a new version of its KN-23 missile, whose highly maneuverable and lower-trajectory flight provides it with greater chances of evading missile defense systems.

North Korea's first missile firing under a reservoir was believed to be aimed at diversifying its launch sites to curtail enemy missile defenses. In recent years, North Korea has also been pushing to build bigger submarines to acquire a nuclear retaliatory attack capability. Before the North’s announcement, South Korea, Japan and U.S. authorities reported all seven rounds of missile launches. But none of their public reports included a reservoir-launched missile, an apparent failure to detect whether the weapon was launched from underwater. Kim Jun-rak, a spokesperson at South Korea’s Joint Chiefs of Staff, told reporters that a missile launch from a reservoir was seen as a desperate attempt by North Korea to escape South Korean and U.S. surveillance. He said a ballistic missile launched from a submarine is an effective weapons

system but didn't say whether the reservoir-fired missile would pose a new security threat to South Korea.

In the face of the increasing North Korean nuclear threat, South Korea has been strengthening its missile defenses while also developing preemptive attack plans. The United States, which deploys about 28,500 troops in South Korea, has been operating an advanced anti-missile system called Terminal High Altitude Area Defense in southern South Korea since 2017, apparently aimed at protecting nearby regions and additional U.S. forces that may arrive through Busan and other southern South Korean ports in the event of war. The U.S. and South Korean militaries also operate Patriot batteries to defend key military facilities and the Seoul capital region, and South Korea is also developing indigenous systems designed to intercept various kinds of North Korean missiles.

<https://www.hindustantimes.com/world-news/south-korea-says-it-has-ability-to-intercept-north-s-missiles-101665472408898.html>

## Science & Technology News

 **The Indian EXPRESS**

Mon, 10 Oct 2022

### **New Plastic Upcycling Tech can Potentially Cut Greenhouse Gas Equivalent to 3 Million Cars**

Researchers have developed a breakthrough upcycling process that can help transform polyethylene (PE)—the most widely used plastic in the world— into polypropylene, which is one of the top 5 most common plastic types in the world. “Today unfortunately a major fraction of PE is not recycled and accumulates in landfills. The fraction that is collected is recycled in the form of energy through combustion. This recycling approach is not really sustainable,” said Damien Guironnet to indianexpress.com over an email. Guironnet is a professor of chemical and biomolecular engineering at the University of Illinois Urbana-Champaign and co-lead author of the research article published in the *Journal of the American Chemical Society* on Friday. According to the researchers’ preliminary analysis, if just 20 per cent of the world’s PE plastic production could be recovered and converted using this method, it could reduce as much greenhouse gas emissions as taking three million cars off the road.

The researchers developed a proof-of-concept for upcycling PE plastic—a reactor that creates a flow of propylene, which can be turned into PP using current technology. The reactor does this by cutting PE molecules many times into small pieces of propylene molecules. The process begins when a catalyst removes hydrogen from the PE chain, creating a location where a reaction can happen. After this, a second catalyst splits the chain in two before finally, a third catalyst moves the reaction up the PE chain so that the process can be repeated by the first catalyst. When the process is complete, 95 per cent of the finished product is propylene. The other 5 per cent is

butene, a chemical that has many uses in the plastic production, gasoline and rubber manufacturing industries. A similar process has been documented in a research article published in the journal *Science* on Thursday. According to the researchers, the research team that authored the *Science* article used a process that is more energy intensive.

Guironnet is confident that the technology is scalable and can be adapted to current industry needs but the research faces a few obstacles before it can be applied at a large enough scale. “The biggest challenge is the catalyst stability. To scale up such a process we will need to identify catalysts that are extremely robust. PE waste always comes with impurities. To remain scalable, we would need to find catalysts that remain unaffected by these impurities,” explained Guironnet. If the researchers manage to find a stable enough catalyst, then the PE that is being upcycled does not need to be as pure but if the catalyst is sensitive, that would mean that the PE has to be cleaned, which will make the solution more expensive.

<https://indianexpress.com/article/technology/science/plastic-upcycling-polyethylene-pe-popolypropylene-pp-8200289/lite/>



*Tue, 11 Oct 2022*

## **Eye in the Sky: ISRO and NASA Develop World’s First Dual Frequency Radar — NISAR**

The Indian space agency, Indian Space Research Organisation (ISRO) and the American space agency, National Aeronautics and Space Administration (NASA), have been working together to build a state-of-the-art Earth observation satellite. The satellite, NASA-ISRO Synthetic Aperture Radar (NISAR), will work along the lines of the European Space Agency’s (ESA) Sentinel 1.

### **Leaning On the Giant**

India launched its first indigenous radar imaging satellite only in 2012. This enabled Earth observation during day and night in all types of weather. In 2014, during Prime Minister Narendra Modi’s visit to the US, ISRO and NASA signed a memorandum to work together on a new radar satellite for Earth observation. A Joint Steering Group for NISAR held its first meeting in 2015. Both agencies will be putting their best foot forwards and combining their strengths. NASA’s Jet Propulsion Laboratory (JPL) will be responsible for the L-band SAR for the satellite. Additionally, it will provide the Global Positioning System (GPS) and a data recorder. On the other hand, ISRO will spearhead the SAR’s S-band. Further, it is ISRO’s responsibility to provide for the spacecraft bus, data transmission system, integration and testing, and launch using the GSLV. ISRO will also be responsible for the on-orbit operations.

At an orbit altitude of 747 KM and an orbit inclination of 98.4 degrees, the NISAR satellite will be in a sun-synchronous dawn-dusk orbit; that is, it will move in tandem with the sun. Depending upon the agencies, it will be either in perpetual dawn or dusk. On average, the satellite will repeat its cycle in 12 days and cover the Earth in about six days. The mission is planned for three

years of life but can sustain at least five years of operation. NASA's science operations with the L-band radar will be satisfied with three years of operability. Meanwhile, ISRO requires five years of operations with the S-band radar. Given the quality and extended life of other missions like ISRO's Mars Orbiter Mission, it is likely that the operation will be extended.

It will be stabilised on three axes using reaction wheels to ensure it is always oriented towards the Earth correctly. According to NASA's JPL, NISAR's data, which will be available for free to the public, will be vital to decoding the impact of climate change. It will provide better monitoring of vegetation than the Sentinel-1.

### **There Were Two: S-band and L-Band**

For the NISAR mission, the frequencies used for L-band and S-band are 1.25 GHz and 3.22 GHz, respectively, with a variation in the incident angle of 33 degrees and 47 degrees, respectively. NISAR will perform interferometry, taking continuous overlapping images over 12 days. Then, by combining all these images, the movement of the land can be captured down to a few millimetres. Studying various natural disasters and the movement of the Earth's crust is beneficial to evaluate and understand the changes our planet undergoes.

“The S-band is helpful for close and far-range weather observations. Atop the NISAR, it will offer excellent soil penetration to study the changes to the soil. L-band, however, is more focused on vegetative study. It penetrates the forest canopies and can scatter due to the trunks, dirt, etc.,” explained Girish Linganna, Aerospace & Defence Analyst. “This means that simultaneously NISAR will be able to capture the changes above the ground and under it. This marriage of data will be unprecedented. It will enable scientific study as well as an application for years to come,” Girish Linganna, adds.

### **Delay**

The project was delayed due to the Covid-19 pandemic; however, given the collaborative nature of the project, the teams were used to remote work environments. In 2021, ISRO shipped its S-band payload to NASA's JPL. The NASA team was recently in India, and both agencies hinted at a Q1 2023 launch.

<https://www.financialexpress.com/defence/eye-in-the-sky-isro-and-nasa-develop-worlds-first-dual-frequency-radar-nisar/2706691/>



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