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समाचार पत्रों से चयित अंश Newspapers Clippings

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Defence Strategic: National/International



Press Information Bureau
Government of India

Ministry of Defence

Thu, 03 March 2022 1:39PM

MoD accords in-principle approval to four projects under Make-I (Government Funded) & five under Make-II (industry-funded) categories of Defence Acquisition Procedure 2020

In a major boost to Prime Minister Shri Narendra Modi's clarion call for 'Aatmanirbharta', Ministry of Defence (MoD), in a landmark step, has offered four projects to the Indian Industry for design & development under Make-I category of Defence Acquisition Procedure (DAP) 2020. The industry will be provided financial support for prototype development of these projects. The list of projects which were accorded 'Approval In-Principle (AIP)' by Collegiate Committee of MoD is as follow:

- **Indian Air Force:** Communication Equipment with Indian Security Protocols (Routers, Switches, Encryptors, VoIP Phones and their software)
- **Indian Air Force:** Airborne Electro Optical pod with Ground Based System
- **Indian Air Force:** Airborne Stand-off Jammer
- **Indian Army:** Indian Light Tank

This is for the first time since the launch of industry-friendly DAP-2020 that Indian Industry has been involved in development of big ticket platforms such as Light tank and Communication Equipment with Indian security protocols.

In addition, AIP has also been accorded to following five projects under industry-funded Make-II procedure:

- **Indian Air Force:** Full Motion Simulator for Apache Helicopter
- **Indian Air Force:** Full Motion Simulator for Chinook Helicopter
- **Indian Air Force:** Wearable Robotic Equipment for Aircraft Maintenance
- **Indian Army:** Integrated Surveillance and Targeting System for Mechanised Forces
- **Indian Army:** Autonomous Combat Vehicle

Projects under 'Make-II' category involve prototype development of equipment/system/platform or their upgrades or their sub-systems/sub-assembly/assemblies/components, primarily for import substitution/innovative solutions, for which no Government funding will be provided for prototype development purposes.

The indigenous development of these projects in the country will help harness the design capabilities of Indian defence Industry and position India as a design leader in these technologies.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1802587>



पत्र सूचना कार्यालय
भारत सरकार

रक्षा मंत्रालय

Thu, 03 March 2022 1:39PM

रक्षा मंत्रालय ने रक्षा अधिग्रहण प्रक्रिया 2020 की मेक-1 (सरकारी वित्त पोषित) श्रेणी के तहत चार परियोजनाओं और मेक-11 (उद्योग-वित्त पोषित) श्रेणी के तहत पांच परियोजनाओं को सैद्धांतिक रूप से मंजूरी दी

प्रधानमंत्री श्री नरेन्द्र मोदी के 'आत्मनिर्भर भारत' के आह्वान को अधिक बढ़ावा देने के लिए रक्षा मंत्रालय ने एक ऐतिहासिक कदम उठाते हुए रक्षा अधिग्रहण प्रक्रिया (डीएपी) 2020 की मेक-1 श्रेणी के तहत डिजाइन और विकास के लिए भारतीय उद्योग की चार परियोजनाओं की पेशकश की है। उद्योग को इन परियोजनाओं के प्रोटोटाइप विकास के लिए वित्तीय सहायता प्रदान की जाएगी। रक्षा मंत्रालय की कॉलेजिएट कमेटी द्वारा जिन परियोजनाओं को 'सैद्धांतिक रूप से मंजूरी' (एआईपी) दी गई है उनकी सूची इस प्रकार है:

- भारतीय वायु सेना: भारतीय सुरक्षा प्रोटोकॉल के साथ संचार उपकरण (राउटर, स्विच, एन्क्रिप्टर्स, वीओआईपी फोन और उनके सॉफ्टवेयर)
- भारतीय वायु सेना: भू-आधारित प्रणाली के साथ एयरबोर्न इलेक्ट्रो ऑप्टिकल पॉड
- भारतीय वायु सेना: एयरबोर्न स्टैंड-ऑफ जैमर
- भारतीय सेना: भारतीय लाइट टैंक

उद्योग के अनुकूल डीएपी-2020 के लॉन्च के बाद ऐसा पहली बार हुआ है कि भारतीय उद्योग को भारतीय सुरक्षा प्रोटोकॉल के साथ लाइट टैंक और संचार उपकरण जैसे बड़े टिकट प्लेटफॉर्म के विकास में शामिल किया गया है।

इसके अलावा, उद्योग द्वारा वित्त पोषित मेक-11 प्रक्रिया के तहत निम्नलिखित पांच परियोजनाओं के लिए एआईपी भी प्रदान किया गया है:-

- भारतीय वायु सेना: अपाचे हेलिकॉप्टर के लिए पूर्ण गति सिम्युलेटर
- भारतीय वायु सेना: चिन्कू हेलिकॉप्टर के लिए पूर्ण गति सिम्युलेटर
- भारतीय वायु सेना: विमान रखरखाव के लिए पहनने योग्य रोबोटिक उपकरण
- भारतीय सेना: यंत्रिकृत बलों के लिए एकीकृत निगरानी और लक्ष्यीकरण प्रणाली
- भारतीय सेना: स्वायत्त लड़ाकू वाहन

'मेक-11' श्रेणी के तहत परियोजनाओं में मुख्य रूप से आयात प्रतिस्थापन/नवाचारी समाधानों के लिए उपकरण/प्रणाली/प्लेटफॉर्म या उनके उन्नयन या उनकी उप-प्रणालियां/उप-असेंबली/असेंबलियां/घटकों का प्रोटोटाइप विकास शामिल है, जिसके प्रोटोटाइप विकास उद्देश्यों के लिए कोई सरकारी वित्त पोषण प्रदान नहीं किया जाएगा।

देश में इन परियोजनाओं के स्वदेशी विकास से भारतीय रक्षा उद्योग की डिजाइन क्षमताओं का लाभ उठाने में मदद मिलेगी और इन प्रौद्योगिकियों में भारत को एक डिजाइन दिग्गज के रूप में स्थापित होने में भी सहायता मिलेगी।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1802641>



Press Information Bureau
Government of India

Ministry of Defence

Thu, 03 March 2022 3:22PM

Hybrid seminars organised during DefExpo 2022 to ensure greater participation

Ministry of Defence is hosting the 12th edition of prestigious biennial defence exhibition, DefExpo 2022, at Gandhinagar, Gujarat from March 10-14, 2022. This mega defence international exhibition is focussing on land, air, naval, internal homeland security and electronic systems. The Government, with policy initiative of 'Make in India' and 'Aatmanirbhar Bharat' believes that India has tremendous potential to emerge as a global defence manufacturing hub. Therefore, the same theme has been adopted for Def Expo 2022.

The DefExpo seminars will be held in a hybrid format, enabling the speakers as well as the audience to participate in various seminars virtually. The seminars, which will be streamed worldwide, will be conducted by leading industry fora, international fora, think-tanks, media houses, Indian industry, DRDO, Ministry of Civil Aviation, state governments etc. The seminars are themed on exports, future of Civil Aviation in India, R&D, Future of Conflicts, Aero Engines and MRO, Outreach programs by the State Governments on investment opportunities etc. Leading international and national experts from defence and aerospace sectors have been invited as speakers for the seminars. The details of the seminars are available on DefExpo 2022 website (<https://defexpo.gov.in/>) and DefExpo 2022 mobile app.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1802640>



पत्र सूचना कार्यालय
भारत सरकार

रक्षा मंत्रालय

Thu, 03 March 2022 3:22PM

डिफेंस एक्सपो 2022 के दौरान अधिक से अधिक लोगों की भागीदारी सुनिश्चित करने के लिए हाइब्रिड (ऑनलाइन एवं ऑफलाइन) सेमिनारों का आयोजन

रक्षा मंत्रालय 10 से 14 मार्च 2022 तक गुजरात के गांधीनगर में प्रतिष्ठित द्विवार्षिक रक्षा प्रदर्शनी के 12वें संस्करण डेफएक्सपो 2022 की मेजबानी कर रहा है। यह विशाल अंतर्राष्ट्रीय रक्षा प्रदर्शनी थल, वायु और नौसेना, देश के आंतरिक हिस्सों की सुरक्षा एवं इलेक्ट्रॉनिक रक्षा प्रणालियों पर केंद्रित है। 'मेक इन इंडिया' और 'आत्मनिर्भर भारत' की नीतिगत पहल के साथ ही सरकार का यह भी भरोसा है कि भारत में रक्षा विनिर्माण के वैश्विक केंद्र के रूप में उभरने की जबरदस्त क्षमता है। यही कारण है कि डेफ एक्सपो 2022 के लिए इसी विषयवस्तु को अपनाया गया है।

डेफ एक्सपो सेमिनार हाइब्रिड प्रारूप में आयोजित किए जाएंगे, जिससे वक्ताओं के साथ-साथ दर्शक भी विभिन्न सेमिनारों में वर्चुअल माध्यम से हिस्सा ले सकेंगे। प्रमुख उद्योग मंचों, अंतरराष्ट्रीय फोरम, थिंक टैंकों, मीडिया हाउसों, भारतीय उद्योग, डीआरडीओ, नागरिक उड्डयन मंत्रालय, राज्य सरकारों आदि के

द्वारा दुनिया भर में प्रसारित होने वाले सेमिनारों का आयोजन किया जाएगा। ये सम्मेलन निर्यात, भारत में नागरिक उड्डयन के भविष्य, अनुसंधान एवं विकास, संघर्षों की संभावनाएं, एयरो इंजन और एमआरओ, निवेश के अवसरों पर राज्य सरकारों द्वारा आउटरीच कार्यक्रमों आदि पर आधारित हैं। रक्षा और एयरोस्पेस क्षेत्रों के प्रमुख अंतरराष्ट्रीय व राष्ट्रीय विशेषज्ञों को इन कार्यक्रमों में वक्ताओं के रूप में आमंत्रित किया गया है। संगोष्ठियों का विवरण डिफेंस एक्सपो 2022 की वेबसाइट (<https://defexpo.gov.in/>) और डेफ एक्सपो 2022 मोबाइल ऐप पर उपलब्ध है।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1802669>



Fri, 04 March 2022

Defence boost: IIT Kanpur, OFMK develop SRS for precision artillery fire

The soft recovery system (SRS) bears the potential to arrest the motion of a 30 mm supersonic projectile moving at a speed of roughly Mach 3 - three times the speed of sound, within a 50-meter distance.

Lucknow: The Indian Institute of Technology Kanpur (IIT-K) and Ordnance Factory Medak (OFMK), have developed soft recovery system for supersonic projectile, an IIT-K press release stated.

OFMK is a unit of Armored Vehicles Nigam Limited (AVNL). The soft recovery system (SRS) bears the potential to arrest the motion of a 30 mm supersonic projectile moving at a speed of roughly Mach 3 - three times the speed of sound, within a 50-meter distance.

SRS technology is used for the recovery of a projectile after initial impact with minimum damage. This is to ensure the development of smart and intelligent warheads with maximum effectiveness and minimum collateral damage. Acquisition of SRS technology is a pre-requisite for the development of smart and guided munitions, officials said.

This SRS technology has been developed under the collaborative efforts and leadership of prof. Nachiketa Tiwari of IIT-K, Alok Prasad, general manager, OFMK, the release stated.

“Heartiest congratulations to the whole team for successfully developing the SRS system for projectiles in conjunction with OFMK. It is a milestone in the Atmanirbhar Bharat initiative of the Indian government,” said Lt. Gen. A. Mukherjee (retd).

“My compliments to professor Nachiketa Tiwari of IIT-K and Alok Prasad, GM, Ordnance Factory, Medak for jointly developing the SRS to strengthen the growing need for smart munitions to ultimately manufacture smart bombs which will greatly increase the accuracy of the artillery shell,” Lt. Gen. Sanjay Kulkarni (retd) said.

“Artillery gun fire shells have huge dispersion and are known as area weapons. Now with increased kill probability due to SRS technology, the artillery will be able to fire killer projectiles which will be more lethal and accurate, thereby cutting on the cost to neutralise targets. I sincerely believe this will strengthen our resolve to become self-reliant in critical technology and also enhance our export potential,” he added.

“Development of futuristic ammunition requires advanced validation techniques and SRS is the most important of them all. It is a unique capability which should be further expanded to higher calibre ammunition. Such testing facilities will help design agencies and defense startup companies in the field of smart munitions development,” said Bharat Singh, OFMK general manager (retd).



IIT Kanpur, OFMK develop SRS for precision artillery fire (file)

Prof Abhay Karandikar, IIT-K director, said, “IIT-K favours multi-stakeholder collaboration for holistic development in research and innovation sector. This is another prime step in this regard and I am glad that IIT-K has contributed to the key development in defense area by developing SRS. It would not only assist in the effective recovery of supersonic projectiles, but also would contribute towards the larger goal of attaining India’s self-reliance in developing advanced defense systems.”

Only few countries have SRS at the moment AND with this development, India has joined select countries who have this. IIT Kanpur team was involved in concept development, design and virtual validation of the SRS, officials said. They also undertook the testing of sub-assemblies; while AVNL’s OFMK was instrumental in fabricating and assembling roughly 50-meter-long assembly to exacting standards, officials said.

Last year, IIT-K and Ordnance Factory Board (OFB), Kolkata had signed a memorandum of understanding to offer customised master of design (M. Des.) program for officers sponsored by OFB, to help them design sophisticated weapons and weapon-systems.

<https://www.hindustantimes.com/cities/lucknow-news/defence-boost-iit-kanpur-ofmk-develop-srs-for-precision-artillery-fire-101646332042179.html>



Fri, 04 March 2022

Army orders more mini vertical take-off UAVs

It had earlier ordered the same UAV in two separate deals

By Dinakar Peri

New Delhi: Mumbai-based drone manufacturer ideaForge has announced that it has won a repeat contract from the Army to supply 200 of its Switch mini Vertical Take-Off and Landing (VTOL) Unmanned Aerial Vehicle (UAV) along with its accessories. The Army had earlier ordered the same UAV in two separate deals.

“ideaForge won this contract against stiff competition from Israel, Russia, Ukraine, France, India and others. The Switch UAV was the only system that emerged successful from the rigorous testing and field trials that the Indian Army is well known for,” a company statement said.

The traditional understanding was that a fixed wing UAV would be the ideal solution for last mile deployments, ideaForge said adding, on analyzing the actual operational constraints that the Army faced, they realised that a hybrid VTOL platform which can take off without a runway or by hand launching would be the ideal solution.

“ideaForge has engineered this product with the unique VTOL approach, keeping in mind the terrain challenges in the operational areas of the Indian Army,” Ankit Mehta, ideaForge Co-Founder and CEO, said in the statement. “Looking ahead, we want to take this expertise across the world, to everyone in need of protecting their borders or to empower their forces with unprecedented last mile situational awareness,” he added.

In the last two years, the Army has signed a series of contracts with Indian start ups for small drones for surveillance and load carrying.

The high-altitude Switch UAV is a VTOL drone that takes off vertically like a helicopter and then transitions into flying like a regular plane even in high altitudes with low temperatures, high winds and low density of air, according to the company. In that context, it is a drone that can be carried on the back of a Jawan and deployed, with confidence, to act as the eyes-in-the-sky for our forces, it said.

In January 2021, the Army signed a contract with ideaForge for Switch UAVs in a deal worth \$20 million. It placed a repeat order to procure an undisclosed number of Switch UAVs to augment surveillance along the LAC. According to the company it has fulfilled the first order as per contractual obligations.

Other deals signed by the Army recently include deals for Swarm drones with Indian start ups, Bengaluru-based NewSpace Research and Tech and Noida-based firm Raphe. The drones from New Space Research and Tech can hit targets with 5-10 kg explosives while mR-20 drones of Raphe can carry cargo of up to 20 kg in high altitude areas.

In the second half of last year, the Army had also placed orders for 'SkyStriker' drones to be manufactured in Bengaluru by a joint venture between Israel's Elbit System and India's Alpha Design Technologies which is now part of Adani Group.

<https://www.thehindu.com/news/national/army-orders-more-mini-vertical-take-off-uavs/article65187683.ece>



Fri, 04 March 2022

HF-24 Marut: All you need to know about India's first indigenous fighter jet

- *A total of 147 Marut were produced by the HAL.*
- *Marut was primarily used for ground attack missions.*
- *HF-24 Marut were part of the Indian defence force for 25 years*

New Delhi: India is moving ahead to strengthen its defence system and the HAL (Hindustan Aeronautics Limited) is leaving no stone unturned to make India stand in the global defence market. In a similar row Tejas LCA (Light Combat Aircraft) the indigenous supersonic fighter developed by the HAL is all set to hit foreign soil next month. It is scheduled to take part in a multinational air exercise called Cobra Warrior 22 at Waddington in the UK from March 6 to 27, the Indian Air Force (IAF) said in a statement. But do you know that the Tejas is not India's first homegrown fighter jet, it was developed after the HAL HF-24 Marut.

Beginning of HAL HF-24 Marut

HF-24 Marut came into existence with the thought of then Prime Minister Jawaharlal Nehru, who had foreseen India's desperate need for a home-made fighter jet. To get his dream fulfilled, Pt Nehru travelled to former Nazi Germany and invited engineer 'Kurt Tank' who had designed Focke Wulf Fw 190, one of the most successful Luftwaffe fighters in the Second World War.

- The formal manufacturing of Indian fighter aircraft said to be HF-24 began in 1956 while the first prototype Marut conducted its maiden flight on June 24, 1961.
- The Marut was first officially delivered to Indian Air Force on April 1, 1967.

Interesting facts of HAL HF-24 Marut

- It was India's first indigenous fighter jet.
- HF-24 Marut was also the first Asian jet fighter to stand potentially on the parameters of the developers.
- It served the Indian Air force for almost 25 years.
- The HF-24 Marut indulge in the Battle of Longewala during the Indo-Pakistani War of 1971.
- A total of 147 Marut were produced by the HAL.
- The Marut was capable of carrying 1,800 kg of bombs, 100 rockets (68 mm) and four 30 mm cannons.



The Marut was capable of carrying 1,800 kg of bombs, 100 rockets (68 mm) and four 30 mm cannons.(Photo caption: Wikimedia commons)

Drawback of HF 24 Marut

Marut was initially developed to cross the supersonic speed but it could never touch Mach 1 due to the low capability of its engine which is said to be the major failure of the Marut.

<https://www.news9live.com/knowledge/hf-24-marut-all-you-need-to-know-about-indias-first-indigenous-fighter-jet-156911?infinite-scroll=1>



Fri, 04 March 2022

Defexpo 2022; BEL to showcase its capabilities

At Defexpo 2022 to be held at Gandhinagar, Gujarat, BEL will showcase state-of-the-art products and systems spanning every domain of its business.

New Delhi: Bharat Electronics Limited, a Defence PSU at Defexpo 2022 to be held at Gandhinagar, Gujarat, BEL will showcase state-of-the-art products and systems spanning every domain of its business. The products and systems to be on display during Defexpo 2022 have been clustered as 'Air Defence & Surveillance', 'C4I Systems', 'Artificial Intelligence-based Products', 'Non-Defence & Diversification Products', 'Radar Systems', 'Communication Systems', 'Airborne Products & Systems', 'Homeland Security and Cyber Security, 'Futuristic Technologies', 'Missile Systems', 'EO & Laser-based Products', and 'Outdoor Display Products'. In addition, BEL will also showcase its R&D capabilities by launching/demonstrating some of its new products / technologies.

BEL's display in the area of 'Air Defence & Surveillance' will include Hexacopter, Tethered UAV, Swarm of UAVs, Robotic Surveillance, Shallow Water Remotely Operated Vehicle (ROV) and D4 Anti-drone Systems. The display in the area of 'C4I Systems' will include C4I technologies, Combat Management Systems and Navigational Consoles and that in the area of 'Artificial Intelligence-based Products' will include AI-based activity interference of air targets for situation awareness.

Also on show will be the complete range of products and systems for 'Non-Defence & Diversification' including High-Level Network Management in Advance Net-Centric Operation, Virtual Reality for Rolling Stock Driver Training System, Air Traffic Management System for Civilian Airport, Advanced Surface Movement Guidance Control System, Super SCADA for Delhi Metro Rail Corporation, Virtual Reality-based Training Simulator, X-ray Baggage Inspection System, Explosive Detector, Automatic Chemical Agent Detector and Alarm, Fuel Cell, Electric Vehicle Batteries for two-wheelers and three-wheelers.

BEL will showcase its 'Radar Systems' comprising Combined Interrogator and Transponder System, Battle Field Short Range Active Electronically Scanned Array (BFSR-AESA) Radar, Frequency-modulated Continuous-wave based Drone Detection Radar, Air Defence Fire Control Radar, Close-in Weapon System, Mountain Fire Control Radar, Weapon Locating Radar, BFSR-XR, X-Band Multi-Function Radar, Battery Surveillance Radar, AESA Radar, and models of 3D Low Level Light Weight Surveillance Radar and 4D Phased Array Medium Power Radar.



BEL to showcase its capabilities at Defexpo 2022

BEL's display in the area of 'Communication Systems' will include Tactical Data Link, 0.76M Ku Band Manpack Terminal (manual assisted), Instant Fire Detection and Suppression System, Rugged Switches, Rugged Routers, Mine Field Recording System, Network Hardware Security Modules, Data Link Receiver Unit, High Capacity Radio Relay, Manpack High Frequency Software Defined Radio (SDR), Point to Multi Point Radio, DSSS Networking Radio, SDR Airborne version, SDR Hand Held Naval version, SDR Manpack Naval version, SDR Naval

Combat, SDR Tactical, Encryptor, Multi Capacity Encryption Unit, Data Multiplexer-cum-Encryption Unit, Configurable Live Mk-II , BEL Tactical Computer Mk-VI, Hardware Security Module, Rugged Tablet, Network Time Server and Data Diode.

‘Airborne Products & Systems’ on display will include Ultra Violet Missile Approach Warning System, Self-Protection Suite for Helicopters, Hand Held Field Signal Generator, HD Airborne Spread Spectrum Modem, HD Ground Spread Spectrum Modem, Directed Infrared Counter Measure System, Tarang II Radar Warning Receiver and Display Unit Indigenous.

Other ‘Futuristic Technologies’ on display include Automatic Dependent Surveillance-Broadcast System, Position Indicator – G3I, Hand-Held Indian Regional Navigation Satellite System, Extended C-Band Block Up-Converter, Monolithic Microwave Integrated Circuit, C Band Phase Locked Oscillator, Router with Call Manager, Voice Gateway Unit, MIL-GRADE TAB, Signal Processing Unit for Flight Level Radar, UHF RFID Reader, 3 ATI Display, Torpbuster CPU Board and Smart Energy Meter.

The ‘Homeland Security and Cyber Security’ cluster will include display of Smart City solutions, Homeland Security solutions, Comprehensive Integrated Border Management System, Naval Airfield Integrated Security System, and Integrated Perimeter Surveillance System, and ‘Missile Systems’ display will Air Defence Weapon System.

‘EO & Laser-based Products’ will include Panoramic Night Vision Goggle, Twin Tube Goggle, Laser Dazzler, Corner Shot Weapon System, Multipurpose Reflex Weapon Sight, Mini Eye-safe LRF Module, FO Gyro-based Sensor Packaged Unit, Laser Fence System, Electronic Artillery Fuzes and Aerial Fuze.

The highlight of BEL’s outdoor display will be GIMBAL for Tethered UAV, Tethered UAV, Shallow Water ROV, Hexacopter and Ultra-Light Weight Enclosure with platform.

The entire set of state-of-art equipment on offer will be a force multiplier for any Defence force and civilian requirements.

<https://www.psuconnect.in/news/bel-to-showcase-its-capabilities-at-defexpo-2022/31550>



Fri, 04 March 2022

Boeing to feature advanced defence capabilities for India at DefExpo 2022

DefExpo-2022 is Asia's largest exhibition on land, naval, and homeland security systems which will showcase India's defence manufacturing capabilities and includes participation from the world's top defence manufacturing companies.

New Delhi: Boeing will feature its range of advanced defence capabilities for India at DefExpo 2022 being held later this year.

It will include the F/A-18 Super Hornet Block III, F-15EX, P-8I, AH-64E Apache, and the CH-47F Chinook.

DefExpo-2022 is Asia's largest exhibition on land, naval, and homeland security systems which will showcase India's defence manufacturing capabilities and includes participation from the world's top defence manufacturing companies.

This 12th edition is being held in the capital of Gujarat, Gandhinagar from March 10-14 this year and the Defence Ministry said that it is the "biggest ever so far."

At the DefExpo-2022, Boeing will outline its investments in services infrastructure, building of local capabilities, workforce training and partnerships in India that are aimed at ensuring the Indian armed forces are always mission-ready, and operate their assets at peak condition.



DefExpo 2022: Boeing will showcase advanced fighter jet features for the Indian Navy (Representational)

Boeing's exhibit at Hall 8, US Pavilion, Stall 8R.28 28 with the theme 'Digitally Advanced. Simply and Efficiently Produced. Intelligently Supported' will display advanced defence capabilities on offer to the Indian armed forces, highlight partnerships on existing defence programs with the Indian Navy and Indian Air Force, and share details about the strategic investments the company has made in India's aerospace and defence ecosystem.

"India is at the front and centre of significant opportunities for Boeing with our proven portfolio of products and services, offering unmatched operational capabilities to India's defence forces across the entire mission spectrum and through their product lifecycle," said Salil Gupte, president, Boeing India in an official statement.

"We are confident about the long-term growth potential of India's defence sector and are committed to supporting and enabling its progress," he added.

As per an official statement from Boeing, during DefExpo, they will showcase the advanced multi-role capabilities of the F/A-18 Super Hornet Block III as the best choice to meet the Indian Navy's carrier-borne fighter jet requirement.

"Visitors will be able to experience virtually, flying the Boeing F/A-18 Super Hornet Block III on a simulator, and learn more about its ability to conduct a wide range of missions, carrier-based aviation, and superior capabilities. The company will also be highlighting its portfolio of products and services that can help India meet their current and future requirements for national security, including the F-15EX, P-8I, CH-47F (I) Chinook, AH-64E Apache, KC-46, and growth in training, sustainment, and performance-based logistics solutions," it read.

<https://www.ndtv.com/india-news/boeing-to-feature-advanced-defence-capabilities-at-defexpo-2022-2800847>

ThePrint

Fri, 04 March 2022

DefExpo 2022: Airbus to display 'Aatmanirbhar Bharat' portfolio

New Delhi: Global aerospace firm Airbus will be displaying its comprehensive range of defence and space capabilities at DefExpo 2022, India's flagship defence exhibition, to be held in Gujarat's Gandhinagar from March 10 to 14.

In a press statement, the firm informed that scale models of the versatile A330 Multi Role Tanker Transport aircraft as well as the multi-role AS565 MBe (Panther) and H225M helicopters will be displayed among other products and services at the Airbus booth in Hall 12, Stand R10 and R11.

"The company, with a strong legacy of working with the Indian Space Research Organisation (ISRO) and its commercial arm NewSpace India Ltd, will also display its extensive space systems portfolio, including its range of EO satellites that can serve the requirements of the Indian armed forces," they said.

Airbus, as per the press release, is actively supporting the modernisation goals of the Indian armed forces and remains committed to making India meet the ambition of an 'Aatmanirbhar Bharat' (Self-reliant India).

"Airbus' commitment to building a robust indigenous military-industrial complex is demonstrated by the offer to set up the complete production capability for the Panther helicopter in India in partnership with the Mahindra group," the release read.

In 2021, India formalised the acquisition of 56 Airbus C295 aircraft to replace the Indian Air Force (IAF) legacy AVRO fleet, opening the doors to the first 'Make in India' aircraft manufacturing in the private sector.

“Airbus is walking the talk on ‘Aatmanirbhar Bharat’. Our C295 programme is a shining example of the transformational partnership and collaboration between the private and public sectors as well as MSMEs. We hope to replicate this win-win model to unlock the full value chain for helicopter manufacturing in India,” said Remi Maillard, President and MD, Airbus India and South Asia.

“As a company, Airbus brings a convincing track record of developing industrial partners in India, and we have demonstrated this in pioneering the growth of the country’s commercial aviation industrial ecosystem,” he said.

At Gandhinagar, the Airbus will also display a model of the Eurostar 3000 satellite and an interactive digital presentation of the S950 optical and S850 radar.

DefExpo-2022 is Asia’s largest exhibition on land, naval, and homeland security systems which will showcase India’s defence manufacturing capabilities and includes participation from the world’s top defence manufacturing companies.

This 12th edition is being held in the capital of Gujarat, Gandhinagar from March 10-14 this year and the Defence Ministry said that it is the “biggest ever so far.”

DefExpo-2022 will be held in hybrid format, with stalls in both physical and virtual realms to ensure greater engagement as the exhibitors will be able to cater to both physical and virtual attendees.

The exhibition is being planned in a three-venue format – exhibition at the Helipad Exhibition Center (HEC); Events and Seminars at the Mahatma Mandir Convention and Exhibition Center (MMCEC) and live demonstration for the public at Sabarmati Riverfront. Safety protocols as instituted by Health Ministry will be ensured and followed. (ANI)

<https://theprint.in/india/defexpo-2022-airbus-to-display-aatmanirbhar-bharat-portfolio/856324/>



Fri, 04 March 2022

Russia conducts S-400 training 4,000 km away from Ukraine: All about the potent missile system

Russia's S-400 training exercises are being seen as the Kremlin's aggressive posturing before NATO countries that have extended support to Ukraine.

By Abhishek Bhalla

New Delhi: Russia has started fresh training exercises of its potent air defence system S-400, a sign of further muscle flexing, according to news reports.

"The S-400 training exercises have started in Russia. The servicemen of the S-400 "Triumf" anti-aircraft missile systems have started practicing combat training tasks to detect and destroy a simulated enemy within the framework of the exercises in the Novosibirsk region," news agency NEXTA tweeted.

Novosibirsk, in southern Russia's Siberian region, is over 4,000 km away from Ukraine where the war is underway.

The exercises are being seen as Russia's strong messaging and aggressive posturing before the NATO countries that have extended their support to Ukraine but are yet to send in their forces against Russia.



The S-400 is a mobile, long-range surface-to-air missile system, one of the most lethal in the world (File)

What is the S-400?

The S-400 is a mobile, long-range surface-to-air missile system, considered to be one of the most lethal in the world. It can take down multiple targets up to a range of 400 km - be it fighter jets, bombers, cruise and ballistic missiles or even unmanned aerial vehicles (UAVs).

The missile system, with its long-range surveillance radars, can detect all aerial threats and can provide an air-defence shield over large cities.

With four different kinds of missiles, its capabilities transcend visual range. It can engage multiple targets, which include tracking 160 objects in a 600 km range and hitting 72 targets up to 400 km. They also have varied abilities - effective in short range 40 km, medium range 120 km, long range 180 km and very long range 400 km. Russia has been using it since 2007.

In the run up to the war, Russia had conducted several exercises, even in Crimea, which it had annexed in 2014.

Upgraded Version

The S-400 missile system is an upgraded version of the S-300 and S-200 Triumph. Russia wanted to induct 56 of these by 2020. Russia has provided this potent weapon system to China and Turkey, among other countries.

The next version, S-500, will be able to target ballistic missiles 600 km away.

Delivery to India

India has also purchased the S-400 system from Russia despite threats of US sanctions. The delivery of the first unit has already been made and the system has been deployed along the western front in the Punjab sector.

Four more units are yet to be delivered, with one unit expected every six months. Russia has made it clear that the war in Ukraine and sanctions on Moscow will not impact the deliveries to India.

"Don't foresee any obstacles as far as S-400 supply to India is concerned. We have routes to continue with this deal unobstructed," Denis Alipov, Russia's Ambassador-Designate to India, said.

<https://www.indiatoday.in/world/russia-ukraine-war/story/russia-conducts-s-400-training-4000-km-away-from-ukraine-all-about-the-potent-missile-system-1920255-2022-03-03>



Fri, 04 March 2022

Royal Australian Navy undertakes cross deck operations with INS Shivalik

Visakhapatnam (Andhra Pradesh) [India], March 3 (ANI): The MH 60R Helo of HMAS Arunta, Royal Australian Navy (RAN), undertook cross deck operations with Indian Navy Ship (INS) Shivalik today at the sea phase of MILAN 2022, said Indian Navy in a statement.

A total of 26 ships, 21 aircraft and one submarine are participating in the multilateral naval exercise being conducted in the Bay of Bengal.

The Sea Phase of MILAN 2022 from March 1 to 4 aims to enhance interoperability and maritime cooperation, and share best practices amongst the participating navies. The schedule includes weapon firings, seamanship evolutions, advanced anti-submarine warfare exercises, cross deck helicopter landings, simulation of complex operational scenarios and tactical manoeuvres, added the navy in the statement.

The sea phase of MILAN 2022 includes advanced and complex exercises in all three dimensions of maritime operations. (ANI)



Royal Australian Navy undertakes cross deck operations with INS Shivalik

<https://www.aninews.in/news/national/general-news/royal-australian-navy-undertakes-cross-deck-operations-with-ins-shivalik20220303110204/>

The Tribune

Fri, 04 March 2022

India's materiel dilemma over Ukraine crisis

The more immediate crisis surrounded diverse Russian materiel awaiting delivery to India, for which substantial payments had already been made, alongside continually needed spares and components for the in-service kit to keep the military adequately operational. Also, India had recently concluded assorted deals with Russia to provide it diverse missiles.

By Rahul Bedi

The chatter in official and media circles over diversifying India's predominantly Russian materiel, following widespread punitive sanctions against Moscow over its Ukraine invasion, costs nothing. However, the expense, energy and time required to vindicate such a gargantuan endeavour are, well, simply inestimable.

A distant casualty of Moscow's ongoing campaign, India faces a nightmarish situation that will necessitate its military replacing some 50 per cent of its Soviet-era and Russian-origin platforms for all the three services, assorted other hardware, missile systems and varied ordnance with local or imported equivalents.

The sheer magnitude, complexity and density of such an enterprise, however, would be exacerbated by India's complex and hidebound procurement procedures, byzantine bureaucracy, continually deferred decision-making, corruption scandals and other handicaps. These, in turn, would be doubly compounded by the services' ineptitude in clearly delineating their wants and in formulating realistic and attainable equipment specifications.

But the more immediate crisis surrounded diverse Russian materiel awaiting delivery to India, for which substantial payments had already been made, alongside continually needed spares and components for the in-service kit to keep the military adequately operational. These included four of the five Almaz-Antey S-400 Triumf self-propelled surface-to-air (SAM) missile systems, four Admiral Grigorovich Project 1135.6M frigates, leasing of one more Project 971 'Akula'(Schuka-B)-class nuclear-powered submarine (SSN) and providing 20,000 Kalashnikov AK-203 7.62x39 mm assault rifles, which were a part of the deal signed last December to locally licence-build 601,427 of them.

Additionally, India had recently concluded assorted deals with Russia to provide it diverse missiles, including man-portable Very Short Range Defence Systems (VSHORADS), tank ammunition and ordnance, much of it for employment by the Indian Army, which is locked in a continuing faceoff with China's People's Liberation Army in Ladakh since May 2020.

But more critically, the US and European sanctions on Russia could conceivably jeopardise India's recent \$375-million BrahMos cruise missile export order from the Philippines. Industry officials deemed this more than likely, as Russia's NPO Mashinostroyeniya (NPOM) that constituted the joint venture with India's Defence Research and Development Organisation to design, upgrade and manufacture BrahMos was responsible for providing the missile system's engine and seekers. NPOM's inability to provide these vital components due to sanctions would threaten India's first major overseas contract aimed at officially boosting materiel exports five-fold to Rs 35,000 crore by 2025.

India was also in advanced discussions with Russia to procure 464 Russian T-90MS main battle tanks (MBTs), an undisclosed number of 2S25 Sprut-SD light tanks for employment in Ladakh and 12 Sukhoi Su-30MKIs — to be licence-built locally — besides several other items. All are collectively imperilled now by the sanctions.

An inventory of the Russian defence employed by India's military reveals the immense and unimaginable magnitude of the task in seeking substitutes. The Indian Air Force's 29 or 30 combat squadrons, for instance, comprise some 272 Su-30MKIs, over 100 MiG-21 'Bis' ground attack fighters, around 60 MiG-29 air superiority platforms and 220-odd Mi-17 'Hip' variant medium-lift helicopters.

The Indian Navy's principal warships were predominantly Russian in origin and design, or both. Topping this list was INS Vikramaditya (ex-Admiral Gorshkov), the retrofitted 44,500-tonne Kiev-class aircraft carrier and its air arm of 16 MiG-29K/KuB fighters. Concurrently, another 29 MiG-29Ks will comprise the combat fleet of INS Vikrant, the indigenously developed 37,500-tonne carrier, presently undergoing sea trials and scheduled for commissioning in August to mark India's 75th Independence Day anniversary.

The Navy also operated six Talwar-class frigates, in addition to another four advanced variants on order, while its underwater platforms included nine 'Kilo'-class Type 877 diesel-electric submarines of a total of 16 boats. Russia had also provided the DRDO vital assistance in designing INS Arihant, the Navy's first indigenously designed and built nuclear-powered ballistic missile submarine (SSBN) that joined service surreptitiously in August 2016.

Russia is also presently involved in transferring knowhow to miniaturise the 82.5-MW reactor for the four or five follow-on SSBNs, presently under construction at the classified Ship Building Centre in Vishakhapatnam.



Unpredictable: The Ukraine crisis outcome is uncertain and Russia's future status as a weapons provider means looking at alternatives. Tribune photo

No other country has been willing to make such strategic technology transfers to India, but sanctions would most definitely thwart Moscow's ability to continue doing so, thereby endangering the SSBN programme and adversely impacting the Navy's operational reach in the Indian Ocean Region to challenge the PLA navy.

Furthermore, over 95 per cent of the Army's fleet of around 3,000 MBTs operated by 67-odd armoured regiments were Russian T-72M1 and T-90S variants — imported directly and licence-built — whilst some 2,000-odd infantry combat vehicles or ICVs — the Boyevaya Mashina Pekhoty (BMP) 1& 2 — were similarly sourced.

Russia's militarism also hit a multiplicity of Ukrainian contracts, like the upgrade of around 60 IAF Antonov An-32 'Cline' transport aircraft, the supply of critical R-27 air-to-air missiles for Su-30MKIs and the transfer of eight Zorya-Mashproekt M7N1EW gas turbines to power the Navy's four under-construction Talwar-class frigates. Two of these were being built at Russia's Yantar Shipyard and two at Goa Shipyard Limited (GSL), under a transfer of technology pact. The Ukrainian engines for the former two warships had reportedly been transferred to Russia, but not the ones intended for GSL.

No Ministry of Defence official or service officer could even remotely predict the outcome of either the Ukraine conflict, the world order after it ended or Russia's future status as one of the world's leading weapons providers. But there was increasing unanimity amongst them that diversifying India's materiel needs was critical and planning for it needed to begin straightaway, especially with regard to spares and related apparatus for in-use equipment.

Such a mammoth task, however, also presented the federal government and the services an opportunity to streamline procurement procedures and undertake realistic planning keeping in mind India's depreciating financial resources. Accelerating decision-making and erring on the side of advanced technologies would also serve to effectively modernise the country's lugubrious military and easing the formation of the proposed integrated theatre commands to meet the palpable threats in India's neighbourhood.

<https://www.tribuneindia.com/news/comment/indias-materiel-dilemma-over-ukraine-crisis-374833>

Science & Technology News



Fri, 04 March 2022

ISRO का मिशन Aditya-L1: सूर्य का नजदीक से करेगा निरीक्षण, 24 घंटे करेगा इमेजिंग

Aditya-L1: यह सूर्य का नजदीक से निरीक्षण करेगा और उसके वातावरण और चुंबकीय क्षेत्र का अध्ययन करेगा। यह एस्ट्रोसैट के 6 साल बाद ISRO का दूसरा अंतरिक्ष आधारित खगोल मिशन होगा। इसका उद्देश्य एक्स-रे, ऑप्टिकल और यूवी स्पेक्ट्रल बैंड में आकाशीय स्रोतों का एक साथ अध्ययन करना है। बता दें कि एस्ट्रोसैट मिशन साल 2015 में शुरू किया गया था।

By राघवेंद्र मिश्रा

कोविड-19 की तीसरी लहर का असर कम हो रहा है। ऐसे में भारतीय अंतरिक्ष अनुसंधान संगठन (ISRO) ने साल 2022 के अपने स्पेस अन्वेषण की तैयारी शुरू कर दी है। इसमें गगनयान से लेकर आदित्य L1, चंद्रयान-3, SSLV है। ISRO का लक्ष्य है कि पिछले दो साल से हुई देरी की इस साल

भरपाई की जा सके। इसके लिए इसरो ने इस साल का अपना कैलेंडर भी जारी कर दिया है। इसमें आदित्य L1 मिशन काफी प्रमुख है।

आदित्य L1 मिशन के साल 2020 में शुरू होने की उम्मीद थी। लेकिन, कोविड-19 की वजह से यह शुरू नहीं हो सका। यह सूर्य का नजदीक से निरीक्षण करेगा और उसके वातावरण और चुंबकीय क्षेत्र का अध्ययन करेगा। यह एस्ट्रोसैट के 6 साल बाद ISRO का दूसरा अंतरिक्ष आधारित खगोल मिशन होगा। इसका उद्देश्य एक्स-रे, ऑप्टिकल और यूवी स्पेक्ट्रल बैंड में आकाशीय स्रोतों का एक साथ अध्ययन करना है। बता दें कि एस्ट्रोसैट मिशन साल 2015 में शुरू किया गया था।

ISRO ने इसे 400 किग्रा वर्ग के उपग्रह के रूप में वर्गीकृत किया है। इसे ध्रुवीय उपग्रह प्रक्षेपण यान XL (PSLV-XL) से लॉन्च किया जाएगा। आदित्य L1 को सूर्य और पृथ्वी के बीच स्थित L-1 लगाज बिंदु के निकट स्थापित किया जाएगा। इसे 7 पेलोड के साथ पोलर सैटेलाइट लॉन्च व्हीकल एक्सएल (PSLV XL) का उपयोग करके लॉन्च किया जाएगा। जो कि सूर्य के कोरोना, सूर्य के प्रकाश क्षेत्र, क्रोमोस्फीयर, सौर उत्सर्जन, सौर हवा, फ्लेयर्स और कोरोनल मास इजेक्शन का अध्ययन करने के साथ-साथ सूर्य की 24 घंटे इमेंजिंग करेगा।

बता दें कि पृथ्वी से सूर्य की दूरी करीब 15 करोड़ किमी है। आदित्य L1 में कुछ चलते घटक होंगे जो टकराव के जोखिमों को बढ़ाते हैं। L1 बिंदु सौर और SOHO का एक तरह से घर है। यह NASA और ESA की एक अंतर्राष्ट्रीय सहयोग परियोजना है। L1 बिंदु पृथ्वी से लगभग 1.5 मिलियन किमी दूर है। यह पृथ्वी-सूर्य प्रणाली की कक्षीय विमान में 5 बिंदुओं में से एक है।

<https://hindi.news18.com/news/nation/aditya-l1-isro-space-missions-for-2022-4044453.html>



Fri, 04 March 2022

बिहार की बेटी का रोबोट दिल्ली के मेगा एक्सपो में: डॉक्टर की बताई दवा मरीजों तक पहुंचाएगा; DRDO, आईसीएमआर और हेल्थ मिनिस्ट्री मिलकर इस पर काम करेंगे

लेखक: प्रणय प्रियंवद

पटना की आकांक्षा के मेडी रोबोट को दिल्ली के जवाहरलाल नेहरू स्टेडियम में आयोजित मेगा एक्सपो में खूब सराहना मिली है। मेडी रोबोट को देश के टॉप साइंटिस्ट ने देखा। वैज्ञानिकों ने सुझाव दिया कि इसे मल्टी लैंग्वेज करें, ताकि देश के किसी भी हिस्से में इसका इस्तेमाल किया जा सके। चिकित्सा क्षेत्र में यह रोबोट काफी काम का है। डीआरडीओ, आईसीएमआर और हेल्थ मिनिस्ट्री ने इस रोबोट के साथ मिलकर काम करने की इच्छा जताई। डिजास्टर मैनेजमेंट की ओर से भी कई सुझाव दिए। विज्ञान और प्रौद्योगिकी राज्यमंत्री डॉ. जितेंद्र सिंह ने इसकी सराहना करते हुए इसे आगे ले जाने की बात कही है।



मेगा एक्सपो में आकांक्षा।

आकांक्षा के मेडी रोबोट की कहानी सबसे पहले दैनिक भास्कर सबके सामने लेकर आया था। इस रोबोट के लिए बीते साल ही शिक्षक दिवस के मौके पर उसे AICTE ने 'छात्र विश्वकर्मा अवार्ड' से नवाजा था।

इसमें देश भर के 38 हजार प्रतिभागियों में से आकांक्षा का चयन किया गया था। आकांक्षा ने अब एक सप्ताह तक दिल्ली में चले मेगा एक्सपो में अपने मेडी रोबोट को प्रजेंट किया। उसने रोबोट में कई नई चीजें भी लगाई हैं।

आरा के MSME एक्सपो में भी मेडी रोबोट दिखाएंगी आकांक्षा

आकांक्षा ने भास्कर से बातचीत में कहा कि वह रोबोट को लगातार मॉडिफाई कर रही हैं। इसका इस्तेमाल ज्यादा से ज्यादा कैसे हो और यह मार्केट में कैसे जाए, इसके लिए काम कर रही हूं। AICTE के वाइस चेयरमैन डॉ. पुनिया सहित कई सरकारी एजेंसियों ने इसे फंडिंग कर स्टार्टअप के रूप में आगे बढ़ाने का आश्वासन दिया है।

मेगा एक्सपो का आयोजन 22 से 28 फरवरी तक केंद्र सरकार के संस्कृति व विज्ञान प्रसार मंत्रालय ने किया था। यहां AICTE (ऑल इंडिया काउंसिल फॉर टेक्निकल एजुकेशन) के स्टॉल पर आकांक्षा ने अपना मेडी रोबोट प्रजेंट किया।

वह कहती हैं कि मैंने अपनी स्टार्टअप कंपनी बना ली है और अब इसके जरिए मिनिस्ट्री की मदद से आम लोगों तक बड़े पैमाने पर मेडी रोबोट को पहुंचाऊंगी। बिहार के आरा में 4 मार्च से MSME का एक्सपो लग रहा है। इस रोबोट को विशेष स्टॉल प्रदान किया गया है। आयोजन का उद्घाटन बिहार सरकार के उद्योग मंत्री शाहनवाज हुसैन करेंगे। मुझे बिहार सरकार से भी काफी उम्मीदें हैं।

रोबोट में अब QR कोड की भी सुविधा

आकांक्षा ने भास्कर से बातचीत में कहा कि अब इसमें QR कोड फैसिलिटी उपलब्ध कराई गई है। मेडिसिन डिस्पेंसर की सुविधा भी जोड़ी गई है। प्रीस्क्रिप्शन के जरिए जो दवा डॉक्टर सजेस्ट करेंगे, उसे यह रोबोट मरीजों को उपलब्ध करा देगा। यह टेलीमेडिसिन के एरिया में काफी अच्छा होगा।

कोरोना में इलाज के लिए बनाया था रोबोट

असल में आकांक्षा ने इस रोबोट को कोविड महामारी के मद्देनजर बनाया था कि डॉक्टर मरीज के पास गए बिना सही इलाज कर सकें। उन्होंने इसे तब तैयार किया था, जब बड़ी संख्या में डॉक्टर कोविड की चपेट में आकर मौत के शिकार हो रहे थे। यह किसी भी पेशेंट के बेसिक पैरामीटर जैसे ईसीजी, ब्लड शूगर, पल्स, ब्लड प्रेशर, टेम्परेचर, वजन और वायरलेस स्टेथोस्कोप के जरिए किसी पेशेंट के हर्ट और लंग्स की स्थिति की भी जांच करता है। फिर दूर बैठे डॉक्टर को इतनी सारी जांच की रिपोर्ट रियल टाइम पर पहुंचा देता है। इसमें इमरजेंसी के लिए ऑक्सीजन और न्यूमोलाइजेशन की भी व्यवस्था है।

<https://www.bhaskar.com/local/bihar/news/bihar-news-akankshas-robot-praised-at-delhis-mega-expo-129461623.html>



Fri, 04 March 2022

Engineering 2D semiconductors with built-in memory functions

A team of researchers at The University of Manchester's National Graphene Institute (NGI) and the National Physical Laboratory (NPL) has demonstrated that slightly twisted 2D transition metal dichalcogenides (TMDs) display room-temperature ferroelectricity.

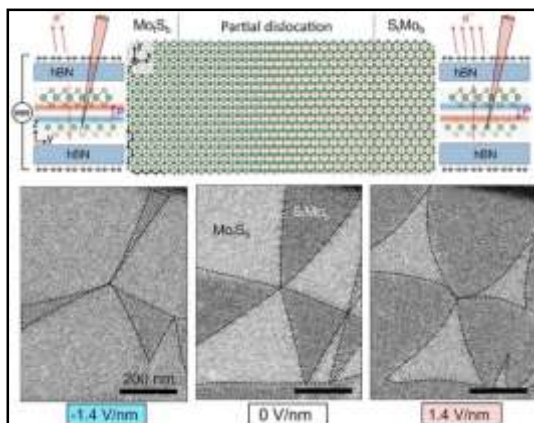
This characteristic, combined with TMDs' outstanding optical properties, can be used to build multi-functional optoelectronic devices such as transistors and LEDs with built-in memory functions on nanometre length scale.

Ferroelectrics are materials with two or more electrically polarisable states that can be reversibly switched with the application of an external electric field. This material property is ideal for applications such as non-volatile memory, microwave devices, sensors and transistors. Until recently, out-of-plane switchable ferroelectricity at room temperature had been achieved only in films thicker than 3 nanometres.

2D heterostructures

Since the isolation of graphene in 2004, researchers across academia have studied a variety of new 2D materials with a wide range of exciting properties. These atomically thin 2D crystals can be stacked on top of one another to create so-called heterostructures—artificial materials with tailored functions.

More recently, a team of researchers from NGI, in collaboration with NPL, demonstrated that below a twist angle of 2° , atomic lattices physically reconstruct to form regions (or domains) of perfectly stacked bilayers separated by boundaries of locally accumulated strain. For two monolayers stacked parallel to each other, a tessellated pattern of mirror-reflected triangular domains is created. Most importantly, the two neighboring domains have an asymmetric crystal symmetry, causing an asymmetry in their electronic properties.



Credit: University of Manchester

Ferroelectric switching at room temperature

In the work, published in *Nature Nanotechnology*, the team demonstrated that the domain structure created with low-angle twisting hosts interfacial ferroelectricity in bilayer TMDs. Kelvin probe force microscopy revealed that neighboring domains are oppositely polarized and electrical transport measurements demonstrated reliable ferroelectric switching at room temperature.

The team went on to develop a scanning electron microscope (SEM) technique with enhanced contrast, using signal from back-scattered electrons. This made it possible to apply an electric field in-situ while imaging changes to the domain structure in a non-invasive manner, providing essential information on how the domain switching mechanism works. The boundaries separating the oppositely polarized domains were found to expand and contract depending on the sign of the applied electric field and led to a significant redistribution of the polarized states.

This work clearly demonstrates that the twist degree of freedom can allow the creation of atomically thin optoelectronics with tailored and multi-functional properties.

Wide scope for tailored 2D materials

Lead author Astrid Weston says that "it's very exciting that we can demonstrate that this simple tool of twisting can engineer new properties in 2D crystals. With the wide variety of 2D crystals to choose from, it provides us with almost unlimited scope to create perfectly tailored artificial materials."

Co-author Dr. Eli G Castanon added that "being able to observe the pattern and behavior of ferroelectric domains in structures that have nanometre thickness with KPFM and SEM was very exciting. The advancement of characterisation techniques together with the extensive possibilities for the formation of novel heterostructures of 2D materials paves the way to achieve new capabilities at the nanoscale for many industries."

More information: Astrid Weston et al, Interfacial ferroelectricity in marginally twisted 2D semiconductors, *Nature Nanotechnology* (2022). DOI: [10.1038/s41565-022-01072-w](https://doi.org/10.1038/s41565-022-01072-w)

Journal information: [Nature Nanotechnology](https://www.nature.com/naturenanotechnology)

<https://phys.org/news/2022-03-2d-semiconductors-built-in-memory-functions.html>

