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With JF-17 out, India's HAL Tejas 'On Verge' of winning Malaysian Military Aircraft tender – Local Media

By Aritra Banerjee

India's Tejas Light Combat Aircraft (LCA) and the Chinese-Pakistani JF-17 have long been long speculated to be in the race for Malaysia's new fighter jet contract. However, there's more to it than meets the eye.

A recent study by Research & Markets listed Tejas and JF-17 'Thunder' as two of the top light fighter jets available in the global export market. Independent experts also told The EurAsian Times the two aircraft as the most economically viable option for developing nations.

However, both have their share of controversies as well. While India's homegrown jet has been stuck in development problems, the JF-17 found itself in the middle of a global misinformation scandal.



[The HAL Tejas \(via Twitter\)](#)

Tejas Vs Thunder

The Tejas is a single-engine, fourth-generation, light combat aircraft developed by India's state-owned Hindustan Aeronautics Limited (HAL). The aircraft has been designed by the Aeronautical Development Agency (ADA) in collaboration with HAL's Aircraft Research and Design Centre (ARDC) for the Indian armed forces.

Tejas has been showcased as a major milestone in Prime Minister Narendra Modi's 'Make in India' initiative. The aircraft entered service with the Indian Air Force in July 2016. The fighter jet is equipped with an array of advanced avionics and weapon systems.

HAL is developing upgraded variants of the Tejas LCA such as the Tejas Mk-1A and Tejas Mk-2. Earlier this year, India's Ministry of Defense (MoD) awarded a Rs 48,000-crore contract to HAL for the supply of 83 new Tejas Mk-1A fighter jets.

This deal made HAL confident about the fighter jet's export potential. However, The EurAsian Times had previously analyzed the challenges Tejas faces in terms of foreign sales.

The JF-17, on the other hand, is a medium-sized multi-role fighter aircraft jointly developed by China's Chengdu Aircraft Corporation (CAC) and Pakistan Aeronautical Complex (PAC) to meet the airpower requirements of the Pakistan Air Force.

The fighter jet comes with both single and twin-seat variants and sports an overall length of 14.9 meters. The aircraft is 4.77m tall and 9.45m wide and has a wing area of 24.4m². The JF-17 has an empty weight of 6,441 kg, a maximum take-off weight (MTOW) of 12,700kg, a loaded weight of 9,100kg, and a maximum landing weight of 7,802kg. The aircraft's fuel weight is 2,268kg.

The JF-17 is powered by a Klimov RD-93 turbofan engine or WS-13 turbofan engine with a dry thrust capacity of 49.4 Kilonewton while its thrust afterburner is 84.4kN. The fighter jet can cruise at a maximum speed of 2,205 kilometers per hour and has a ferry range of 3,480km, an operational radius of 1,352km, and boasts a service ceiling of 16,920m.

The jet is armed with 1 x 2 mm GSh-23-2 twin-barrel cannon guns, 57mm, 90mm unguided rocket pods, short-range, AIM-9L/M, PL-5E, PL-9C, and beyond visual range (BVR) PL-12/SD-10 air-to-air missiles. The aircraft also comes armed with a slew of anti-surface missiles like the MAR-1 anti-radiation missile, AM-39 Exocet anti-ship missile, and Ra'ad ALCM cruise missile.

The JF-17 took its maiden flight in 2003 and formally entered into service in 2007. The first operational fighter fleet was the Black Spider squadron which saw the induction of 14 JF-17s in 2010. The prototype for the Block III variant completed its maiden flight last year.

Controversy Surrounding JF-17

JF-17s have been delivered to Nigeria and there are also talks with Fuerza Aérea Argentina (FAA) or the Argentina's air force regarding the aircraft. Last month, the JF-17 was in the news after Pakistan Strategic Forum (PSF), an Islamabad-based think tank, ran a misinformation campaign suggesting that Argentina has decided to buy this aircraft.

"The Government of the Argentine Republic has officially included funding for the purchase of 12 PAC JF-17 A Block III fighters in a draft budget for 2022 presented to Argentina's Parliament. The funding requests \$664 million for the purchase of 12 JF-17s from Pakistan. The Argentine Air Force has chosen Pakistan's JF-17 Thunder, discarding offers from Russia, the USA, and India," PSF said.

The Pakistani Consulate General in Jeddah later tweeted – "Argentina has officially earmarked \$664 million in its next year's budget for the purchase of 12 JF-17 Block-III fighter jets from Pakistan".

However, Argentina's Defense Ministry dismissed these reports. It said – "the Defense Ministry informs that, by means of Public Credit Operations Authorization note, it has requested the inclusion of the authorization to manage a credit of up to \$664 million for the acquisition of multipurpose fighter aircraft for the surveillance and control of airspace into the 2022 budget".

"Likewise, the Ministry clarifies that it has not issued a decision to purchase a supersonic aircraft of any origin and is in the stage of technical-economic and financial evaluation of five alternatives", it added.

Tejas — A Key Contender

The Indian LCA Tejas has also been projected as a key contender in the ongoing Argentine fighter jet deal, however, it is yet to be officially confirmed.

"We have several offers, there is the Chinese JF-17, the Russian MIG-35 and MIG-29. While we do not have any specific offer from the United States, we do know that they are preparing one. We also had a rapprochement with India, which is wanting to offer us the Tejas but we are just in the first talks," Brigadier Xavier Julian Isaac, FAA chief, had told Infodefensa, a Spanish language website.

Professor Juan Battaleme, a defense analyst, told FE Online, "If Tejas is preferred by FAA, it will help in promoting ties between the two countries and could be a bridge to reinforce ties with the West that India has and with Russia too."

JF-17 Out Of Race, HAL Tejas Top Choice?

Malaysian media reported that the Royal Malaysian Air Force (RMAF) received six bids in response to its light combat aircraft (LCA) tender. Interestingly, while India's Tejas figures in the list, the JF-17 has not been named. The latter was long rumored to be a key contender in the Malaysian LCA race.

The Edge Markets, a Malaysian business news portal, reported that nine companies acquired the RFP (request for proposal) was in July, and six bids were received by the closing date on October 6.

The interested bidders, according to The Edge Markets, are — Korea Aerospace Industries (KAI) FA 50; Turkey Aerospace Industries' Hürjet; China National Aero-Technology Import & Export Corp's (Catic) L-15 fighter jet; Italy's Leonardo M-346 planes; India's HAL Tejas, and Russian MIG 35.

Malaysia's LCA tender was announced in June this year. It was seen in response to mounting geopolitical tensions in the region, linked to China's aggressive posture.

RMAF currently employs its Sukhoi Su-30 MKM and the Boeing F/A-18 fighter to defend its airspace. The service also uses BAE Hawk advanced trainer for air defense and air denial.

Eighteen new aircraft are to be procured as part of the contract with the option to include another 18 in the future. The first eight aircraft to be procured are meant for the RMAF's training purposes. The next 10 will be deployed for operational use performing both air-to-ground and air-to-air missions.

It has been reported that the RMAF's LCA requirements include aerial refueling, beyond-visual-range (BVR) combat, and supersonic flight capabilities. The contract stipulates that 30% of the aircraft's parts are to be indigenously produced in Malaysia. Deliveries are to commence within 36 months since the contract is signed.

It is unclear why JF-17 did not participate in the tender, but the original closing date was Sept 22 which was extended to Oct 6. If all goes as planned, the winning bidder could be announced by April next year, the report says.

The report further adds – Hindustan Aeronautics (HAL) is willing to set up an MRO (Maintenance, Repair, and Operations) facility in Malaysia if awarded the contract. It is unclear if the other bidders are also contemplating doing so.

There is a likelihood that the bidding will get aggressive soon and China, for instance, could come up with very enticing offers in terms of financing and technology transfer. However, recent aerial incursions by 16 Chinese military jets into Malaysian airspace could hamper Beijing's bid.

Meanwhile, HAL Tejas is believed to have met all the necessary specifications. If it is successful, Malaysia will be its first external market of Indian Tejas aircraft, the report adds.

<https://eurasianimes.com/jf-17-indias-hal-tejas-favourite-to-win-malaysian-military-aircraft/>

Indigenous Pinaka deployed at China border, more wait for longer range

By Manu Pubby

Synopsis

Designed by the Defence Research and Development Organisation (DRDO), the Pinaka currently has a range of about 38 km, which is slightly increased when it is deployed at high altitude areas. The defence ministry has recently cleared a case for enhanced Pinaka rockets that would go up to 47 km as well.

The indigenously developed Pinaka multi-barrel rockets launcher has been deployed to the China front, significantly boosting offensive capability but the army will have to wait for an extended range system that can take on targets more than 75 km away, with technicalities over testing and validation remaining unresolved.

The Pinaka rocket system, designed to replace the Russian origin BM 21 Grads, has been deployed in the Tawang sector in Arunachal, where Chinese reserve forces brought forward last year are yet to retreat.

Designed by the Defence Research and Development Organisation (DRDO), the Pinaka currently has a range of about 38 km, which is slightly increased when it is deployed at high altitude areas. The defence ministry has recently cleared a case for enhanced Pinaka rockets that would go up to 47 km as well.

However, the game changer would be guided, extended range rockets for the system that can effectively engage targets at over 75 km, with an inbuilt precision strike capability. These rockets would give more standoff range and are likely to be at least twice as accurate as the current system.

Officials said that the guided version of the rockets has been successfully developed and demonstrated by the DRDO that conducted a range of tests in 2017-2020, showing that the system can be fired at over 75 km with precision. The final tests, officials said, were completed in February last year.

However, the case for procuring the guided version has not moved ahead, due to technicalities related to testing and validation. The issue, sources said, relates to an upgrade that would be required in the launcher systems for the extended range rockets. Without the upgrade, the rockets will not be able to demonstrate accurate hits at over 75 km.

As launchers are not available for validation tests, the procurement for the rockets is yet to commence. Sources said that efforts are being made to upgrade the launchers in the newer systems which have been ordered but no progress has been made on the upgrade yet.

As reported, the defence ministry had, in August 2020, inked a '2,580 crore deal to manufacture the indigenous Pinaka multi-barrel rocket launchers for the Army. The contract has been placed with private sector companies L&T and Tata Aerospace and Defence, with a significant portion of work also falling with public sector unit BEML which supplies the trucks for the rocket launchers.

The Pinaka programme has been a home-grown success story, with technology transfer successfully executed by DRDO to the private sector for manufacturing the systems as well as ammunition. Of the six new regiments, L&T has been awarded the contract to manufacture four while the balance two will be made by Tata Aerospace and Defence.

<https://economictimes.indiatimes.com/news/defence/indigenous-pinaka-deployed-at-china-border-more-wait-for-longer-range/articleshow/87265407.cms>



The Pinaka rocket system, designed to replace the Russian origin BM 21 Grads, has been deployed in the Tawang sector in Arunachal, where Chinese reserve forces brought forward last year are yet to retreat.



Tue, 26 Oct 2021

Indian Army deploys Pinaka and Smerch rocket systems on border with China

As reported by The Times of India, the Indian Army has deployed Pinaka and Smerch Multiple Rocket Launcher Systems (MRLS) at forward positions near the China border to counter any threat arising across on the Line of Actual Control (LAC).

Pinaka is a multiple rocket launcher produced in India and developed by the Defence Research and Development Organisation (DRDO) for the Indian Army. The system has a maximum range of 40 km for Mark-I and 60 km for the Mark-I enhanced version and can fire a salvo of 12 HE rockets in 44 seconds. The system is mounted on a Tatra truck for mobility. Pinaka saw service during the Kargil War, where it was successful in neutralizing enemy positions on the mountain tops. It has since been inducted into the Indian Army in large numbers. About 5,000 missiles are being produced every year while an advanced variant is under development with enhanced range and accuracy. In 2019, an upgraded guided-missile version of the system had been test-fired, with a range of over 90 km.



The Indian Army has deployed Pinaka and Smerch Multiple Rocket Launcher Systems (MRLS) at forward positions near the China border (Picture source: ANI)

The BM-30 Smerch (Tornado, whirlwind), 9K58 Smerch or 9A52-2 Smerch-M is a Soviet-era heavy multiple rocket launcher. The system was designed in the early 1980s and entered service in the Soviet Army in 1989. When first observed by the West in 1983, it received the code MRL 280mm M1983. In India, a total of 162 9A52-2T systems are in service. The launchers for the Indian Army's 9K58 Smerch 300 mm multiple rocket launch (MRL) systems are mounted on 81 Indian designed 10×10 high-mobility vehicles provided by Indian private-sector defense manufacturer Ashok Leyland. The vehicle, which is fitted with a hydraulic crane to reload the system, will supplement and eventually replace the 9A52-2 launch vehicles based on the MAZ-543M 8×8 truck chassis. The Indian Army operates several launcher variants for the Smerch system, including around 162 9K58 Smerch batteries, each of which has six launch vehicles. Since 2012 India's state-owned Ordnance Factory Board has produced several rocket variants for the system that have a strike range of 70 or 90 km."

Sino-Indian border conflict

Beginning on 5 May 2020, Chinese and Indian troops engaged in aggressive melee, face-offs and skirmishes at locations along the Sino-Indian border, including near the disputed Pangong Lake in Ladakh and the Tibet Autonomous Region, and near the border between Sikkim and the Tibet Autonomous Region. Additional clashes also took place at locations in eastern Ladakh along the Line of Actual Control (LAC).

In late May, Chinese forces objected to Indian road construction in the Galwan river valley. According to Indian sources, melee fighting on 15/16 June 2020 resulted in the deaths of 20 Indian soldiers and casualties of 43 Chinese soldiers. Media reports stated that soldiers were taken captive on both sides and released in the coming few days while official sources on both sides went on to deny this. On 7 September, for the first time in 45 years, shots were fired along the LAC, with both

sides blaming each other for the firing. Indian media also reported that Indian troops fired warning shots at the PLA on 30 August.

Partial disengagement from Galwan, Hot Springs and Gogra occurred in June–July 2020 while complete disengagement from Pangong Lake north and south bank took place in February 2021. Following disengagement at Gogra in August 2021, Indian analysts pointed out that the LAC has shifted westwards at patrol point 17A (PP 17A).

Amid the standoff, India reinforced the region with approximately 12,000 additional workers, who would assist India's Border Roads Organisation in completing the development of Indian infrastructure along the Sino-Indian border. Experts have postulated that the standoffs are Chinese pre-emptive measures in responding to the Darbuk–Shyok–DBO Road infrastructure project in Ladakh. China has also extensively developed their infrastructure in these disputed border regions and are continuing to do so. The revocation of the special status of Jammu and Kashmir, in August 2019, by the Indian government has also troubled China. However, India and China have both maintained that there are enough bilateral mechanisms to resolve the situation. This includes multiple rounds of colonel, brigadier and major general rank dialogue, special representatives' meetings, meetings of the 'Working Mechanism for Consultation and Coordination on China-India Border Affairs' (WMCC), meetings and communication between the foreign ministers and the defense ministers. On 10 October 2021, the 13th corps-commander-level meeting took place. The Chinese and Indian armies keep reinforcing their units deployed in the area, though.

Following the Galwan Valley skirmish on 15 June, some Indian campaigns about boycotting Chinese products were started. Action on the economic front included cancellation and additional scrutiny of certain contracts with Chinese firms, and calls were also made to stop the entry of Chinese companies into strategic markets in India. By November 2020, the Indian government had banned over 200 Chinese apps including apps owned by Alibaba, Tencent, Baidu, Sina, and Bytedance.

https://www.armyrecognition.com/analysis_focus_army_defence_military_industry_army/indian_army_deploys_pinaka_and_smerch_rocket_systems_on_border_with_china.html

Tue, 26 Oct 2021

Taxi trials of India's SWiFT unmanned combat aerial vehicle demonstrator

Snapshot

- *Work on the project, which was earlier called AURA (short for Autonomous Unmanned Research Aircraft), began sometime around 2009.*
- *The programme is linked to the development of India's fifth-generation stealth fighter Advanced Medium Combat Aircraft or AMCA.*

India's highly secretive unmanned combat aerial vehicle (UCAV) programme, under which a technology demonstrator called stealth wing flying testbed or SWiFT is being developed, has reached a new milestone.

A demonstrator built under the programme has completed low-speed taxi trials. Twitter handle @DefenceReach, which scooped the first pictures of the taxi trials, has now put out a video of the trial on YouTube.

The trial appears to have been conducted on 18 August this year at the Aeronautical Test Range near Challakere in Karnataka's Chitradurga district. The DRDO has not confirmed the date of taxi trials.

Earlier this year, reports said that the Combat Vehicles Research and Development Establishment, a Chennai-based lab of the DRDO, has handed over retractable landing gear systems for SWiFT.

In a technology bulletin released in October 2020, the DRDO had said that it had completed the designing of the landing gear for the programme and the manufacturing of the airworthy components was under progress.

"SWiFT UAV is a Technology Demonstrator and is a scaled-down version of Ghatak UCAV (Unmanned Combat Air Vehicle). The main intent of SWiFT UAV is to demonstrate and prove the stealth technology and high-speed landing technology in autonomous mode," the DRDO has said.

A model of this platform was recently seen in a video lecture published by the Indian Institute of Technology Kanpur, which is involved in the fundamental research and testing related to the stealth UCAV programme.

It was most likely a "mockup or a sub-scale flying model" of the SWiFT.

Ghatak's undercarriage and landing gear were seen in this model, which was sitting in the background as an IIT Kanpur professor delivered a lecture in the institution's Aeromodelling Lab.

Ghatak is intended to be an unmanned aircraft which can not only be used for surveillance but also to fire precision weapons at designated targets, using its stealth features to avoid detection by enemy sensors in contested airspace.

The Bengaluru-based Aeronautical Development Agency is developing the UCAV with participation from the Defence Electronics Application Laboratory and many other labs of the Defence Research and Development Organisation.

Work on the project, which was earlier called AURA (short for Autonomous Unmanned Research Aircraft), began sometime around 2009.

The programme is linked to the development of India's fifth-generation stealth fighter Advanced Medium Combat Aircraft or AMCA.

The Ghatak programme formally received sanction as a 'Lead-in Project' in May 2016 and started receiving funding from early 2017, *Livefist* has reported.

Very little technical detail about the UCAV project is available due to its classified nature. Wrapped in secrecy, the programme is under the direct oversight of the Prime Minister's Office and the National Security Advisor.

<https://swarajyamag.com/defence/watch-taxi-trials-of-indias-swift-unmanned-combat-aerial-vehicle-demonstrator>

ThePrint

Tue, 26 Oct 2021

3 Indian start-ups win IAF swarm drone competition, at least 2 in line for defence contracts

IAF's 3-year-long Mehar Baba Swarm Drone Competition was conceptualised to encourage the development of swarm drones, and was open to indigenous talent and firms

By Snehesh Alex Philip, Edited by Poulomi Banerjee

New Delhi: Three Indian start-ups have won a three-year-long swarm drone competition organised by the Indian Air Force, which will now pave the way for at least two of them to get formal contracts for surveillance, attack and electronic warfare drones.

The 'swarm architecture' award went to NewSpace Research & Technologies Pvt Ltd, run by former IAF officer Sameer Joshi. Incidentally, NewSpace had recently won a USD 15 million swarm drone order from the Indian Army.

The 'communication architecture' award went to a Delhi Technology University team in a tie-up with Adani Defence, and the 'drone architecture' award went to Dhaksha Unmanned Systems.

Sources in the defence establishment told ThePrint that the results which were announced Sunday took into account the unique characteristics offered by all the three companies, and there was no single winner per se.

However, NewSpace is understood to have performed well on all parameters.

The IAF had conceptualised the Mehar Baba Swarm Drone Competition, which was launched on 3 October 2018, to encourage development of swarm drones, for utilisation in varied domains. The name of the competition honoured Late Air Commodore Mehar Singh, affectionately called 'Baba' Mehar Singh by his associates and admirers in the IAF.

It was conceptualised to evolve proprietary design, development, manufacturing and production of "low cost-high impact" solutions for swarm drone technology, the IAF said in a statement Sunday. The competition was open to only indigenous talent and indigenous start-ups.

'Operationalised future warfare philosophy in real time'

As reported by ThePrint in September, the finalisation of the winners will now pave the way for inking formal contracts.

The firms will get assistance from select Base Repair Depots, which carry out major repair and overhaul of aircraft and other equipment of the IAF, since the force is looking at a more complex system than what has been showcased so far.

The firms will also get armament procured from the Defence Research and Development Organisation (DRDO).



Representative image of swarm drones. | sameerjoshi73.medium.com

Industry sources said with the induction of swarm drones in their capability matrix, the Indian armed forces have operationalised a future warfare philosophy in real time.

This capability puts India at par with nations like the US, China, UK, Russia and Turkey, which are inducting swarm drones into their arsenal, the sources said.

When the IAF began the Mehar Baba Swarm Drone Competition in 2018, it received 154 applicants from across the country.

Of these, 54 were shortlisted in the first round and 20 were further selected in the second round.

These 20 were then asked to demonstrate 10 drones with 10-km range and 10 medical drops in Pokhran. The companies were reimbursed Rs 25 lakh each by the IAF.

The top five from the 20 were given a task of demonstrating a 50-km range with 20 drones and 20 medical or emergency aid drops in GPS-denied, rogue drone and anti-drone jamming environments.

<https://theprint.in/defence/3-indian-start-ups-win-iaf-swarm-drone-competition-at-least-2-in-line-for-defence-contracts/756314/>

Outlook

Tue, 26 Oct 2021

Nation's long term vision of self reliance in defence sector

The framework and implementation of essential policies rich culture, heritage, geography, and size have been the major positive points about the economy on a global stage.

By Akshat Jain

Jawahar Lal Nehru, the first president of free India, had a strong belief in the concept of self-reliance. He devoted his efforts and public presence to motivate and educate people about the importance of the economic upliftment of a country based on scientific and technological development. According to him, scientific temper can frame India's future, and it can strengthen the roots to achieve the ultimate goal of self-reliance in India.

The framework and implementation of essential policies rich culture, heritage, geography, and size have been the major positive points about the economy on a global stage. India has begun its journey on an international platform as an independent economy with its vision and leadership. The beginning of an era that leads to non-alignment. "There were speculation and concerns discussed internationally back then about the capability of the Indian economy and the response of the economy towards the international pressure." The primary aim of the Indian Defence Policy was to self develop and be able to stand out in various departments like development, national security and industrialization.



Self-reliance allows an economy to take necessary help from the international market, which is not seen in the case of self-sufficient. The more progressive way to development is by becoming self-reliant rather than staying in the disbelief of being able to stand out with rigid ways of self-sufficiency. Liberalization allowed Indian industries to flourish and achieve beyond measures. The growth opportunity increased, and the shell created before 1991 got uncovered with the first initial steps to globalization. Indian defence economy was trapped under the load of acting as a self-sufficient economy. As soon as the same was removed, the true potential of industrialization was observed by other economies globally. This article will highlight the significant milestones seen by the Indian economy during the transformation period. The rich history and flourishing post-

globalization of the Indian defence economy will be summarised. With the conclusion, the reader will draw a clear picture of the Indian economy in a wholesome.

Indian Defence-Industrial Roots

In 1801, East India Company laid down the foundation of the Gun Carriage Agency adjacent to Calcutta (now Kolkata). The 18th century was a very early time for India to be able to produce arm forces. The British rule hindered the growth and production as the rulers hardly contributed to the unique opportunity's upliftment. The overlooking of the same was discouraging, and they had clear reasons. Britishers had their cheaper alternative to arrange the same from British industry at much more affordable rates. Until the 19th century, there were six ordnance factories dedicated to the manufacturing of guns. The arrival of World War II changed the scenario for the country and the rulers back then of the economy. To fight back the growing Japanese economy and hostilities in the country, sixteen ordnances were working day-night to produce 7 lakh rifles between 1942 and 1945.

During British rules, the growth was filled with obstacles. There were no steps taken to make India self-reliant regarding the Indian defence force and types of equipment. The colonial rule of Britishers limited the possible scope of the economy and had strong footprints even after the country's Independence. India was just a base camp for Britishers to address Asians and Africans. A tiny and limited number of arms and ammunition were produced during the British rule in India. The restriction of entry to factories producing arms and ammunition and no employment for Indian citizens in defence arm production factories was a neck wrecking step taken by Britishers.

Post-independence Pandit Jawahar Lal Nehru invited a special guest to comment and guide India about the self-reliance defence. Patrick Blackett, the British Physicist, was asked, and as per his vision, the Indian government needed industrial capabilities and financial capabilities to prepare itself for the primary requirement. He suggested India “focus on non-competitive products such as anti-aircraft guns and vehicles for transportation of defence equipment”. And he focused on minimizing the quality to maximize the profit margin over low-cost expenditure made on the same. As per his suggestion, India should dedicate its available resources towards the establishment of the aircraft industry, kurt tank, HF 24 Marut and other low ended defence equipment’s (Ian Anthony, 1992)

From Independence – Decades of 60’s

World War II created a significant demand for armed forces in sub-continent. As a result, India got its chance to utilize the battleground population to help other neighbouring countries (Samir K Sen, 2003). 2.6 million arms and equipment were available and made within the country, raising the biggest democracy with self-sufficient Indian Defence Industrialists. Delhi became the capital, and the new capital of independent India controlled all significant directions of 12 ordnance factories for low ended weapons like mortars, guns, 5-9 mm pistols etc.

From 1960’s – 1980’s

Sharing borders with neighbouring countries like China was the reason behind the significant overhaul of the defence forces policies. They helped India to scale up the production in massive quantities. Military assistance received from countries like the UK and the US allowed India to lay down the foundation for Air Defence Force. With the second war with Pakistan for protecting Jammu and Kashmir, India suffered from an economic crunch. The most challenging time facing agricultural crisis and minimal foreign exchange reserve, the country was suffering tremendously. During 50's India was facing significant hardships as supplies of arms and defence equipment drastically dropped off from western countries. The military annexation in Goa of the Portuguese colony around this period contributed to complicating the relationship of the economy with the Western countries. The primary reason was the membership of Portugal with NATO. “Savior was India's favourable relationship with the former Soviet Union”, and the scope became unlimited for development in advanced technology. It, as a result, benefited Indian Defence tremendously.

Inclusion of India's Defence-Industrial Sector:

Considering medium artillery, small arms and ammunition, India is very close to self-reliance. The success can be seen as India can produce tactical missiles, helicopters, main battle tanks, frigates, combat aircraft and armoured personnel carriers. But it has adversely affected the development of advanced weapon systems domestically. As per studies, India has managed to achieve just one-third of the self-reliance defence industrialism. There is a long way to go for the economy. “A study by the Federation of Indian Chambers of Commerce and Industry criticized India decided to reduce its military imports by between 25 per cent and 75 per cent by 2009-2019, and it would not only boost indigenous production but would also create 120,000 jobs and lead to a 30–50 per cent cost saving for the government. Several reasons explain India's mixed performance in defence production.”

India First Indigenous developed 5.56 mm - 9mm machine gun

Research and development have been a part of the defence budget, and it amounts to up to 6 per cent of the total budget.” The over-expenditure has been common in the past, and lessons are evident; India is learning to minimize the cost for the production of arms and immatures.

Measures in the 21st Century Taken By India To Achieve Self-Reliance In Defence Manufacturing

DRDO is the best example of self-reliance reflected by Indian Defence industrialization; it has helped to demonstrate the utilization of finance technology to define the defence system of India in future. The development of Agni and Prithvi ballistic missiles is one of the most prominent achievements to reflect the same. Indian has been among the top procurer of defence equipment in past decades.

Indigenization of India Defence Production

The make in India concept has been the most rewarding realization for the Indian economy, to unleash the present capability and focus on the areas that can help create future capabilities. The country has a long way to go to create hi-tech arm weapons and types of equipment. With the clash between India and China, the country has realized the importance of framing defence policies and has made it possible by laying down the bricks to create a well-rooted building. India has followed an incremental path towards self-reliance and indigenisation. It has achieved this through off-the shelf procurement, indigenous production of spares and other steps. But it has singularly failed to help India in the design and production of advanced weapons systems. A study argues that if India were to reduce its military imports by between 25 per cent and 75 per cent by 2009-2019, it would boost indigenous production and create 120,000 jobs.

The economy learnt its lessons after being vulnerable before Independence.

The governing parties have tried their best in the interest of the defence force, and efforts have reflected success and failure. The upliftment of science and technology has been wholesome with the economy's performance as a developing nation. Technology has backed India and has encouraged defence policies to utilize export opportunities to domestic products. Political influence over this subject has been favouring the country. Aspirants can see the scope of technology and has successfully adapted the pathway to overall growth. A mix of procurement, co-production, licensed production, ventures, cooperative development and manufacturing spare parts domestically has contributed towards the success of the Indian Defence Industry. A self-sufficient country just got the right way to self-reliance and have managed to utilize the opportunity of the ultimate aim to export the defence equipment produced in India.

<https://www.outlookindia.com/website/story/outlook-spotlight-nations-long-term-vision-of-self-reliance-in-defence-sector/398680>

Defence Strategic: National/International



Press Information Bureau
Government of India
Ministry of Defence

Mon, 25 Oct 2021 3:01PM

Raksha Mantri Shri Rajnath Singh chairs Ambassadors' Round Table for DefExpo 2022

*Invites foreign defence companies to participate in Asia's
largest defence exhibition in Gandhinagar, Gujarat*

Key Highlights of RM's speech:

- *DefExpo 2022 to sow seeds of successful new ventures & international partnerships for shared prosperity*
- *The exhibition to boost investment, bolster Indian aerospace & defence ecosystem and cater to defence requirements of the world*
- *India open to do business on a mutually beneficially collaborative basis for all-round welfare of everyone*
- *India has potential for R&D in space, cyberspace, futuristic capabilities & disruptive technologies*
- *Defence exports grew by 334% in last five years; India now exporting to over 75 countries due to collaborative efforts*

In a major outreach to the friendly foreign countries as also to the defence manufacturing industries of the world, Raksha Mantri Shri Rajnath Singh chaired the Ambassadors' Round Table for DefExpo 2022, in New Delhi on October 25, 2021. The Round Table was aimed to brief the Ambassadors of foreign missions about the planning, arrangements and other details of DefExpo 2022, which will be held in Gandhinagar, Gujarat between March 10-13, 2022.

More than 200 delegates, including Ambassadors, Heads of Missions and Defence Attaches attended the Round Table, reflecting the growing global interest in the Indian Defence space. Chief of Defence Staff General Bipin Rawat, Chief of Air Staff Air Chief Marshal VR Chaudhari, Secretary (Defence Production) Shri Raj Kumar and other senior officials of Ministry of Defence & Government of Gujarat were also present.

Inviting the foreign delegates to attend DefExpo 2022, Asia's largest defence exhibition, Shri Rajnath Singh said, India is open to conduct business on a mutually beneficially collaborative basis, in the spirit of give and take, for all-round welfare of everyone. He exuded confidence that DefExpo 2022 will bring all the latest technologies under one roof and provide a myriad of opportunities to the stakeholders in the aerospace & defence industry.

"Resurgent India, where defence manufacturing is an identified pillar of growth, will display its ability to take lead at DefExpo 2022. I am confident that pursuing the vision of our Hon'ble Prime Minister Shri Narendra Modi, DefExpo-2022 will sow the seeds of successful new ventures and international partnerships to promote shared prosperity, boost investment, expand manufacturing and bolster aerospace and defence ecosystem in India, which shall be ready to serve the defence requirements of our friendly countries also," said Shri Rajnath Singh.

The Raksha Mantri thanked the foreign delegates for participating in DefExpo 2020 & Aero India 2021 and said DefExpo 2022 aims to further the benchmark of its previous editions with greater presence of foreign and Indian exhibitors, OEMs and foreign countries. “We are committed to supporting the partnerships that have been forged thus far as also form newer bonds for mutual growth,” he said.

Shri Rajnath Singh added that DefExpo 2022 will provide an overview of what India has been able to achieve in terms of defence R&D and production, application of modern technologies, liberalised collaborative policies introduced by the Government in last seven years. Saying that the Government is committed to furthering the defence business interests through synergistic growth, he expressed confidence that increased international participation will lead to development of mutually advantageous relationships between India & other countries.

The Raksha Mantri stated that the Indian aerospace and defence manufacturing sector is ready to soar to newer heights and it has the potential for R&D in space, cyberspace, futuristic capabilities and disruptive technologies such as Artificial Intelligence, Block-chain, Virtual Reality, 3D Printing, Digital Frontier and Internet of Military Things.

Reaffirming the Government’s resolve to modernise the Armed Forces and make a strong & self-reliant defence industry, Shri Rajnath Singh said, various measures have been taken by the Government, including increasing defence capital outlay in the annual budget of 2021-22 by 18.75 % from the preceding year, which is the highest ever increment in the last 15 years. Other policy reforms include simplifying industrial licensing process; allowing 74% Foreign Direct Investment through automatic route and 100% with Government approvals for Critical technologies; introduction of Open General Export License policy; positive indigenisation lists of 209 items; launch of seven new Defence companies and opening up of testing & trial facilities for the private sector etc. The reforms in defence manufacturing are attracting greater interest from Indian and foreign defence manufacturers, innovators, MSMEs.

The Raksha Mantri appreciated the efforts of the Indian defence industry and thanked the foreign aerospace and defence companies for investing in the Indian defence growth story. “It is because of the collaborative efforts of entities from all over the world that our defence exports have grown by 334% in last five years and now India is exporting to more than 75 countries. Our export performance is a strong indicator of the quality and competitiveness of our defence products,” he said.

Shri Rajnath Singh also reiterated the Government’s commitment to the collective security system laid down in Chapter VII of the UN Charter which deals with action with respect to threats to the peace, breaches of the peace and acts of aggression. “As a responsible nation, we wish to ensure a stable international security system through these collaborations and efforts,” he said.

On the occasion, the Raksha Mantri also launched DefExpo 2022 website (www.defexpo.gov.in). The website provides online services to exhibitors, besides hosting informative content about the various indigenous defence products and tourism, arts and crafts of Gujarat. The website is an enabler for exhibitors to register and book space online on a first-come-first-serve basis, make online payments, book conference halls and venues for Business-to-Business (B2B) meetings. The website is the first interface and will make the process of booking and information access effortless.

Trade visitors will be able to buy their tickets from the website for visiting the show during business days *i.e.* 10th & 11th March 2022. Free Entry is planned for the general public on 12th & 13th March. Defence publications and Media will have to register online through the website.

At DefExpo-2022, which coincides with ‘Azadi Ka Amrit Mahotsav’ celebrations, the countries will not only get an opportunity to showcase their equipment and platforms, but also be able to explore the strengths and capabilities of the expanse of Indian Defence industry for forging Business partnerships. The event will help boost investment, expand manufacturing capacities and capabilities, discover avenues for technology absorption and thus, contribute to furthering the target of USD 5 Billion defence export by 2024. India aims to utilise this opportunity to further its

business with the mantra of shared prosperity. The Indian Government's commitment to make India self-reliant with indigenous defence capabilities will be reaffirmed.

<https://www.pib.gov.in/PressReleasePage.aspx?PRID=1766285>



**Press Information Bureau
Government of India**

Ministry of Defence

Mon, 25 Oct 2021 11:00AM

Admiral M Shaheen Iqbal, Chief of Naval Staff, Bangladesh Navy, visit to India

Admiral M Shaheen Iqbal, Chief of Naval Staff, Bangladesh Navy, is on an official visit to India, from 23 – 29 Oct 21. At New Delhi, Admiral Shaheen Iqbal will interact with the Chief of Naval Staff, in addition to the Chief of Defence Staff and other high ranking *Gol* officials. During the bilateral interactions, issues relating to joint cooperative efforts like Coordinated Patrol along International Maritime Boundary Line, bilateral exercise BONGOSAGAR, conduct of naval training and reciprocal visits of delegations would be discussed.

On completion of engagements in Delhi, Admiral Shaheen Iqbal is scheduled to visit Mumbai, where he will meet with VAdm R Hari Kumar, Flag Officer Commanding-in-Chief, Western Naval Command and visit Flagship of Western Naval Command. On completion of Mumbai visit, the Admiral would proceed to Defence Services Staff College, Wellington to witness training activities and interact with Commandant, DSSC.

India and Bangladesh share bonds of history, language, culture and multitudes of other commonalities. The excellent bilateral ties reflect an all-encompassing partnership based on sovereignty, equality, trust and understanding, that goes beyond strategic ties. India and Bangladesh are jointly celebrating Golden Jubilee Celebrations of Victory in Bangladesh Liberation War and 1971 War this year. A host of joint activities have been conducted which include reciprocal ship visits by both Navies and participation in Republic Day Parade 2021 at New Delhi by Bangladesh Armed Forces Contingent and gifting of WAR memorabilia. During the last quarter of 2021, conduct of *Talks* by Bangladesh War Veterans at Naval War College & Indian Naval Academy and participation of Indian Armed Forces contingent & Band in 'Victory Day Celebrations' in Bangladesh are planned.



<https://www.pib.gov.in/PressReleasePage.aspx?PRID=1766229>



पत्र सूचना कार्यालय
भारत सरकार
रक्षा मंत्रालय

Mon, 25 Oct 2021 11:00AM

बांग्लादेश के नौसेना प्रमुख एडमिरल एम. शाहीन इकबाल का भारत दौरा

बांग्लादेश के नौसेना प्रमुख एडमिरल एम. शाहीन इकबाल 23 अक्टूबर से 29 अक्टूबर, 2021 तक भारत के सरकारी दौरे पर हैं। नई दिल्ली में एडमिरल शाहीन इकबाल भारत के नौसेना प्रमुख के साथ-साथ चीफ ऑफ डिफेंस स्टॉफ और भारत सरकार के उच्चपदस्थ अधिकारियों से भी बातचीत करेंगे। द्विपक्षीय वार्तालाप के दौरान अंतर्राष्ट्रीय समुद्री सीमा, द्विपक्षीय रक्षा अभ्यास 'बोंगोसागर', नौसेना प्रशिक्षण तथा शिष्टमंडलों के आपसी दौरे जैसे संयुक्त सहयोगी प्रयासों सम्बंधी मुद्दों पर बातचीत होगी।

दिल्ली में अपना कार्यक्रम पूरा करने के बाद एडमिरल शाहीन इकबाल का मुम्बई जाने का कार्यक्रम है, जहां वे पश्चिमी नौसेना कमान के फ्लैग ऑफीसर कमांडिंग-इन-चीफ वाइस एडमिरल आर. हरि कुमार से मिलेंगे तथा पश्चिमी नौसेना कमान के सबसे महत्त्वपूर्ण पोत का भी दौरा करेंगे। मुम्बई दौरा पूरा करने के बाद एडमिरल, डिफेंस सर्विसेज स्टाफ कॉलेज, वेलिंगटन के लिये प्रस्थान करेंगे। वहां वे प्रशिक्षण गतिविधियों का अवलोकन करेंगे और डीएसएससी के कमानडेंट से बातचीत करेंगे।



भारत और बांग्लादेश के बीच साझा इतिहास, भाषा और संस्कृति के अलावा तमाम समानतायें हैं। दोनों देशों के रिश्ते सिर्फ सामरिक सम्बंधों तक ही सीमित नहीं हैं, बल्कि दोनों देशों के बीच शानदार द्विपक्षीय रिश्ते सम्प्रभुता, समानता, विश्वास और आपसी समझ पर आधारित हैं। भारत और बांग्लादेश संयुक्त रूप से इस वर्ष बांग्लादेश मुक्ति संग्राम, 1971 का स्वर्ण जयंती समारोह मना रहे हैं। इस सिलसिले में कई संयुक्त गतिविधियों का आयोजन किया गया। इनके तहत दोनों देशों की नौसेनाओं के युद्धपोतों ने दो-तरफा दौरे किये, बांग्लादेश सशस्त्र बलों के दल ने 2021 गणतंत्र दिवस परेड में हिस्सा लिया और युद्ध स्मारिकाओं को उपहारस्वरूप दिया गया। वर्ष 2021 की अंतिम तिमाही के दौरान नेवल वॉर कॉलेज और इंडियन नेवल अकादमी में बांग्लादेश के पूर्व सैनिकों के साथ संवाद तथा भारतीय सशस्त्र बल और बैंड की बांग्लादेश में 'विजय दिवस समारोहों' में भागीदारी की योजना बनाई गई है।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1766255>

India to highlight achievement in defence R&D at DefExpo-2022 in Gujarat

Gandhinagar in Gujarat will host the 12th edition of India's mega defence exhibition, the DefExpo, from March 11-13 next year

New Delhi: "The next edition of the DefExpo will provide an overview of what India has been able to achieve in terms of defence research and development, production and application of modern technologies for use by the military," Defence Minister Rajnath Singh said on Monday.

Gandhinagar in Gujarat will host the 12th edition of India's mega defence exhibition, the DefExpo, from March 11-13 next year.

In an address at an ambassadors' roundtable on the upcoming expo, Singh said that India's defence exports have grown by 334 per cent in the last five years and now India is exporting military equipment to more than 75 countries.

"Our export performance is a strong indicator of the quality and competitiveness of our defence products," he said.

The defence minister said that he was sanguine that the exhibition will bring all the latest technologies under one roof and provide a myriad of opportunities to the stakeholders in the aerospace and defence industry.

"The Defence Expo-2022 is going to provide an overview of what India has been able to achieve in terms of defence R and D and production, application of modern technologies, liberalized collaborative policies that we have introduced in a short period of 5-7 years," Mr Singh said.

He told the envoys that the participation of their respective countries at the expo will lead to the development of "mutually advantageous relationships" in the defence sector.

"India is open to doing business on a mutually beneficially collaborative basis, in the spirit of giving and take, for the all-round welfare of everyone," he said.

"At the same time, I can also assure you that the state of Gujarat has such richness of culture, art, food and serenity to offer that DefExpo-2022 will leave a lasting imprint on the participating delegates," he added.

The focus of the exhibition will be to showcase India as an emerging hub for the manufacturing of military hardware.

"The defence ministry will remain available and proactively engage through the next four-plus months to develop and build DefExpo-2022 as one of the marquee events as India celebrates its 75 years of independence as Azadi Ka Amrit Mahotsav," Mr Singh said.

Major global and domestic military firms are expected to participate in the biennial edition of the DefExpo with their latest weaponry and platforms.

The 11th edition of DefExpo had taken place in Lucknow last year.

'The theme of the upcoming DefExpo will be "India: The Emerging Defence Manufacturing Hub",' officials said.

The government is expected to highlight measures at the event to transform India into a hub of military manufacturing.



"The defence ministry will remain available and proactively engage through the next four-plus months to develop and build DefExpo-2022 as one of the marquee events as India celebrates its 75 years of independence as Azadi Ka Amrit Mahotsav," Singh said.

The government has initiated a series of measures in the last couple of years to encourage the domestic defence industry.

In August last year, Mr Singh announced that India will stop the import of 101 weapons and military platforms like transport aircraft, light combat helicopters, conventional submarines, cruise missiles and sonar systems by 2024.

A second negative list, putting import restrictions on 108 military weapons and systems such as next-generation corvettes, airborne early warning systems, tank engines and radars, was issued recently.

In May last year, the government announced increasing the FDI limit from 49 per cent to 74 per cent under the automatic route in the defence sector.

<https://www.thehindu.com/news/national/india-to-highlight-achievement-in-defence-rd-at-defexpo-2022-in-gujarat/article37158198.ece>



Tue, 26 Oct 2021

Chief of Army Staff Naravane chairs top review meet on India's security challenges, situation along LAC

The commanders also deliberated on the security scenario in Jammu and Kashmir in the face of a spate of killings of civilians in the Union Territory in the last few weeks

Top commanders of the Indian Army on Monday carried out a comprehensive review of the country's security challenges, including in eastern Ladakh and other sensitive areas along the Line of Actual Control (LAC) with China, on the opening day of a four-day conference, people familiar with the developments said.

The commanders also deliberated on the security scenario in Jammu and Kashmir in the face of a spate of killings of civilians in the Union Territory in the last few weeks, they said.

The conference chaired by Chief of Army Staff Gen MM Naravane is taking place in the national capital. They said the top commanders reviewed India's combat readiness in eastern Ladakh where Indian and Chinese troops are locked in a bitter standoff for 17 months, though the two sides have completed disengagement at a number of friction points.

Defence Minister Rajnath Singh is expected to address the commanders on Wednesday. They said the commanders also deliberated on issues relating to human resources and reform measures in the 1.3-million-strong force.

The conference is an institutional platform for conceptual-level deliberations, culminating in making important policy decisions for the Indian Army. Chief of Defence Staff Gen Bipin Rawat, Navy Chief Admiral Karambir Singh and Chief of Air Staff Air Chief Marshal VR Chaudhari are also scheduled to address the senior leadership of the Indian Army on avenues for promoting tri-service synergy.

The army commanders are also expected to deliberate on various reform measures recommended by separate internal committees, the people cited above said. They said the



The commanders reviewed overall military preparedness in eastern Ladakh as well as in other sectors of the LAC. (File photo of Army chief MM Naravane.)

discussions on the situation in eastern Ladakh and ways to further bolster India's military preparedness in the region are likely to dominate the conference in the next three days.

"The commanders will review overall military preparedness in eastern Ladakh as well as in other sectors of the LAC," said one of the people cited above. The eastern Ladakh border standoff between the Indian and Chinese militaries erupted on May 5 last year following a violent clash in the Pangong lake areas and both sides gradually enhanced their deployment by rushing in tens of thousands of soldiers as well as heavy weaponry.

The tension escalated following a deadly clash in Galwan Valley on June 15 last year. As a result of a series of military and diplomatic talks, the two sides completed the disengagement process in the Gogra area in August and in the north and south banks of the Pangong lake in February.

The last round of military talks on October 10 ended in a stalemate following which both sides blamed each other for the impasse. In a strong statement after the 13th round of talks, the Indian Army said the "constructive suggestions" made by it at the negotiations were neither agreeable to the Chinese side nor could Beijing provide any "forward-looking" proposals.

Each side currently has around 50,000 to 60,000 troops along the LAC in the sensitive sector.

<https://www.news18.com/news/india/chief-of-army-staff-naravane-chairs-top-review-meet-on-indias-security-challenges-situation-along-lac-4364024.html>

THE TIMES OF INDIA

Tue, 26 Oct 2021

LAC preparedness reviewed at Army commanders' meet

By Rajat Pandit

New Delhi: With China set to keep its troops forward deployed for the second consecutive winter along the frontier, especially across eastern Ladakh, top Indian generals on Monday discussed measures to maintain high operational readiness as well as further crank up logistics and infrastructure development.

The Army commanders' conference, chaired by General M M Naravane and attended by the vice-chief and commanders-in-chief of the six operational and one training command, kicked off with an "update" by the military operations directorate.

The discussions will be taken forward over the next three days, with defence minister Rajnath Singh, chief of defence staff General Bipin Rawat, Navy chief Admiral Karambir Singh and IAF chief Air Chief Marshal V R Chaudhari also slated to address the Army brass.

Operational preparedness along both the 3,488-km Line of Actual Control (LAC) with China, amidst the continuing 17-month military confrontation in eastern Ladakh, and the 778-km Line of Control (LoC) with Pakistan, which has seen a recent spurt in infiltrations, was reviewed during the brainstorming on Monday.

"The People's Liberation Army (PLA) is preparing for the coming winter. We are also prepared for the long haul, with advance winter stocking and logistics for the forward areas already being put in place," said a source.



“Yes, there is still a big gap in border infrastructure development on our side as compared to China. But it’s being progressively narrowed with construction of more roads, bridges, tunnels, forward helipads and ammunition storage facilities,” he added.

Deliveries of new weapons, drones, ammunition, armaments, vehicles and special mountaineering equipment have also begun under emergency procurements. Since June last year, the Army has inked 68 such capital procurement contracts worth around Rs 6,500 crore and 113 revenue procurement deals worth almost Rs 9,000 crore.

With the rapid emergence of non-contact and ‘grey zone’ warfare, in addition to the traditional kinetic conflicts, the conference will also focus on the induction and use of ‘niche technologies’.

These ‘disruptive’ technologies range from drone swarms, robotics, lasers and loiter munitions to artificial intelligence, cloud computing, big data analysis and algorithmic warfare. China, of course, is far ahead of India in these domains.

As of now, China seems disinclined to go beyond the troop disengagement achieved in the Pangong Tso-Kailash Range region in February and at Patrolling Point-17A near India’s crucial Gogra post in early-August.

There was no forward movement in resolving the stand-off at PP-15 in the Hot Springs-Gogra-Kongka La area during the 13th round of military talks on October 10, leave aside the much more intractable ones at Charding Ninglung Nallah (CNN) track junction at Demchok and the strategically-located Depsang Plains.

<https://timesofindia.indiatimes.com/india/lac-preparedness-reviewed-at-army-commanders-meet/articleshow/87267730.cms>



Tue, 26 Oct 2021

Researchers discover ferromagnetism induced by defects in correlated 2D materials

By Liu Jia

A weak ferromagnetic (FM) ground state at low temperature in few-layered van der Waals (vdW) magnetic $\text{Ni}_{1-x}\text{Co}_x\text{PS}_3$ nanosheets containing sulfur vacancies (S_v) was discovered by a research team led by Prof. He Jun from National Center for Nanoscience and Technology (NCNST) of the Chinese Academy of Sciences (CAS), in collaboration with Prof. Jin Song from the University of Wisconsin-Madison. This work was published in *Science Advances*.

Transition metal phosphorus trichalcogenides (MPX_3 , $\text{X} = \text{S}$ or Se ; $\text{M} = \text{Mn}, \text{Fe}, \text{Co}, \text{Ni}$, etc.), as the representatives of two-dimensional (2D) vdW magnetic materials, have gained wide attention in various fields, including superconductivity, optoelectronics and catalysis. In particular, NiPS_3 exhibits intriguing quantum properties owing to the intrinsic strong charge-spin correlation effects. It is an antiferromagnetic (AFM) material with a model Hamiltonian of the XXZ type.

In this study, researchers found that the existence of crystal defects in chemically synthesized $\text{Ni}_{1-x}\text{Co}_x\text{PS}_3$ nanosheets, i.e., sulfur vacancies (S_v), could suppress the strong intralayer antiferromagnetic exchange interaction (J_3) in NiPS_3 , and the Co substitution decreases the formation energy of S_v during the synthesis process.

Besides, they found that the conversion synthesis process for the $\text{Ni}_{1-x}\text{Co}_x\text{PS}_3$ nanosheets are necessary to promote the formation of S_v . S_v do not seem to exist in sufficient quantity in chemical vapor transport grown single crystal. The presence of S_v in $\text{Ni}_{1-x}\text{Co}_x\text{PS}_3$ nanosheets led to the suppression of long-range AFM correlations while other competing ferromagnetic exchange interactions dominate at low temperatures, creating a magnetically frustrated system.

As a consequence, the magnetic field required to tune this defect mediated ferromagnetic state (< 300 oersted) is much lower than the value needed to tune a typical vdW antiferromagnet ($>$ several thousand oersted), which made these nanosheets more appealing for spintronic applications.

Theoretically, in correlated NiPS_3 , the half-filled $\text{Ni } e_g$ orbitals coupled with half-filled S $3p$ orbitals, which mediates the electron hopping between neighboring Ni sites through superexchange interaction. Owing to the negative charge transfer energy, the S ligand transfers one electron to the half-filled e_g Ni $3d$ orbital to form a d^9L ground state, namely negative charge transfer (NCT) state. NCT state also dominates between antiferromagnetically aligned neighboring Ni atoms. In this case, the presence of S_v could affect the electronic correlation and then tune the magnetic ordering in correlated NiPS_3 .

These findings provide a less explored route for controlling competing correlated states and magnetic ordering by defect engineering in 2D vdW magnets.

More information: Fengmei Wang et al, Defect-mediated ferromagnetism in correlated two-dimensional transition metal phosphorus trisulfides, *Science Advances* (2021). DOI: [10.1126/sciadv.abj4086](https://doi.org/10.1126/sciadv.abj4086)

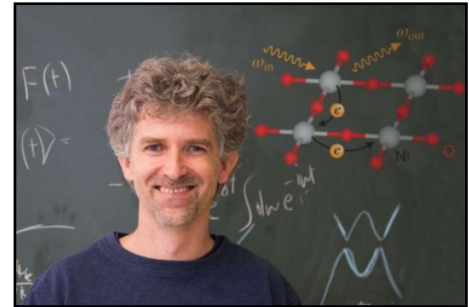
Journal information: [Science Advances](https://www.science.org)

<https://phys.org/news/2021-10-ferromagnetism-defects-2d-materials.html>

New tricks for finding better superconductive materials

Even after more than 30 years of research, high-temperature superconductivity is still one of the great unsolved mysteries of materials physics. The exact mechanism that causes certain materials to still conduct electric current without any resistance even at relatively high temperatures is still not fully understood.

Two years ago, a new class of promising superconductors was discovered: so-called layered nickelates. For the first time, a research team at TU Wien has now succeeded in determining important parameters of these novel superconductors by comparing theory and experiment. This means that for the first time a theoretical model is now available that can be used to understand the electronic mechanisms of high-temperature superconductivity in these materials.



Jan Kuneš. On the right: Nickel and oxygen atoms, and moving electrons in between. Credit: Vienna University of Technology

In search of high-temperature superconductors

Many superconductors are known today, but most of them are only superconducting at extremely low temperatures, close to absolute zero. Materials that remain superconducting at higher temperatures are called "high-temperature superconductors"—even though these "high" temperatures (often in the order of magnitude of less than -200°C) are still extremely cold by human standards.

Finding a material that still remains superconducting at significantly higher temperatures would be a revolutionary discovery that would open the door to many new technologies. For a long time, the so-called cuprates were considered particularly exciting candidates—a class of materials containing copper atoms. Now, however, another class of materials could turn out to be even more promising: Nickelates, which have a similar structure to cuprates, but with nickel instead of copper.

"There has been a lot of research on cuprates, and it has been possible to dramatically increase the critical temperature up to which the material remains superconducting. If similar progress can be made with the newly discovered nickelates, it would be a huge step forward," says Prof. Jan Kuneš from the Institute of Solid State Physics at TU Wien.

Hard-to-access parameters

Theoretical models describing the behavior of such superconductors already exist. The problem, however, is that in order to use these models, one must know certain material parameters that are difficult to determine. "The charge transfer energy plays a key role," explains Jan Kuneš. "This value tells us how much energy you have to add to the system to transfer an electron from a nickel atom to an oxygen atom."

Unfortunately, this value cannot be measured directly, and theoretical calculations are extremely complicated and imprecise. Therefore, Atsushi Hariki, a member of Jan Kuneš' research group, developed a method to determine this parameter indirectly: When the material is examined with X-rays, the results also depend on the charge transfer energy. "We calculated details of the X-ray spectrum that are particularly sensitive to this parameter and compared our results with measurements of different X-ray spectroscopy methods," explains Jan Kuneš. "In this way, we can determine the appropriate value—and this value can now be inserted into the computational models used to describe the superconductivity of the material."

Important prerequisite for the search for better nickelates

Thus, for the first time, it has now been possible to explain the electronic structure of the material precisely and to set up a parameterised theoretical model for describing superconductivity in nickelates. "With this, we can now get to the bottom of the question of how the mechanics of the effect can be explained at the electronic level," says Jan Kuneš. "Which orbitals play a decisive role? Which parameters matter in detail? That's what you need to know if you want to find out how to improve this material further, so that one day you might be able to produce new nickelates whose superconductivity persists up to even significantly higher temperatures."

More information: Keisuke Higashi et al, Core-Level X-Ray Spectroscopy of Infinite-Layer Nickelate: LDA+DMFT Study, *Physical Review X* (2021). DOI: [10.1103/PhysRevX.11.041009](https://doi.org/10.1103/PhysRevX.11.041009)

Journal information: [Physical Review X](https://doi.org/10.1103/PhysRevX.11.041009)

<https://phys.org/news/2021-10-superconductive-materials.html>



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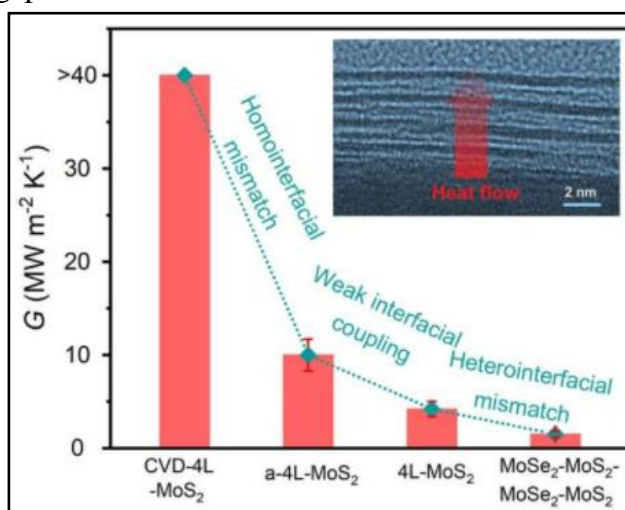
Atomic-scale 'lasagna' keeps heat at bay

Researchers from Tokyo Metropolitan University have found new ways of controlling how heat flows through thin materials by stacking atomically thin layers of atoms into van der Waals heterostructures. By comparing different stacks of different materials, or even the same material after heat treatment, they found that weak coupling and mismatch between layers helped significantly reduce heat transport. Their finding promises sensitive control of heat flow at the nanoscale in thermoelectric devices.

Heat is everywhere, and it flows. Heat in the wrong places can also be damaging. Examples include overheating electronics, as microchips produce more heat than they can move away while they carry out intensive computational tasks. This can damage or severely reduce the lifetime of electronic devices, making control of heat flow at the nanoscale a pressing concern for modern society.

A team led by Professor Kazuhiro Yanagi of Tokyo Metropolitan University has been working on ways to produce and handle ultrathin layers of a class of materials known as transition metal dichalcogenides. Here, they took layers of molybdenum disulfide and molybdenum diselenide a single atom thick and stacked them together into layers of four (4L films). The layers could be coupled together in different ways. The team's unique, gentle way of transferring large single atom-thin sheets allowed them to create stacks of layers bound together by van der Waals forces. They could also be strongly bound by more conventional techniques, specifically chemical vapor deposition (CVD). This gives rise to a number of permutations for how isolated layers could be put together, and potentially control how heat gets through them.

By using a special coating technique, they were able to detect how miniscule amounts of heat flowed past these stacks with rather good accuracy. Firstly, they found that layers strongly bound by CVD let through significantly more heat than their loosely bound counterparts. This effect could



Different levels of heat transfer are found in layers formed (from left to right) by chemical vapor deposition, annealed weakly bound layers, weakly bound layers, and alternating layers made of two different materials. (inset) Electron microscopy image of the cross-section of a typical 4L structure. Credit: Tokyo Metropolitan University

be partially reversed by annealing weakly held layers, making the binding stronger and improving upon the transport of heat. Furthermore, they compared stacks of four molybdenum sulfide layers to a "lasagna"-like structure made of alternating layers of molybdenum sulfide and molybdenum selenide. Such heterostructures had an artificial structural mismatch between adjacent layers of atoms which led to significantly lower levels of heat transfer, more than 10 times less than with strongly bound layers.

The team's findings not only demonstrate a new technical development but provide general design rules on how one might control how heat flows at the nanoscale, whether you want more or less flow. These insights will lead to the development of ultrathin, ultralight insulators as well as new thermoelectric materials, where heat might be effectively channeled for conversion into electricity.

More information: Wenyu Yuan et al, Control of Thermal Conductance across Vertically Stacked Two-Dimensional van der Waals Materials via Interfacial Engineering, *ACS Nano* (2021). DOI: [10.1021/acsnano.1c03822](https://doi.org/10.1021/acsnano.1c03822)

Journal information: [ACS Nano](https://phys.org/news/2021-10-atomic-scale-lasagna-bay.html)
<https://phys.org/news/2021-10-atomic-scale-lasagna-bay.html>



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Covid: Vaccine study links virus to rare neurological illness

Rare neurological conditions may occur after Covid vaccination, but the risk is far higher in people who catch Covid, new research suggests

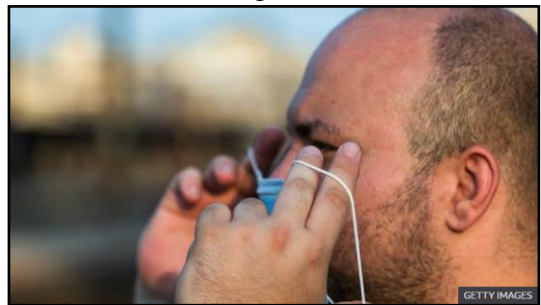
By Smitha Mundasad

Doctors say the landmark UK study provides further reassurance that being vaccinated offers the best protection for overall health.

The investigators examined the NHS records of 32 million adults in England to assess any rare adverse events linked to Covid vaccines.

The study appears in Nature Medicine.

The scientists, from the Universities of Oxford and Edinburgh, compared the levels of neurological conditions seen within a month of having a first Covid jab, to those seen within a month of a positive coronavirus test.



One thing they looked for was a rare condition called Guillain-Barre Syndrome (GBS) known to be associated with certain infectious diseases and linked to some other vaccines.

GBS causes inflammation of the nerves and can lead to numbness, weakness and pain, usually in the feet, hands and limbs and can spread to the chest and face.

It can be treated and most people will eventually make a full recovery, but it can be very serious and even life-threatening for some.

In the study, following the first dose of vaccine, there were:

- 38 extra cases (compared to the baseline risk of getting the condition) of GBS for every 10 million adults having the Oxford-Astrazeneca vaccine
- 60 extra cases of haemorrhagic stroke (a bleed in the brain) for every 10 million adults having the Pfizer vaccine

Meanwhile for people who had a coronavirus infection, there were approximately:

- 145 extra GBS cases per 10 million with a positive test
- 123 extra brain inflammation disorder cases like encephalitis meningitis and myelitis per 10 million people
- 163 extra cases of myasthenia-like disorders (immune conditions affecting the nerves and muscles) per 10 million people

There was also an increased risk of bleeds on the brain in the first seven days after a positive Covid test, but risks returned to a normal, baseline level within a month.

Researchers repeated their study on a smaller population of vaccinated adults in Scotland and found the same link with GBS and the Astrazeneca vaccine. They did not see the same pattern of increased risks with the Pfizer jab.

They say it remains unclear why these links appear and suggest more studies are needed to understand this.

<https://www.bbc.com/news/health-59011511>

