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Govt okays induction of nuke-capable Shaurya missile amid Ladakh standoff

The test firing of 4 missiles by DRDO in a month - the fourth will be tested around mid-October - is a message to the country's adversary that India will not cow down to any coercion, military or diplomatic

By Shishir Gupta

New Delhi: The Narendra Modi government has quietly approved induction and deployment of 700-km range surface-to-surface supersonic Shaurya strategic missile even as forward movement has been recorded in development of 5,000 km range K-5 submarine-launched ballistic missile. Shaurya is the land version of the submarine-launched BA-05 missile and has been developed by the Defence Research and Development Organization (DRDO). The land version was discreetly tested for the final time before induction as part of user trials in Odisha's Balasore on October 3.

According to top missile experts, Shaurya is a delivery system stored in a composite canister for rapid deployment and minimum interaction with the elements for a long period. The strategic missile flies at a supersonic speed of Mach 7, or 2.4 km per second, at a height of 50 km (within atmosphere) and hits the designated target at Mach 4.

The missile will be soon deployed at locations identified by the Indian Strategic Forces Command under guidance from National Security Council. The missile has a warhead weighing around 160 kg.

While the Modi government's decision to go for a land version is significant as the missile can be launched by a single vehicle, the DRDO is also making rapid strides in the development of a 5,000 km version of the submarine-launched ballistic missile (SLBM). With a range equivalent to Agni-5 land-based ballistic missile, the K-5 will be deployed on Arihant class of nuclear submarines.

While missile scientists are tight-lipped about the K-5 SLBM, the weapon system is expected to be tested in the next 15 months and then deployed on the 6,000-tonne Arihant class of SSBNs. The second Arihant-class nuclear-powered submarine, INS Arighat, is to be operationalised within the next six months.

The consecutive testing of hypersonic missile (September 7), Shaurya missile (October 3) and supersonic missile assisted release of torpedo (October 5) by DRDO from Balasore are clear signals from the government to the country's adversary that India will not cow down to any coercion. The 800 km-range subsonic Nirbhay cruise missile will be tested in the next couple of weeks and will be inducted into the Indian Army and Navy. The tactical missile has already been deployed in limited numbers in response to the Chinese build-up in Tibet and Xinjiang.



A new version of Shaurya missile, was successfully test-fired last week. (Photo courtesy: DRDO)

Coming at a time when India is engaged with a belligerent Chinese Army in Ladakh sector, a senior government official said the testing and deployment of short-range delivery platforms clearly conveys Modi Government's intention of not backing down to any aggression or cartographical expansion plan of any adversary in the neighbourhood.

<https://www.hindustantimes.com/india-news/shaurya-missile-to-be-inducted-in-strategic-arsenal-agni-5-s-sea-version-by-2022/story-bS1100SkwoGLEXW5ANFQuO.html>

ThePrint

Wed, 07 Oct 2020

DRDO readies for another missile test, this time it's subsonic 'Nirbhay'

In the last month, DRDO has carried out several tests of missiles and related technology, amid the Covid-19 pandemic and tensions with China

By Snehesh Alex Philip

New Delhi: Amid the ongoing India-China stand-off in Ladakh, the Defence Research and Development Organisation (DRDO) is preparing for yet another missile test — an 800 km-range subsonic 'Nirbhay' cruise missile — which is likely to take place by the end of October or in early November.

This test is likely to be the last trial before the 'Nirbhay' missile is inducted formally into the armed forces.

Since September, the DRDO has carried out multiple missile tests. The first test was that of the Hypersonic Technology Demonstrator Vehicle (HSTDV) on 7 September, and its success paves the way for missiles that can travel at six times the speed of sound, making India the fourth country in the world after the US, China and Russia to develop such technology.



DRDO's Nirbhay missile at the Republic Day parade | Photo: PIB via Wikipedia

This was followed by a test of the nuclear-capable 'Shaurya' missile on 3 October, and the supersonic missile-assisted release of a torpedo on 5 October. The 'Shaurya' missile is now ready for induction into the Strategic Forces Command (SFC), which handles India's nuclear arsenal.

In the interim, a different version of the in-service surface-to-surface supersonic cruise missile Brahmos was also tested on 30 September. The DRDO has also carried out other tests, including one for the indigenous Anti-Tank Guided Missile (ATGM), besides a host of others.

Message to China?

Asked whether the back-to-back tests were part of the messaging towards China, sources explained that some of the tests were planned for earlier but got delayed due to the Covid pandemic, while in some cases the tests were scheduled for now.

"The missile tests were held up due to the Covid pandemic, even though the labs were working round the clock. These tests show that the DRDO is back to business as usual," a DRDO source said.

<https://theprint.in/defence/drdo-readies-for-another-missile-test-this-time-its-subsonic-nirbhay/518116/>

India to acquire fighter jet engine technology & JV with foreign OEM soon: IAF Chief RKS Bhadauria

During his annual press conference on 5 September, Air Chief Marshal R.K.S. Bhadauria indicated the possibility of a Joint Venture (JV) in developing fighter jet aero-engine in India that will potentially set forth a new era of aerospace in India. He put his trust on home grown LCA Tejas MK1A & 5th Gen AMCA for IAF over foreign fighter jets

By Manish Kumar Jha

Interacting with BW Businessworld, on the recent CAG report on the failure of Rafale Offsets and subsequent delays of the transfer of technology (TOT) for aero engine, Chief of the Indian Air Force RKS Bhadauria hinted a possible deal soon.

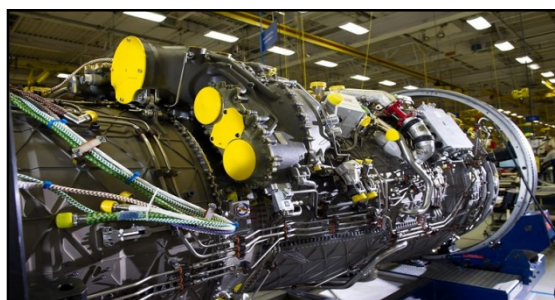
There is a lot of ambiguity in this regard. What are the issues on the TOTs as French partner Safran has not been able to transfer engine technology under the offset agreement so far? Where we are now at the moment as far as engine technology is concerned?

Chief RKS Bhadauria said: “In military aerospace zone, I think the engine is the biggest problem today and that is area that we must address. DRDO has been at it as we had numerous discussions. This engine issue is a complex issue. Technology involved is complex. DRDO and all concerned be it-- Safran, Rolls Royce and others-- they have been in discussion.” Further on the CAG report and upon the question raised by the author, Chief remarked: “As you asked specifically about Safran, the technology transfer did not materialize between DRDO & Safran and that is why it is not part of Offset as yet. Should it get firmed up between the two it will become part of the offset. So our understanding on that should be clear. It is from both side. If they firm up the commitment to take the transfer of technology, and sort out the negotiations with DRDO thereafter it will become part of the offset. Offsets contracts cater for such a possibility.”

When asked whether we are building upon Kaveri engine or DRDO is developing all together new engine capability, Chief said: “In terms of what is happening on the engine, what I am aware of is that there is a concerted effort to form a JV. Kaveri (Engine) came a long way but now it is not possible to assimilate it in AMCA kind of project. So JV is what we are looking at. We will see soon that the contours of JV get fructified.”

“It is not that Kaveri has failed. Part of Kaveri has been quite successful. In terms of design and manufacturing we will of course leverage the Kaveri Know how down the line and even assimilate in future JV for aero engine,” Chief further explained the past effort of DRDO.

“So, there will be technology that will be part of our plan and there needed technology to be built up. Since we have a tight timeline and how much should be capacity and on all that DRDO has to be finalized Chief elaborated on the sheer efforts and expertise gained such elusive technology that only very countries have been able to develop and master,” Chief said.



Are we not leveraging on international partnership for jointly develop aero engine for fighter jets as lot many countries – French Safran and UK's Rolly Royce among others are offering though none has been fructified so far? So any concrete result will happen this year? Replying on such possibilities Chief said: yes- sooner or later. "But I have been hoping for a long time," Chief said at last, knowing the complexity and the unwillingness of foreign OEMs to transfer such coveted technology to India.

On the multi-role fighter aircraft (MRFA) and Rafale, Chief made it clear that the IAF has placed the trust in the LCA. In the next five years we will commence induction of 83 LCA Mk1A. We are supportive of DRDO and HAL's effort at their indigenous production and you will soon see the contract of HTT 40 and LCH in this area CAS Bhadauria said.

"At the moment, we are concentrating on 83 LCA Mk 1A. After that, the follow-up planned is MRFA (multi-role fighter aircraft), which is 'Make in India' and the other line is on LCA versions, and Advanced Medium Combat Aircraft (AMCA)," said the IAF chief.

On India- china standoff at LAC in the Indian territory of ladakh, Chief said: "China can't get the better of India in any conflict and the air force, with its capability and intent serving as a deterrent for the adversary, is ready to handle any contingency, whilst he acknowledged the strengths of the Chinese air force and gave a broad overview of how the IAF would counter it."

The IAF chief said there was no question of underestimating the capabilities of the People's Liberation Army Air Force (PLAAF) as it had made huge investments in "technology, systems and numbers". He also spoke about the IAF's assessment of the Chinese J-20 fifth-generation fighter aircraft, calling it "work in progress".

Asked if the IAF had come close to launching airstrikes against Chinese targets after the June 15 Galwan Valley skirmish in which 20 Indian soldiers were killed, Bhadauria said, "No. But we were prepared for it."

On China using air bases in Pakistan-occupied Kashmir, including Skardu, and the possibility of a two-front war, the IAF chief said, "Whether China will use Skardu is an open-ended question. But if China needs Pakistan's help to confront us, I have nothing to say. If Skardu gets used by China and we are in conflict with China, then it's a collusive threat. And we will deal with it accordingly," IAF chief said. He said: "We have full capability for a two-front war."

Chief also talked about the new dimensions of aerial warfare and the role of UAVs in the conflict. Chief said: "Firstly, drones are important part for ISR and gathering of reconnaissance. It is very important. Their role in the initial conflict us very important. Once the conflict starts they do become susceptible to enemy action. But you can't win a war by sending Drones or even arms Drones. In terms of cost of Drones, it is an issue and it depends on capability. That increase in capability has its own cost. We know some system are costlier and some are not. So when we go head these will factor in final assessment. As attack weapon they have been very successful but they will be always limitation. There is combination of such asset that you need to have. We are aware of what kind of mix we should have."

Chief said: Direct energy is in our wish list. Now we are talking about 5th generation. DRDO is working on this. By the time, we will have 5th generation fighter jets, we should aim for 6th generation technology as far as Direct Energy is concerned. This will be the best outcome in our indigenous effort.

Asked on US deployment of B-2 bomber in Indian Ocean region and if it worked as deterrent to China in restraining, IAF Chief said: "American military deployment is from their own perspectives. When we prepare we don't plan it from our perspective. Their deployment is according to their strategic thinking. The American deployment took place without our coordination. Nobody will fight our war- we will have to fight ourselves."

Chief said India will have 450 air combat platforms. On how it builds up to Chief said: "It is not exact math but if you start counting from the current plan of action, we are acquiring 83 LCA Tejas Mk1a; 106 HTT 40, 100 LCA next generation; AMCA 7 squadrons and helicopters among others. He said the time line for LCA Tejas Mk 1a is about 4 years. AMCA is being progressed.

“Within a decade, we will be able to get them. By 2027 we are expecting AMCA by DRDO. Another 114 MMRCA addition will take place. For some of them approvals have not happened so this is the plan of action, but if start counting number will even go beyond 450. That is a huge numbers. I don’t think anybody has committed such numbers anywhere in the world,” CAS explained.

"This is the time for private sector and public sector to come together and supported by DRDO" Chief remarked on the building robust aerospace ecosystem in India as the result of such possibilities.

On the assimilation of indigenous technology Chief said a leading Indian IT firm has developed for IAF an electronic Maintenance Management System (e-MMS), which has all our flying platforms on it. Virtually this is the world’s largest such maintenance monitoring system and this has been a huge achievement with the private sector. "Virtually this is the world’s largest such maintenance monitoring system and this has been a huge achievement with the private sector," he said.

Despite many such platforms and indigenous effort whether IAF will be catch up to formidable number of 42 squadron? “Even we move at the fastest pace we cannot touch 40 squadron in a decade. If we get to 36 to 37 by the end of this decade, it will be good achievement” Chief said. But that is good number with our indigenous effort and technology.

<http://www.businessworld.in/article/India-To-Acquire-Fighter-Jet-Engine-Technology-JV-With-Foreign-OEM-Soon-IAF-Chief-RKS-Bhadoria/06-10-2020-328496/>



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Atmanirbhar Bharat: Indigenously built 5th generation fighter aircraft to be included in Air Force by 2029

HAL Tejas, Sukhoi-30 MKI, and Rafael, along with Navy's HAL, Naval Tejas, and MiG-29s in the Air Force, will be replaced this 5th generation indigenous fighter jet

By Ravi Dubey

India will now manufacture the fifth-generation fighter aircraft on its own under the Atmanirbhar Bharat Abhiyan. Currently, Rafael fighter jets coming from France are of 4.5 generation, while America, Russia, and France have developed next-generation aircraft.

Therefore, India has decided to manufacture the fifth generation Advanced Medium Combat Aircraft on its own, while reducing the dependence on foreign companies and promoting 'Self-reliant India' and 'Make in India' mission. For this, work has started on fast-forwarding the scheme, pending for three years.

Thus, the detailed design of AMCA has been finalized, and now better engines are being sought.

India will make its fifth-generation fighter aircraft

India had decided to work with Russia to build the fifth-generation fighter aircraft (FGFA) after it signed a deal with France in 2016 for 36 Rafale jets of 4.5 generation. Under this plan, the Indian Air Force was to produce fifth-generation fighter aircraft based on the Russian aircraft Sukhoi-57.



FILE PHOTO

A total of 43 changes were to be made to Sukhoi-57, including advanced sensors, networking, and combat avionics. The scheme was put on hold in 2017 to promote indigenization and reduce dependence on foreign technology.

Now India has decided to manufacture the fifth generation Advanced Medium Combat Aircraft on its own while reducing the reliance on foreign companies and promoting 'Self-reliant India' and 'Make in India' missions. Therefore, work has been started on fast-forwarding the scheme, which has been pending for three years.

These companies have been given responsibility

Advanced Medium Combat Aircraft (AMCA) is an Indian program to develop fifth-generation fighter aircraft. Aeronautical Development Agency (ADA) and Aircraft Research and Design Center (ARDC) are designing this fighter aircraft, while Hindustan Aeronautics Limited (HAL) will build the plane based on this design.

ADA has also designed the indigenous Light Combat Aircraft (LCA) Tejas. Therefore it was given the responsibility to develop the fifth-generation fighter aircraft. The detailed design was finalized in February 2019 after completion of the study on the preliminary design.

A CAD model of the plane was shown at Aero India-2019.

What will be specialties

The fifth-generation indigenous fighter jet will play various roles apart from air superiority, ground attack, bombing, and an interception. It will be capable of defeating previous generation fighters with supercruises, stealth, and advanced AESA radars, super moveability, data fusion, and advanced avionics with many ground and sea defence systems.

HAL Tejas, Sukhoi-30 MKI, and Rafael, along with Navy's HAL, Naval Tejas, and MiG-29s in the Air Force, will be replaced this 5th generation indigenous fighter jet.

The indigenous fighter jet is intended to succeed Jaguar, Mirage 2000, and MiG-27 in the Indian Air Force. It will be the third supersonic jet of Indian origin after HAL Marut and HAL Tejas.

According to the Indian Air Force and Aeronautical Development Agency, India's first 5th generation fighter jet requires an engine that has future development potential for use in 6th generation unmanned programs.

India is in talks with a British company for this. The company has promised to jointly develop a new engine, which will not be based on the engine EJ-200 of American stealth aircraft.

As per the plan, it will be an all-weather multipurpose fighter aircraft with single-seat and twin-engine. India's first fifth-generation fighter jet is planned to be launched in 2024.

A total of four prototypes are initially planned, with the first flight expected to take place in 2025 or 2026, and begin production in 2029.

Air Chief Marshal Air Marshal RKS Bhadoria also said that we had put our faith in the indigenous 5th generation aircraft at the annual press conference on Monday. It will be our mainstay after a decade.

The AMCA will feature the sixth generation. Air Marshal Sandeep Singh also said that there are plans to include Advanced Medium Combat Aircraft into the Air Force major by the end of this decade.

<https://www.dnaindia.com/india/report-atmanirbhar-bharat-indigenously-built-5th-generation-fighter-aircraft-to-be-included-in-air-force-by-2029-2847893>



Wed, 07 Oct 2020

"No one will fight our wars": IAF Chief on US deployments in Indian Ocean

Addressing the annual Air Force Day press conference here, the Air Force Chief said India does not plan its war efforts with support from others and does everything on its own

New Delhi: Noting that there has been no coordination with the US forces in relation to border tensions with China, Air Force Chief RKS Bhadauria on Monday asserted that India has to fight its wars on its own and cannot count on others for this.

Addressing the annual Air Force Day press conference here, the Air Force Chief said India does not plan its war efforts with support from others and does everything on its own.

He ruled out any linkage of deployment of US military assets in the Indian Ocean with India's border tensions with China and said American deployments are done according to their perspective.

"American deployments are done as per their perspective. We don't plan our efforts with support from someone else. They have not been deployed in coordination with us. We have to fight our own wars. No one will fight our wars for us. We have to do it ourselves," he said.

The Air Chief was asked to comment on reports that reported American deployment of B-2 bombers in the Indian Ocean was to deter the Chinese from doing any misadventure in Ladakh.

On the possibility of the Indian Air Force buying the second batch of 36 more Rafale fighter aircraft, the Air Chief said it was a complex subject and "various options" were being deliberated upon in the Force.

He suggested that the decision to either buy more Rafales or to go in for an open tender for 114 multirole fighter aircraft was yet to be finalised.

"Whether we go in for more Rafale or MRFA, it will be an open competition...The current status is that we have received all the RFIs (for the MRFA programme). All these issues are on the table now in terms of taking a final call...There are various issues that need to be considered," he said.

The first batch of five Rafale jets arrived in India on July 29, nearly four years after India signed an inter-governmental agreement with France to procure 36 of the fighter aircraft at a cost of ₹ 59,000 crore.

<https://www.ndtv.com/india-news/iaf-chief-on-us-deployments-in-indian-ocean-no-one-will-fight-our-wars-2305616>



IAF's frontline war machines Rafale, Sukhoi-30 MKI, Apache, Tejas, Gajraj to showcase its firepower on IAF Day 2020

By Ritesh K Srivastava

New Delhi: The Indian Air Force (IAF) on Tuesday conducted a full dress rehearsal ahead of the IAF day. The highlight of the rehearsal were the newly-inducted Rafale fighter jets which participated in the event at the force's Hindon base in Ghaziabad, Uttar Pradesh.

1. Indian Air Force's lethal war machines to display its firepower on IAF Day

The Indian Air Force Day will be celebrated on October 8. On this day, IAF's frontline warplanes like Rafale, Su-30MKI, Apache, Tejas, 'Gajraj' will showcase its lethal firepower. 56 aircraft, including 19 fighters and seven transport aircraft along with 19 helicopters, would be taking part in aerial display during this year's Air Force Day Parade, according to a press release by the IAF.



The Rafale fighter aircraft would fly in the 'Vijay' formation along with the Jaguars and then in the 'Transformer' formation with the Sukhoi-30 MKI and Light Combat Aircraft (LCA) Tejas fighter aircraft during the IAF Day parade this year.

2. SU-30MKI - The twinjet multirole air superiority aircraft of the IAF

SU-30MKI "Flanker": The Su-30MKI is a twinjet multirole air superiority, all-weather, long-range fighter aircraft of the IAF.

3. Mi-35: The twin-engine turboshaft, assault, anti-armour helicopter

Mi-35: The Mi-35 is a twin-engine turboshaft, assault, anti-armour helicopter capable of carrying 8 men assault squad with four-barrel 12.7 mm rotary gun in nose barbette and upto 1500 kg of external ordnance including Scorpion anti-tank missiles.

4. C-17 "Globemaster"- IAF's high-wing, 4-engine, military-transport aircraft

C-17 "Globemaster": The C-17 is a high-wing, 4-engine, T-tailed military-transport aircraft, capable of carrying large equipment, supplies & troops both by day & night. Extended reach and swift response.

5. C-130J: IAF's four-engine turboprop military transport aircraft

C-130J "Super Hercules": The C-130J is a four-engine turboprop military transport aircraft. IAF has integrated this machine for Special Ops, HADR missions & air maintenance roles.

6. Rafale - IAF's 4.5 generation, twin-engine omnirole, air supremacy fighter

Rafale: The Rafale is a 4.5 generation, twin-engine omnirole, air supremacy, interdiction, aerial reconnaissance, ground support, in-depth strike, anti-ship and nuclear deterrence fighter aircraft, equipped with a wide range of weapons.

7. AH-64E Apache - The twin-turbo shaft attack helicopter of IAF

AH-64E Apache: The Apache is a twin-turbo shaft attack helicopter with a tandem cockpit for two crew & a tail wheel-type landing gear arrangement.

8. LCA "Tejas": The multirole, supersonic light combat aircraft of IAF

LCA "Tejas": The Tejas is an indigenously developed, single-engine, fourth-generation, high-agility, multirole, supersonic light combat aircraft.

9. Mi-17 V5 - IAF's medium-lift, armed assault helicopter

Mi-17 V5: The Mi-17 V5 is a medium-lift helicopter, equipped with state-of-art navigational equipment & modern avionics, designed to be deployed for troops & arms transport, fire support and search-and-rescue (SAR) missions.

10. Gajraj - IAF's four-engine, multi-purpose, turbofan strategic airlifter

Gajraj: IL-76 “Gajraj” is a four-engine, multi-purpose, turbofan strategic airlifter & military-transport aircraft. The aircraft can deliver heavy machinery to remote areas, carry tanks, artillery & is utilised for #HADR Operations.

11. IAF's indigeneous armed attack helicopter

Rudra: The ALH Rudra is an indigenously produced attack helicopter, capable of a wide range of missions, including reconnaissance, troop transport, anti-tank warfare, and close air support.

<https://zeenews.india.com/photos/india/iafs-frontline-war-machines-rafale-sukhoi-30-mki-apache-tejas-gajraj-to-showcase-its-firepower-on-iaf-day-2020-2315129/iafs-indigeneous-armed-attack-helicopter-2315130>



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Aircrafts including Rafale, Mig-29 and Sukhoi-30 take part in IAF Day parade rehearsal

The 88th IAF day will be observed on October 8. It is celebrated every year to mark the foundation day of the Air Force. The IAF was established in 1932

Edited By Shivani Kumar

New Delhi: The Indian Air Force (IAF) on Tuesday conducted a full dress rehearsal ahead of the IAF day. The highlight of the rehearsal were the newly-inducted Rafale fighter jets which participated in the event at the force’s Hindon base in Ghaziabad, Uttar Pradesh.

The 88th IAF day will be observed on October 8. It is celebrated every year to mark the foundation day of the Air Force. The IAF was established in 1932.

The Tejas LCA, Jaguar, Mig-29, Mig-21, and Sukhoi-30 aircraft were also part of the rehearsal. IAF’s helicopter fleet like Mi17V5, ALH Mark-4, Chinook, Mi-35 and Apache performed flypast during the rehearsal.

A total of 56 aircraft, including 19 choppers and seven transport aircraft, will fly during the parade.

Suryakiran aerobatic team and Sarang aerobatic team were also part of the flypast.

In a major boost to India’s air force power, five Rafale fighter jets were formally inducted into the IAF on September 10. The jets are operating in the Ladakh region amid the tense standoff with neighbouring China over the border row.

<https://www.hindustantimes.com/india-news/aircrafts-including-rafale-mig-29-and-sukhoi-30-take-part-in-iaf-day-parade-rehearsal/story-2raudB3PbXOkL5Am4ZQr2O.html>



Indian Air Force's Rafale jet flies past during a full dress rehearsal for the 88th Indian Air Force Day celebrations, at Hindon Airbase in Ghaziabad.(PTI)

Indian Air Force Day 2020: Why Rafale jets were inducted into the 'Golden Arrows' squadron?

The 88th Indian Air Force Day will be celebrated on Thursday, October 8. It is celebrated to mark the day the Indian Air Force was established in 1932.

Meanwhile, the Indian Air Force conducted a full dress rehearsal on Tuesday, including a flypast by its aircraft, at its Hindon base in Ghaziabad.

The Tejas LCA, Jaguar, Mig-29, Mig-21 and Sukhoi-30 aircraft were part of the rehearsal, besides the newly inducted Rafale fighter jet, an IAF official said.

To the uninitiated, five Rafale fighter jets were formally inducted into the IAF on September 10 in a major boost to India's air power capability at a time when the country has been engaged in a months-long tense border standoff with China in eastern Ladakh.



According to a report, a traditional 'sarva dharma puja', a ceremonial 'water cannon salute' and an aerial display featuring various breathtaking manoeuvres by the aircraft marked their induction of the Rafale fighter jets into the 17 Squadron 'Golden Arrows' of the IAF at the Ambala airbase.

Defence Minister Rajnath Singh presented an induction scroll to Group Captain Harkeerat Singh, the Commanding Officer of the 17 Squadron of the 'Golden Arrows' of the IAF thus formally completing the induction of the five Rafale fighter jets into the squadron.

Speaking during the induction ceremony, Air Chief Marshal RKS Bhadauria, said, "The Rafale aircrafts along with the skills of the 17 Squadron of the 'Golden Arrows' will form a lethal combination and will challenge our adversaries."

"This induction could not have happened at a more opportune time considering the security situation today. The aircraft has already flown and familiarised with the operational needs and Rafale are good to go and deliver," added Bhadauria.

Meanwhile, Rajnath Singh said that the induction of Rafale jets into the IAF has also strengthened the Indo-French relations. "We are facing new geostrategic challenges and our two democracies are working together to resolve these challenges," he added.

As per IAF, "The 'Golden Arrows' was resurrected on 10 Sep 19. The Squadron was originally raised at Air Force Station, Ambala on 01 Oct 1951. 17 Squadron has many firsts to its credit; in 1955 it was equipped with first jet fighter, the legendary De Havilland Vampire. In Aug 1957, the Squadron became the first to convert on to a swept wing fighter, the Hawker Hunter." (With PTI inputs)

<https://www.freepressjournal.in/india/indian-air-force-day-2020-why-rafale-jets-were-inducted-into-the-golden-arrows-squadron>

More American-origin Sig-Sauer assault rifles to be given to troops deployed on China border

A second lot of Sig Sauer guns would be for the troops deployed on the China front in Eastern Ladakh and other areas

New Delhi: Having already received and deployed the first lot of around 72,500 Sig Sauer assault rifles from the US for counter-terrorists operations, the new batch of these assault rifles would be given to the soldiers deployed on the front with China in Eastern Ladakh.

A recent Defence Acquisition Council held by Prime Minister Narendra Modi government approved the acquisition of the second batch of around 72,500 Sig Sauer assault rifles from America under fast track procedures for the Army.

"The first lot of these assault rifles was provided to the troops deployed in the counter-terrorist operations in Jammu and Kashmir. The second lot of the guns would be for the troops deployed on the China front in Eastern Ladakh and other areas," government sources told ANI.



Sig Sauer assault rifle | Photo Credit: ANI

The idea is to provide the best of equipment facing the enemy on the frontline, they said.

The new rifles will replace the existing Indian Small Arms System (Insas) 5.56x45mm rifles used by the forces and manufactured locally by the Ordnance Factories Board.

As per the plan, around 1.5 lakh imported rifles were to be used by the troops in the counter-terrorism operations and frontline duties on the Line of Control (LoC) and the newly-activated Line of Actual Control (LAC).

The remaining forces would be provided with the AK-203 rifles, which are to be produced jointly by India and Russia at the Amethi ordnance factory.

Amid the ongoing dispute with China over the boundary issue, the Indian Army is going to place another order of 72,000 Sig 716 assault rifles from the United States.

The Indian Army had been trying to replace their standard INSAS assault rifles for many years but the attempts failed due to one reason or the other.

Recently, the Defence Ministry placed an order of 16,000 light machine guns (LMGs) from Israel to do away with the shortage of these guns.

<https://www.timesnownews.com/india/article/more-american-origin-sig-sauer-assault-rifles-to-be-given-to-troops-deployed-on-china-border/663226>

बड़ी सफलता- ISRO-DRDO के बाद रोहतक की यह कंपनी अब नासा और अमेरिकन आर्मी के लिए नट-बोल्ट बनाएगी

जसमेर लाठर की कंपनी एरो फास्टनर (Aero Fastener) प्राइवेट लिमिटेड के साथ अमेरिका की कंपनी का करार हुआ है। अमेरिकन कंपनी, नासा (NASA) और वहां की सेना के लिए नट-बोल्ट सप्लाई करेगी। वैसे एरो फास्टनर कंपनी डीआरडीओ व इसरो (ISRO) के लिए फास्टनर बना रही है।

नई दिल्ली: रोहतक (Rohtak) की एरो फास्टनर (Fastener) प्राइवेट लिमिटेड के बने नट-बोल्ट अब नासा के रॉकेट और अमेरिकन आर्मी के टैंक और दूसरे हथियारों में भी कसे जाएंगे। भारतीय अंतरिक्ष अनुसंधान संगठन (ISRO) और आठ साल से रक्षा अनुसंधान एवं विकास संगठन (DRDO) पहले से ही यहां के बने नट-बोल्ट का इस्तेमाल अपने यहां कर रहे हैं। अभी तक खास तरह के बने नट-बोल्ट के कच्चे माल पर रूस का कब्जा था। लेकिन एरो फास्टनर के मैनेजिंग डायरेक्टर जसमेर लाठर की कोशिशों ने रूस की निर्भरता को खत्म कर दिया है। हाल ही में नासा (NASA) और अमेरिकन आर्मी (American Army) को नट-बोल्ट की सप्लाई देने वाली अमेरिका की एक कंपनी और एरो फास्टनर के बीच कारोबारी करार हुआ है।

इंडियन नट-बोल्ट पर यहां पड़ी थी अमेरिकन कंपनी की निगाह

एरो फास्टनर प्राइवेट लिमिटेड के 44 वर्षीय मैनेजिंग डायरेक्टर जसमेर लाठर की कंपनी पिछले 5 साल से इसरो और 8 साल से डीआरडीओ के लिए नट-बोल्ट तैयार किए जाते हैं। अमेरिका की कंपनी के साथ हुए करार के बारे में बात करते हुए लाठर ने बताया, कुछ नए डिजाइन के फास्टनर (नट-बोल्ट) हमने तैयार किए हैं। फरवरी 2020 में रक्षा मंत्रालय ने रक्षा उपकरणों से संबंधित एक प्रदर्शनी का आयोजन किया था।

हमने भी वहां अपने नट-बोल्ट का स्टॉल लगाया था। इसी दौरान अमेरिका की कंपनी की निगाह हमारे प्रोडक्ट पर पड़ी। मैटल और मैटल में मिलाए जाने वाले खास तरह के कैमिकल के चलते उन्हें हमारे नट-बोल्ट बेहद पसंद आए। अभी कुछ वक्त पहले ही हमारी कंपनी और अमेरिकन कंपनी के साथ कागजी करार साइन हुआ है।



जसमेर लाठर ने तीन मशीनों के साथ इस कंपनी को शुरू किया था

एरो फास्टनर ने रूस को पीछे छोड़ पीएम का सपना किया पूरा

जसमेर बताते हैं कि टैंक, मिसाइल, सेटेलाइट में उपयोग होने वाले फास्टनर के लिए केमिकल का मिश्रण बहुत मायने रखता है। रूस व अन्य कुछ देशों में सेना की डिमांड के मुताबिक रॉ-मैटेरियल मिलता है। लेकिन सप्लाई में परेशानी आती थी। रक्षा मंत्रालय की कई ऐसी योजनाएं थीं, जिनमें रूस से नट-बोल्ट या फिर रॉ-मैटेरियल के लिए आश्रित थे। रूस डिमांड के बावजूद तैयार नट-बोल्ट या फिर रॉ-मैटेरियल देरी से भेजता था। इस कारण योजनाएं समय पर पूरी करने में देरी होती। लेकिन अब हम अपने यहां तैयार कर रहे हैं। आत्मनिर्भर बनकर पीएम नरेन्द्र मोदी के सपने को भी पूरा किया।

कोरोना काल में वेंटिलेटर के लिए रक्षा मंत्रालय को दी नट-बोल्ट की सप्लाई

कोरोना संक्रमण काल में रक्षामंत्रालय की भारत इलेक्ट्रॉनिक्स कंपनी वेंटिलेटर बना रही थी। ऐसे में नट-बोल्ट की जरूरत भी थी। लॉकडाउन के जिस दौर में छोटी-बड़ी सैकड़ों कंपनियां बंद थी, तो ऐसे में एरो फास्टनर ने 30 हजार नट-बोल्ट व कुछ अन्य उपकरण तैयार कर रक्षामंत्रालय को सप्लाई दी। जसमेर लाठर सेना के लिए आठ लाख बोटिंग मशीनों के कल-पुर्जे भी तैयार कर चुके हैं।

<https://hindi.news18.com/news/business/this-company-of-rohtak-was-making-fastener-for-isro-drdo-will-now-also-be-used-by-nasa-and-american-army-dlnh-3282307.html>

Science & Technology News

The Tribune

Wed, 07 Oct 2020

ISRO plans to launch new rocket before Dec 2020

The 34-metre rocket will have a lift-off mass of 120 tons and has the capability for multiple satellite launches at different orbits

Chennai: The Indian space agency is working towards launching its new rocket 'Small Satellite Launch Vehicle (SSLV)' before December 2020, said a senior official. He also said necessary tests to check its biggest motor — booster motor fired by solid fuel — will be done in November.

"The SSLV launch will be from the first launch pad at Sriharikota rocket port after the flight of Polar Satellite Launch Vehicle C49 (PSLV C49). Post PSLV C49's flight, the launchpad set up has to be reconfigured to suit SSLV," S Somanath, Director, Vikram Sarabhai Space Centre (VSSC), and part of the Indian Space Research Organisation (ISRO), told IANS.

"Sometime next month, PSLV C49 will fly with about 10 satellites. The rocket will be carrying India's RISAT-2BR2 and other commercial satellites. It will be followed by PSLV C50 with the GSAT-12R satellite in December. The rocket is being assembled at Sriharikota with various systems coming from different centres. It will fly from the second launch pad," Somanath said.

"From the drawing board to launchpad the time taken is only about two-and-half years. The SSLV is a three-stage engine rocket all powered by solid fuel," Somanath added.

The 34-metre rocket will have a lift-off mass of 120 tons. The rocket has the capability for multiple satellite launches at different orbits. The SSLV can carry a 500 kg payload for low earth orbit (LEO) and 300 kg for sun-synchronous orbit (SSO).

According to Somanath, the development cost of the rocket is about Rs 120 crore.

"The major development for SSLV is its brand new electronic systems with local components. All the qualifications of the systems have been done. The rocket also has a simple pyrotechnic system," Somanath said.

The new miniaturised telemetry system developed for SSLV has achieved 70 per cent mass reduction in the telemetry package.

According to Somanath, in order to develop the rocket at a lower cost, ISRO with a simplified manufacturing process — for instance, cutting down the machining time wherever possible — went to the next level of vendors with the necessary capabilities.

Somanath said the developmental cost of SSLV was low and only the third stage of the PSLV rocket had been adopted for the new rocket. The per kg cost of launching a satellite will be similar to that of ISRO's other rocket PSLV.

He said the first payload for SSLV had already been booked and some more payloads are being looked at as the rocket has a capacity to carry up to 500 kg.

According to ISRO, the first satellite to be carried by SSLV will be 142 kg Microsat-2A to demonstrate launch on demand capability. The satellite is expected to meet the ever-increasing user demands for cartographic applications at cadastral level, urban and rural management, coastal land use and regulation, utility mapping, development and various other geographic information system (GIS) applications.

Queried about a different name for the rocket as new private players have named their rockets as 'Vikram' and 'Agnibaan', Somanath said it is for the government to decide on that. IANS

<https://www.tribuneindia.com/news/nation/isro-plans-to-launch-new-rocket-before-dec-2020-151852>

THE TIMES OF INDIA

Wed, 07 Oct 2020

IIT-B's X-ray space telescope 'Daksha' to unlock more secrets of the universe

Mumbai: In a novel astrophysics mission, Indian Institute of Technology Bombay (IIT-B) in partnership with various scientific institutions has begun work on designing an X-ray space telescope called Daksha to study gravitational waves.

The project comprises two satellites to be deployed on opposite sides of the earth to ensure continuous coverage of the entire sky. Like India's first space telescope, Astrosat, Daksha will be deployed 650 metres above the earth's surface.

Speaking to TOI, principal investigator for the project, Varun Bhalerao, said Daksha's main goal is to study what are known as "X-ray emissions from gravitational wave events." It will also detect explosive events in space like about a 1,000 gamma ray bursts.

Bhalerao, who is attached to IIT's physics department, said the project is led by IIT-B in partnership with Ahmedabad-based Physical Research Laboratory, an Isro affiliate, the Tata Institute of Fundamental Research, the Pune-based Inter-University Centre For Astronomy and Astrophysics and the Bengaluru-based Raman Research Institute and Isro.

According to Bhalerao, Daksha will be more sensitive than Nasa's Swift and Fermi satellites which study gamma ray bursts.

Two years ago Isro had invited proposals from across the country for designing an astrophysics mission. "Isro received 20 proposals of which five, including the Daksha mission, were shortlisted. It will be launched three years after it receives the green signal from Isro," he said.

Daksha will be IIT-B's fifth space-themed project---the first was the Pratham student satellite launched on September 26, 2016, the second, Advitiy, is under development, besides a mission to the moon in collaboration with the University of Colorado under the GLEE project (Great Lunar Expedition For Everyone) and the Mars Rover designed and built by IIT-B students

<https://timesofindia.indiatimes.com/city/mumbai/iit-bs-x-ray-space-telescope-daksha-to-unlock-more-secrets-of-the-universe/articleshow/78519072.cms>

Scientists solve 90-year-old geometry problem

By Byron Spice

Carnegie Mellon University computer scientists and mathematicians have resolved the last, stubborn piece of Keller's conjecture, a geometry problem that scientists have puzzled over for 90 years.

By structuring the puzzle as what computer scientists call a satisfiability problem, the researchers put the problem to rest with four months of frenzied computer programming and just 30 minutes of computation using a cluster of computers.

"I was really happy when we solved it, but then I was a little sad that the problem was gone," said John Mackey, a teaching professor in the Computer Science Department (CSD) and Department of Mathematical Sciences who had pursued Keller's conjecture since he was a graduate student 30 years ago. "But then I felt happy again. There's just this feeling of satisfaction."

The solution was yet another success for an approach pioneered by Marijn Heule, an associate professor of computer science who joined CSD last August. Heule has used an SAT solver—a computer program that uses propositional logic to solve satisfiability (SAT) problems—to conquer several hoary math challenges, including the Pythagorean triples problem and Schur number 5.

"The problem has intrigued many people for decades, almost a century," Heule said of Keller's conjecture. "This is really a showcase for what can be done now that was not possible previously."

The conjecture, posed by German mathematician Eduard Ott-Heinrich Keller, has to do with tiling—specifically, how to cover an area with equal-size tiles without any gaps or overlap. The conjecture is that at least two of the tiles will have to share an edge and that this is true for spaces of every dimension.

It's easy to prove that it's true for two-dimensional tiles and three-dimensional cubes. As of 1940, the conjecture had been proven true for all dimensions up to six. In 1990, however, mathematicians proved that it doesn't work at dimension 10 or above.

That's when Keller's conjecture captured the imagination of Mackey, then a student at the University of Hawaii. With an office next to the university's computing cluster, he was intrigued because the problem could be translated, using discrete graph theory, into a form that computers could explore. In this form, called a Keller graph, researchers could search for "cliques"—subsets of elements that connect without sharing a face, thus disproving the conjecture.

In 2002, Mackey did just that, discovering a clique in dimension eight. By doing so, he proved that the conjecture fails at that dimension and, by extension, in dimension nine.

That left the conjecture unresolved for dimension seven.

When Heule arrived at CMU from the University of Texas last year, he already had a reputation for using the SAT solver to settle long-standing open math problems.

"I thought to myself, maybe we can use his technique," Mackey recalled. Before long, he began discussing how to use the SAT solver on Keller's conjecture with Heule and Joshua Brakensiek, a double major in mathematical sciences and computer science who is now pursuing a Ph.D. in computer science at Stanford University.

An SAT solver requires structuring the problem using a propositional formula—(A or not B) and (B or C), etc. —so the solver can examine all of the possible variables for combinations that will satisfy all of the conditions.



John Mackey, left, and Marijn Heule have pursued a math puzzle known as Keller's conjecture for decades. They found a solution by translating it into satisfiability problem. Credit: Stephen Henderson

"There are many ways to make these translations, and the quality of the translation typically makes or breaks your ability to solve the problem," Heule said.

With 15 years of experience, Heule is adept at performing these translations. One of his research goals is to develop automated reasoning so this translation can be done automatically, allowing more people to use these tools on their problems.

Even with a high-quality translation, the number of combinations to be checked in dimension seven was mind-boggling—a number with 324 digits—with a solution nowhere in sight even with a supercomputer. But Heule and the others applied a number of tricks to reduce the size of the problem. For instance, if one data configuration proved unworkable, they could automatically reject other combinations that relied on it. And since much of the data was symmetrical, the program could rule out mirror images of a configuration if it reached a dead end in one arrangement.

Using these techniques, they reduced their search to about a billion configurations. They were joined in this effort by David Narvaez, a Ph.D. student at the Rochester Institute of Technology, who was a visiting researcher in the fall of 2019.

Once they ran their code on a cluster of 40 computers, they finally had an answer: the conjecture is true in dimension seven.

"The reason we succeeded is that John has decades of experience and insight into this problem and we were able to transform it into a computer-generated search," Heule said.

The proof of the result is fully calculated by the computer, Heule said, in contrast to many publications that combine computer-checked portions of a proof with manual write-ups of other portions. That makes it difficult for readers to understand, he noted. The computer proof for the Keller solution includes all aspects of the solution, including a symmetry-breaking portion contributed by Narvaez, Heule emphasized, so that no aspect of the proof needs to rely on manual effort.

"We can have real confidence in the correctness of this result," he said. A paper describing the resolution by Heule, Mackey, Brakensiek and Narvaez won a Best Paper award at the International Joint Conference on Automated Reasoning in June.

Solving Keller's conjecture has practical applications, Mackey said. Those cliques that scientists look for to disprove the conjecture are useful in generating nonlinear codes that can make the transmission of data faster. The SAT solver thus can be used to find higher dimensional nonlinear codes than previously possible.

Heule recently proposed using the SAT solver to tackle an even more famous math problem: the Collatz conjecture. In this problem, the idea is to pick any positive whole number and divide by 2 if it's an even number or multiply by 3 and add 1 if it's an odd number. Then apply the same rules to the resulting number and each successive result. The conjecture is that the eventual result will always be 1.

Solving Collatz with the SAT solver "is a long shot," Heule acknowledged. But it is an aspirational goal, he added, explaining that the SAT solver might be used to resolve a number of less-intimidating math problems even if Collatz proves unattainable.

<https://phys.org/news/2020-10-scientists-year-old-geometry-problem.html>

Hydrogen embrittlement creates complications for clean energy storage, transportation

As the global energy market shifts from coal, petroleum fuel, and natural gas to more environmentally friendly primary energy sources, hydrogen is becoming a crucial pillar in the clean energy movement. Developing safe and cost-effective storage and transportation methods for hydrogen is essential but complicated given the interaction of hydrogen with structural materials.

Hydrogen can cause brittleness in several metals including ferritic steel—a type of steel used in structural components of buildings, automobile gears and axles, and industrial equipment. Recent advancements in experimental tools and multiscale modeling are starting to provide insight into the embrittlement process.

A review of various methods, published in *Applied Physics Reviews*, has improved the understanding of the structure, property, and performance of ferritic steels that are subjected to mechanical loading in a hydrogen environment. While there are many studies of stainless steel, the researchers concentrated on ferritic steel, a cheaper steel that is used in the construction of pipelines and other large structures.

"Determining the location of the hydrogen in the host metal is the million-dollar question," said May Martin, one of the authors.

Specifically, understanding where the hydrogen goes under strain in a bulk material is critical to understanding embrittlement.

"We haven't answered this question but by combining techniques, we are getting closer to that answer," said Martin.

The researchers highlighted several combinations of techniques and methods, including atom probe tomography. APT is a measurement tool that combines a field ion microscope with a mass spectrometer to enable 3-D imaging and chemical composition measurements at the atomic scale, even for light elements like hydrogen.

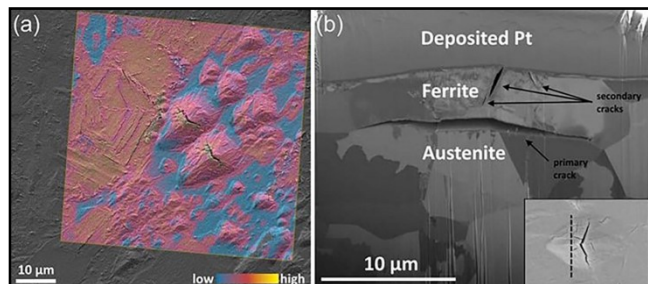
Other techniques that show promise are 2-D mapping by secondary ion mass spectrometry to answer the question of where hydrogen lies in a material. Ion mass spectrometry is a technique used to analyze the composition of solid surfaces and thin films by sputtering the surface of the specimen with a focused primary ion beam and collecting and analyzing the ejected secondary ions.

The researchers said it is particularly in the last decade that large advances have been made in hydrogen embrittlement, thanks to the development of new experimental capabilities. As new experimental techniques are refined it is expected the field will continue to develop at a remarkable pace. "As the field expands, we hope our paper is a good resource for those getting into the field," said Martin.

More information: "Hydrogen embrittlement in ferritic steels," *Applied Physics Reviews* (2020). aip.scitation.org/doi/10.1063/5.0012851

Journal information: *Applied Physics Reviews*

<https://phys.org/news/2020-10-hydrogen-embrittlement-complications-energy-storage.html>

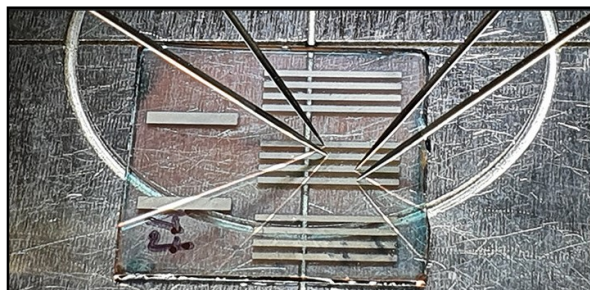


Hydrogen can cause brittleness in several metals including ferritic steel, but recent advancements provide insight into the embrittlement process. a) The arrowhead-shaped delaminations in stainless steel reveal cracks with significantly higher deuterium concentrations b) Secondary ion cross-sectional profile for one such delamination. Credit: O. Sobol, G. Holzlechner, G. Nolze, T. Wirth, D. Eliezer, T. Boellinghaus, and W.E.S. Unger

Energy-harvesting plastics pass the acid test

A polymer previously used to protect solar cells may find new applications in consumer electronics, reveals a KAUST team studying thin films capable of converting thermal energy into electricity.

When two sides of a semiconductor are at different temperatures, electron migration from hot to cool areas can generate a current. This phenomenon, known as the thermoelectric effect, typically requires semiconductors with rigid ceramic structures to maintain the heat difference between the two sides. But the recent discovery that polymers also exhibit thermoelectric behavior has prompted a rethink of how to exploit this method for improved energy harvesting, including incorporation into wearable devices.



Diego Rosas-Villalva explained that the team was surprised that such an extremely thin polymer was so effective in improving the lifetime of the device. Credit: KAUST

Derya Baran and her team at KAUST are helping to engineer self-powered devices using a conducting polymer containing a blend of poly(3,4-ethylenedioxythiophene) and polystyrenesulfonate (PEDOT:PSS) chains. Relatively inexpensive and easy to process for applications, including inkjet printing, PEDOT:PSS is one of the top-performing thermoelectric polymers thanks to its ability to take in efficiency-boosting additives known as dopants.

Diego Rosas-Villalva, a researcher in Baran's group, explains that thermoelectric PEDOT:PSS thin films are often exposed to dopants in the form of strong acids. This process washes away loose PSS chains to improve polymer crystallinity and leaves behind particles that oxidize PEDOT chains to boost electrical conductivity.

"We use nitric acid because it's one of the best dopants for PEDOT," says Rosas-Villalva. "However, it evaporates rather easily, and this decreases the performance of the thermoelectric over time."

After the doping step is completed, the PEDOT:PSS film has to undergo a reverse procedure to neutralize or "dedope" some conductive particles to improve thermoelectric power generation.

Typical dedopants include short hydrocarbons containing positively charged amine groups. The KAUST researchers were studying a polymerized version of these amine chains, known as ethoxylated polyethylenimine, when they noticed a remarkable effect—PEDOT:PSS films dedoped with polyethylenimine retained twice as much thermoelectric power after one week compared with untreated specimens.

The team's investigations revealed that polyethylenimine was effective at encapsulating PEDOT:PSS films to prevent nitric acid escape. In addition, this coating modified the electronic properties of the thermoelectric polymer to make it easier to harvest energy from sources, including body heat.

"We were not expecting that this polymer would improve the lifetime of the device, especially because it's such a thin film—less than 5 nanometers," says Villalva. "It's been incorporated into other organic electronics before, but barely explored for thermoelectrics."

More information: Diego Rosas Villalva et al. Enhanced Thermoelectric Performance and Lifetime in Acid-Doped PEDOT:PSS Films Via Work Function Modification, *ACS Applied Energy Materials* (2020).

[DOI: 10.1021/acsaem.0c01511](https://doi.org/10.1021/acsaem.0c01511)

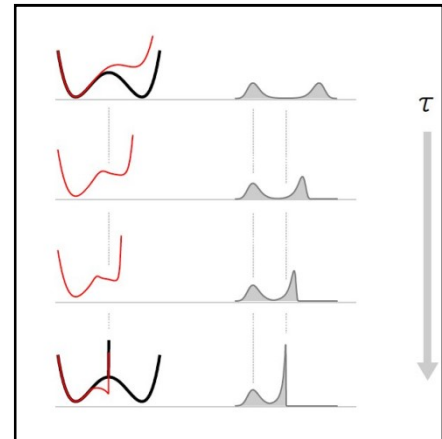
<https://phys.org/news/2020-10-energy-harvesting-plastics-acid.html>

A protocol to minimize the thermodynamic cost of erasing a single bit over a given amount of time

By Ingrid Fadelli

Stochastic thermodynamics theory is a framework that delineates the amount of heat, dynamics and entropy in small (i.e., mesoscopic) systems that are far from a state of thermodynamic equilibrium. In recent years, scientists have tried to use this theory to better understand the dynamics underlying a variety of systems, including colloidal particles, DNA, RNA, enzymes, molecular motors and electronic devices.

In a paper recently published in *Physical Review Letters*, researchers at Simon Fraser University combined stochastic thermodynamics with another construct known as optimal transport theory, with the aim of unveiling the thermodynamic cost associated with the erasure of a single bit of information from a device over a definite amount of time. Optimal transport theory is a framework introduced toward the end of the 18th century that answers questions such as: "If one has to move dirt from pile A to pile B, how should it be carried to minimize the effort required to transport it from one location to another?"



Credit: Proesmans, Ehrich & Bechhoefer

About a decade ago, theoretical physicist Erik Aurell and other researchers realized that optimal transport theory could also be used to solve a variety of optimization problems rooted in the field of thermodynamics. In their recent study, the team of researchers at Simon Fraser University performed calculations based on a technique introduced by Aurell and his colleagues.

"Our paper is based on the general framework of stochastic thermodynamics," Karel Proesmans, one of the researchers who carried out the study, told Phys.org. "By combining this theory with ideas from optimal transport theory, it is possible to calculate the minimum thermodynamic cost of a non-equilibrium process. We used these ideas to generalize Landauer's principle to finite-time processes."

Landauer's principle, the primary principle outlining the thermodynamics of information processing, sets a lower theoretical limit for the energy consumed by a device when performing a given computation. It thus also provides a specific value that represents the minimum thermodynamic cost of erasing information from a device (i.e., $kT \ln 2$ per bit, where k is the Boltzmann constant and T is the temperature of the surrounding environment).

This minimum cost, however, is typically only achieved for operations that are performed very slowly. In their study, on the other hand, Proesmans and his colleagues set out to identify the most efficient way possible of erasing a bit from a device quickly within a set amount of time.

"We have derived protocols that minimize the work needed to erase a bit of information in a given amount of time, assuming we have complete control over the applied forces affecting the particle," Proesmans said. "In so doing, we also derived a simple lower bound on the amount of work needed to erase a bit."

The recent study carried out by Proesmans and his colleagues led to two important findings. First, the researchers were able to calculate lower and upper bounds on the minimum amount of work needed to erase a bit from a device. In the future, these bounds could serve as a reference for evaluating the performance of state-of-art devices and experimental platforms. Moreover, the

framework proposed by the researchers could be used to construct optimal protocols for erasing bits from electronic devices.

"So far, we have focused on theoretical calculations," Proesmans said. "Our next step will be to test our bound on experimental systems. In particular, we will look at setups consisting of colloidal particles in optical tweezers. Another interesting question that we would like to answer is how well our bound changes when one has limited control over the system."

More information: Karel Proesmans et al. Finite-Time Landauer Principle, *Physical Review Letters* (2020). DOI: [10.1103/PhysRevLett.125.100602](https://doi.org/10.1103/PhysRevLett.125.100602)

Journal information: [Physical Review Letters](https://phys.org/news/2020-10-protocol-minimize-thermodynamic-erasing-bit.html)
<https://phys.org/news/2020-10-protocol-minimize-thermodynamic-erasing-bit.html>



Wed, 07 Oct 2020

New measurement of nucleus of thorium-229 moves scientists step closer to a nuclear clock

By Bob Yirka

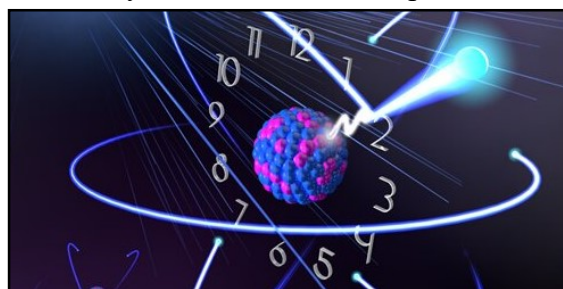
A team of researchers from Germany and Austria has taken a new measurement of the nucleus of a thorium-229 isotope, moving one step closer to a nuclear clock. In their paper published in the journal *Physical Review Letters*, the group describes how they measured the isotope and their results.

Over the past few hundred years, scientists have developed ever more accurate clocks. Evolving from quartz movements to the ticking of electrons in an atomic shell, scientists have advanced timekeeping to the point that some atomic clocks are accurate to one part in 10^{18} —accurate enough not to lose a single second over the life of the universe to date.

But still, scientists want an even more accurate clock: one based on oscillations of the nuclei of an atom—or in this case, an isotope. Researchers have attempted to make such a clock previously, but have failed for various reasons, mostly related to the high transition energies involved. Most such work has been focused on thorium-229 because its excited state is the lowest known for all atomic nuclei.

Until now, multiple attempts have been made to identify the exact wavelength of ultraviolet light that could be used to excite the thorium-229, which would reveal the kind of laser that could be used to create a nuclear clock. Each has given slightly different results, but scientists are getting closer to the answer. In this new effort, the researchers have come the closest yet, bringing with it the possibility of a new age of time-keeping.

The work involved measuring the radiation emitted by a sample of uranium-233 as it decayed to several types of isomers, one of which was thorium-229—a technique that has been tried before. But this time, the team used a method that was more precise, which led to a more precise estimate of the wavelength of ultraviolet light needed to measure the oscillations of the isotope's nucleus. They measured the transition energy at 8.1 electronvolts, which would mean an ultraviolet laser with a wavelength of 153.1 nanometers could be used to build the elusive nuclear clock. The team plans to carry out multiple measurements using the same technique to reduce uncertainty, and perhaps to arrive at the exact measurement needed to build the most accurate clock imaginable.



Artist's rendition of a nuclear optical clock. Credit: P. G. Thirolf et al., *Ann. Phys.* 531, 1800381 (2019).

More information: Tomas Sikorsky et al. Measurement of the Th229 Isomer Energy with a Magnetic Microcalorimeter, *Physical Review Letters* (2020). DOI: [10.1103/PhysRevLett.125.142503](https://doi.org/10.1103/PhysRevLett.125.142503)

Lars von der Wense. Ticking Toward a Nuclear Clock, *Physics* (2020). DOI: [10.1103/Physics.13.152](https://doi.org/10.1103/Physics.13.152)
[Press release](#)

Journal information: [Physical Review Letters](#)
<https://phys.org/news/2020-10-nucleus-thorium-scientists-closer-nuclear.html>

COVID-19 Research News



Wed, 07 Oct 2020

Jamia Millia Islamia researchers develop saliva-based Covid-19 testing kit

The team of scientists from Multidisciplinary Centre for Advanced Research and Studies (MCARS) at JMI along with experts from other institutes have developed a RNA extraction free saliva-based detection technology for COVID-19, it said

New Delhi: Researchers at the Jamia Millia Islamia (JMI) have developed a saliva-based testing kit to detect COVID-19 which can display results within an hour, a statement from the varsity said on Monday.

The team of scientists from Multidisciplinary Centre for Advanced Research and Studies (MCARS) at JMI along with experts from other institutes have developed a RNA extraction free saliva-based detection technology for COVID-19, it said.

A person can put their saliva sample into the kit and within an hour, it will display the results. The researchers are also planning to link it to a mobile application so that if the person is not able to infer the results on the kit, then the app will alert him with the results, researchers said. The technology is named MI-SEHAT (Mobile Integrated Sensitive Estimation and High- specificity Application for Testing) and can be used as point of care (POC) device for COVID-19 detection in the field with a provision for at-home testing, the statement said.

Dr Mohan C Joshi, an expert who is part of the team, claimed that the smartphone-enabled POC prototype has been developed and validated using synthetic SARS-CoV-2 RNA, which displays results within an hour without the intervention of a technical expert.

He said in such a difficult time when the rapid diagnosis of COVID-19 remains the effective measure to contain and manage the viral spread, cost-effective rapid testing of SARS-CoV-2 RNA remains the gold standard. “The available standalone or integrated PCR-based detection kit remains confined to the sophisticated instrumental diagnostic laboratory setup and takes minimum two to three hours in providing the result with the need for error- prone RNA extraction step,” he said.

PhD students, MD Iqbal Azmi and Md Imam Faizan at MCARS, JMI have benchmarked all the experiments in the laboratory which has helped the team to develop the prototype.

JMI Vice Chancellor Professor Najma Akhtar said being a user-friendly technology, MI-SEHAT will encourage home testing and thus will restrict interaction and movement of COVID-19



Jamia Millia Islamia.(HT file)

positive patients outside the home. “Further, it will reduce exposure of our healthcare professionals to COVID-19 positive patients who are directly or indirectly engaged in testing,” she said.

<https://www.hindustantimes.com/education/jamia-millia-islamiah-researchers-develop-saliva-based-covid-19-testing-kit/story-2kdEwshjWq5tNVMCeLNn1N.html>



Wed, 07 Oct 2020

New testing method can diagnose Covid-19 in just 30 minutes, study finds

The researchers noted that PCR molecular test currently used for Covid-19 diagnosis has very high accuracy but entails a complex preparation process to extract or refine the virus

Seoul: Scientists have developed a new method that allows anyone to easily and quickly detect Covid-19 in just 30 minutes, and is as accurate as the current PCR diagnostic test.

The SENSR technology developed by researchers at Pohang University of Science & Technology (POSTECH) in South Korea diagnosis Covid-19 based on the RNA sequence of the virus, reducing the stress on one single testing location and avoiding contact with infected patients as much as possible.

RNA is a nucleic acid that mediates genetic information or is involved in controlling the expression of genes.

The biggest benefit is that a diagnostic kit can be developed within a week even if a new infectious disease appears other than Covid-19, according to the research published in the journal Nature Biomedical Engineering.

The researchers noted that PCR molecular test currently used for Covid-19 diagnosis has very high accuracy but entails a complex preparation process to extract or refine the virus.

The test is not suitable for use in small farming or fishing villages, or airport or drive-thru screening clinics as it requires expensive equipment as well as skilled experts, they said.

The researchers designed the test kit to produce nucleic acid binding reaction to show fluorescence only when Covid-19 RNA is present.

The virus can be detected immediately without any preparation process with high sensitivity in a short time. And it is as accurate as the current PCR diagnostic method.

Using the new technology, they found the SARS-CoV-2 virus RNA, the cause of Covid-19, from an actual patient sample in about 30 minutes.

In addition, five pathogenic viruses and bacterial RNAs were detected which proved the kit's usability in detecting pathogens other than Covid-19, according to the researchers.

Another great advantage of the SENSR technology is the ease of creating the diagnostic device that can be developed into a simple portable and easy-to-use form, the researchers said.

The method not only allows onsite diagnosis before going to the screening clinic or being hospitalised, but also allows for a more proactive response to Covid-19 by supplementing the current centralized diagnostic system.

“This method is a fast and simple diagnostic technology which can accurately analyse the RNA without having to treat a patient's sample,” said POSTECH Professor Jeong Wook Lee. “We can



RNA is a nucleic acid that mediates genetic information or is involved in controlling the expression of genes.(Yogendra Kumar/HT PHOTO)

better prepare for future epidemics as we can design and produce a diagnostic kit for new infectious diseases within a week,” Lee said.

<https://www.hindustantimes.com/world-news/new-testing-method-can-diagnose-covid-19-in-just-30-minutes-study-finds/story-Xs7TnzX84EfomjchCLJ1XN.html>



Wed, 07 Oct 2020

Can vitamin D help the body fight coronavirus? Here's what a study finds

Researchers found that patients who were vitamin D-sufficient, had better immunity and could fight the viral infection

New Delhi: We all know that good health is the sum total of many different minerals, vitamins, proteins, etc., that come to us either through our food, or through our lifestyle choices — such as exercising every day and sleeping on time.

While it is a known fact that the sun is the best source of vitamin D, a recent study has found that vitamin D can reduce COVID-19's severity among patients, thereby giving them another reason to stay under the sun for a longer time.

According to the Boston University School of Medicine — that conducted the study — COVID-19 patients with adequate levels of vitamin D have lesser chance of showing “adverse clinical effects of the coronavirus” — like becoming unconscious and suffering from hypoxia (when there is oxygen deficiency in the body). The results of the study were published in *Plos One* medical journal.

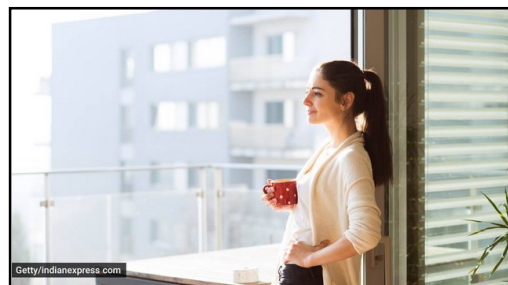
Researchers also found that patients who were vitamin D-sufficient, had lower levels of an inflammatory marker in the blood (known as the C-reactive protein), and higher levels of lymphocytes, which is a type of immune cell that helps in the fight against the infection, reports *The National*.

“This study provides direct evidence that vitamin D sufficiency can reduce the complications and ultimately death from COVID-19,” author Michael F Holick, professor of medicine, physiology and biophysics, and molecular medicine, was quoted as saying.

For the research, the blood samples of 235 hospitalised coronavirus patients were drawn and studied.

While you can take vitamin supplements, doctors advise that spending some early hours of the day under sun can help your body absorb the vitamin. This, in turn, can help you become healthier.

<https://indianexpress.com/article/lifestyle/health/vitamin-d-coronavirus-study-health-sunlight-immunity-6704113/>



While you can take vitamin supplements, doctors advise that spending some early hours of the day under sun, can help your body absorb the vitamin. (Source: Getty/Thinkstock)

