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Wed, 11 May 2022

DRDO's Agni-P missile: A nightmare for India's adversaries!

By the 1960s, China had established itself as a major nuclear power, with the aid of Russia, which bilateral relations, however, soured over time. India then needed to instill confidence in its people regarding its safety. India had to also send a strong message to international leaders about its nuclear preparedness. India in the early 1970s tested its first nuclear bomb at Pokhran, much to the chagrin and ire of the international community. Thereafter, India built and tested its Agni -1 missile with a range of 1000 km in 1989. The country has clearly come a long way since then. India is now engaged in developing Agni – 6 in the series, with a massive range of 10,000 km. Agni, developed by the Defence Research and Development Organisation (DRDO) in 1989, was an instant success. The then Government used it to strengthen the world perception of the country's defence capability.

Lessons from Gulf War

Following the Iraqi invasion of Kuwait during the Gulf War of 1991, India realised the immense functionality of Iraqi missiles and the engineering prowess of the scientists who had developed them. The battle, which hardly lasted a month, witnessed the bellicose Iraqis thrust Scuds and frog missiles — World War 2 weapons — into neighbouring nations of Saudi Arabia and Israel, which were countered by 'Sat' guided patriot missiles. The war turned into a lesson regarding the importance of further developing Agni to match international standards.

What is Agni?

Agni is a surface-to-surface missile launched from the ground to strike targets on land or sea. It can be fired from handheld weapons or ground installations, and can be mounted on to vehicles or ships. Since the launching platform is typically stationary or moving slowly, it is powered by a rocket engine or an explosive charge. Agni missiles have fins or wings for lift and stability, although hypervelocity or short-range missiles may use body lift or fly a ballistic trajectory.

India's Agni Trajectory

India, a new entry to the list of countries that tested long-range missiles, has taken a giant leap by impressively developing the Agni series. The recently inducted Agni 5 has a range of 5000 kms.

Classified as a ballistic missile, it can target Beijing and almost all major cities of China. Going by the development of the series and its effectiveness.

Agni 1- covers a range of up to 1000 kms, Agni 2- 2000 kms, Agni 3- 2500 kms, Agni 4 more than 3500 kms and can be fired from a mobile launcher. Agni 5, with a range of 5000-8000 kms, is marked as an inter-continental ballistic missile while Agni 6: ICBM with a range of 8000 kms to 10,000 kms is classified MIRVed Warhead. When the missile was first tested, it could carry 1000 kgs of payload/nuclear warhead. Agni 1 and 2 used Solid fuel as propellant. Agni 2 was 20 meters long with a one-meter diameter and weighed about 18 tonnes.

Agni 3's circular error probable CEP lies in the range of 40 meters- making it the most accurate strategic ballistic missile globally, enhancing its kill efficiency. This missile can hit strategic targets beyond 3500 kms carrying over 1.5 tonnes of warheads. Agni 4 is embedded with an indigenously developed ring laser gyro and composite rocket motor. It is 20 meters in length, propelled by solid propellant, weighing 17 tonnes. Agni 5 is India's first ICBM and can reach a target beyond 5000 kms and weighs up to 49 tonnes. Its canister launch missile system reduces the launch time, improves its storage capacity and eases management. Besides, it is built using high quality composite material to make it a lightweight system.

Agni 6 is yet to undergo tests and trials. The latest among the Agni series, it can hit targets beyond 10,000 kms and can be launched from a submarine. The latest Agni series is Agni-P tested in December 2021- an advanced variant with improved parameters, manoeuvrability and accuracy. It comes with a canister, ranges up to 1000-2000 km, weighs half the weight of Agni 3 and has new propulsions with guided systems. It is also imbued with technologies from Agni 4 and Agni 5.

<https://www.financialexpress.com/defence/drdo-agni-p-missile-a-nightmare-for-indias-adversaries/2519904/>



पत्र सूचना कार्यालय
भारत सरकार

रक्षा मंत्रालय

Tue, 10 May 2022 6:55 PM

राष्ट्रपति ने रक्षा अलंकरण समारोह (चरण -1) के दौरान छह मरणोपरांत सहित 13 शौर्य चक्र प्रदान किए 14 परम विशिष्ट सेवा पदक, चार उत्तम युद्ध सेवा पदक और 24 अति विशिष्ट सेवा पदक भी प्रदान किए गए

भारतीय सशस्त्र सेनाओं के सर्वोच्च कमांडर राष्ट्रपति श्री राम नाथ कोविंद ने 10 मई 2022 को नई दिल्ली में राष्ट्रपति भवन में आयोजित रक्षा अलंकरण समारोह (चरण -1) के दौरान सशस्त्र सेनाओं के कर्मियों को छह मरणोपरांत सहित 13 शौर्य चक्र प्रदान किए। विशिष्ट वीरता, अदम्य साहस और कर्तव्य के प्रति सर्वोच्च समर्पण के लिए भी कर्मियों को वीरता पुरस्कार दिए गए।

राष्ट्रपति ने सैन्य कर्मियों को असाधारण स्तर की विशिष्ट सेवा के लिए 14 परम विशिष्ट सेवा पदक, चार उत्तम युद्ध सेवा पदक और 24 अति विशिष्ट सेवा पदक भी प्रदान किए।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1824243>



Wed, 11 May 2022

AI engineering & Boeing may join hands to maintain VVIP 'India one' B777s & navy's P-8I

Soon to be privatised Air India Engineering Services Ltd (AIESL) and Boeing may join hands to maintain the two VVIP Boeing-777s used by the president, VP and PM for their medium and

long haul international flights. The American aerospace major on Tuesday said it is exploring “opportunities with AIESL for the maintenance, repair and overhaul (MRO) of critical equipment on key Boeing defence platforms in India, including the P-8I operated by the Indian Navy and the 777 VIP aircraft operated by the Indian Air Force.” The announcement was made at the Boeing India Atmanirbharta in Defence conference here on Tuesday.

Boeing Defence India MD Surendra Ahuja said: “Our planned collaboration with AIESL could position us to provide significant value-add to our defence customers locally by enabling faster turnaround, exceptional operational capability and mission readiness for the Indian armed forces. This is also an important step as part of our commitment to the government of India’s Aatmanirbhar Bharat vision of making India a regional MRO hub.” AIESL CEO Sharad Agrawal said: “Such collaboration would drive forward our vision for strengthening MRO capabilities in India, for India. We remain excited and committed as we provide critical support to India’s armed forces as part of the Boeing India Repair Development and Sustainment (BIRDS) hub initiative.”

In a statement, Boeing said the collaboration would support the Indian Navy’s growing P-8I fleet, building up the local aviation ecosystem, while ensuring quicker turnarounds for the Indian Navy. It would also help build indigenous MRO capabilities as it would bring the P-8I landing gear repair and overhaul work to India for the first time. “Boeing India’s collaboration with AIESL would provide further impetus to the BIRDS hub initiative, an in-country network and alliance of suppliers led by Boeing in India that envisions a competitive MRO ecosystem for engineering, maintenance, skilling, repair and sustainment services of defence and commercial aircraft. The hub has been growing capabilities in India in the areas of heavy maintenance, component repairs, training and skilling of MRO maintainers. An important aspect of BIRDS is training programs to increase skilled manpower by developing sub-tier suppliers and medium, small and micro enterprises (MSMEs) to build high quality MRO capabilities in India,” the statement said.

<http://www.indiandefensenews.in/2022/05/ai-engineering-boeing-may-join-hands-to.html?m=1>



Tue, 10 May 2022

Drone attacks in Punjab, a relook

In the past 48 hours, India’s Border Security Force (BSF) has brought down two drones from Pakistan in the Amritsar and Tarn Taran sectors of the Indo-Pak border in Punjab. One of the drones was carrying a payload of heroin. In October 2021, *The Indian Express* reported on the drone incursions in Punjab by travelling to the affected areas. The following investigation was filed after travelling through the Amritsar, Tarn Taran and Gurdaspur districts. A relook:

Drones over Punjab

It has been a tough night for the policemen stationed in Bhikhiwind, Khalra and Khemkaran areas of Tarn Taran district. They have been on a hunt for drones which have been sighted by BSF jawans on the Indo-Pak border but their vigil has not resulted in any solid information or

located the payload that the drones may have been carrying from Pakistan to India. The lush green fields of this part of Tarn Taran district have seen the worst of fighting between India and Pakistan in the two wars of 1965 and 1971. In 1965, this was the area on Khemkaran-Bhikiwind road that saw a Pakistan Army tank offensive threatening to make deep inroads into Indian territory till it was stopped in its tracks by a resolute Indian defence many kilometres down this road. Almost every border villager here has tales to tell of the two wars and how they or their elders fared in it.

These border districts of Amritsar, Gurdaspur and Tarn Taran have also witnessed the worst during the years of militancy in Punjab between 1984 to 1995 which claimed thousands of lives and sent the state and the country into turmoil. But now a new unseen enemy is at hand. One that is often only heard and not seen. BSF personnel open fire at the drones which are launched from within Pakistan but they have no idea if they ever hit them or not. Many times they can only observe some lights flashing and retreating when they fire at them with their small arms.

The topography of the area offers no particular challenge to someone who may be interested in sending drones across the border from Pakistan. The land is flat for miles on end and the line-of-sight signal would be available for the person operating the drone. And at many places the villages and houses are so close to the border fence that it would not be difficult to land the drone in some courtyard with precision.

“They operate the drones with GPS coordinates which are pre-programmed for the drone to land at some place or at least reach that place to dump the consignment,” says SSP Tarn Taran, Opinderjit Singh Ghuman. He too has been on the night domination patrolling which failed to yield results. “Not even a scooter was seen plying on the road by my police personnel on ‘nakas’ so there was no one who could have moved around to pick any packets of drugs or arms,” he says. Ghuman is not certain whether these drones actually go back or they may even stay on at the place of delivery. “The range at which they can operate goes down with the amount of weight they carry. Therefore the area of operation of these drones is limited. It could well be that some of them just land at the farthest end with the coordinates already fed into them,” he says.

Clad in jeans and shirt, Inderbir Singh, Sarpanch of Pahuwind village, is much younger in age than the white bearded Sarpanches in the area. He has a house and businesses in Amritsar and also maintains the farm at his village. But he is sceptical about the drones threat being as serious as being portrayed. “We have only heard about the drones being flown into India from Pakistan. We have never seen any. Nor has anyone in our villages. But we read news reports that something has happened and some weapons and drugs have been recovered. You tell us. Is it true? Can something like this happen so frequently,” asks Inderbir.

Proliferation of arms and ammunition in the border areas is at an all time high according to a cabinet minister of Punjab who does not want to be named. “Every packet of heroin which comes on a drone also brings with it a 9 mm pistol. There are so many illicit arms in the border areas that one has to be very careful picking a fight even with a passing motorbike rider. Who knows he may pull out a Chinese pistol on you,” says the minister. The SSP, however, says that this is not a new phenomenon. “Even with traditional methods of smuggling on the border, heroin packets have always come with small arms like pistols and some ammunition. The game plan is quite clear. The drugs may get passed on to be supplied in the rest of the country or even the world, but the pistols and other arms are more likely to remain in the state to increase crime,” he says.

The SSPs contention is backed by facts. Almost every drug seizure by BSF and Punjab Police on the border has weapons like pistols, AK-47 rifles and grenades with it. And, of course, Pakistani Sim cards for mobiles are also ubiquitous. This reporter searched and found not less than three Pakistani telecom providers signal being easily available all along the border. However, in the age of mobile data, the importance of Sim cards has diminished as the risk of interception is greater. “Whatsapp calls are the favoured means of communication between Indian smugglers and Pakistani smugglers as these are encrypted and the data connectivity is quite good in the border areas too,” says an intelligence official.

The Sarpanch of village Dhul Nau very close to the Indo-Pak border has his hands full fighting the sudden floods which have come in the village due to heavy rains. Drones are his least concern at the moment. “*Koi drone nayi aunda ethe. Saareyan nu pata hai kaun kee karda* (No drone comes here. Everybody knows what people are upto),” says Sarpanch Rashpal Singh. What he is hinting at is that the “nefarious” activities of some people are known to everybody in the villages and not hidden. This is a common thread which runs all along the border belt with villagers insisting that the Police and the intelligence officials, apart from the BSF, are well aware of the “bad elements” and that the drones are just a “theory”.

SHO Khemkaran police station Kuldeep Rai too has had a sleepless night having been part of the night domination patrol. A veteran of the fight against militancy in Punjab, Rai has his hands full with routine policing too, as any SHO in the Majha region, famous for people getting into a fight on slightest excuse, will testify. But now he was busy sorting out the problems of a man whose wife, in her early 50s, has eloped with a young man of 25 and refuses to come back home. Free from his desk job, the SHO accompanies this reporter to the border fencing where the Kasur Nullah enters Pakistan and actually goes towards the Pakistani city of Kasur after which it is named. Rains of the past few days have swollen the Nullah and a Pakistan Rangers post is just a stone’s throw away. Standing astride the newly constructed bridge on the Nullah, Kuldeep Rai is circumspect about the drones. “We have not seen much activity in the area of our police station. It is more towards Khalra. I am not sure of the reason. But out here it is peaceful,” he says. There is no explanation why certain areas on the border are more preferred for drone activities while others, right next door, are left untouched.

“It all may be a hoax for all we know. Who has seen a drone coming? We are just told that it was heard one night or the other night and that BSF has fired at it. As for people who are involved in smuggling. *Sareya nu pata kaun ne* (everyone knows who they are). Before the fence came up these people were involved in smuggling gold. Now it is ‘something else’,” says Gurmukh Singh, sarpanch of Mastgarh village, located very close to the border. Brothers Karambir Singh and Rajbir Singh at Rajoke village, which has seen a lot of drone activity, have some searching questions to ask. Karambir, the elder brother, is also the Sarpanch of the village. “Youth who do nothing go around in cars and wear shoes worth Rs 20,000. From where do they get the money for these? I do not know about this drone business but there is enough going on without drones too. Why does the police not ask these people from where they are able to afford these expensive things,” asks Rajbir, a sportsman. When asked about the recovery of arms and ammunition in the area dumped by drones, the brothers scoff at it. “Do you think someone will bury expensive weapons worth lakhs in the mud to let the police find them?” asks Parambir.

SHO (station house officer) of the Khalra police station Jaswant Singh, under whom Rajoke village falls, and which also has a police chowki, is well acquainted with this area and has had previous tenures there. Not the one to take any chances, after the sightings of drones by the BSF

near the village, he has deployed a quick reaction team 24X7 in an armoured truck on the road leading from the border towards the rest of the village. “*Senior afsar kehnde ne drone sirf aunda, jaanda nahin wapis,*” (senior officers say the drone only comes, it does not go back). We have not seen or heard anything. Only BSF people say they have and they fire at them,” he says. After recent sightings Jaswant Singh too has played a part in the night domination operations but found nothing. “This is my second tenure here. I never heard about drones coming during my first tenure but now in my second stint, I have heard about them coming twice in a short span of time,” he says.

The ‘routine offender’

Rajatal village in Amritsar district is located as close to the fence as a village can be. From the house of the sarpanch Amritpal Kaur, the border fence is clearly visible and so are some houses in the Pakistani village across the border. A kos minar from Mughal times, depicting the original alignment of the grand trunk road connecting Lahore to Delhi is also visible in the distance. But Amritpal Kaur is the Sarpanch only in name. Her male relatives call the shots. And among them is Suba Singh, her brother in law. In his early 70s, Suba Singh has by his own admission has “*barah-terah*“(12-13) cases registered against him which range from smuggling narcotics and arms to possession of fake Indian currency. He has also been convicted in one case but he has filed an appeal against it. Having spent time in jail, the battle-hardened Suba Singh is quite vociferous in his defence and the goings on in the border villages. He volunteers the information that his younger brother Punjab Singh also has some cases pending against him.

The house the family lives in is very comfortable and well made. “Our family had 46 acre of land handed down by our father. I have accrued Rs 7 crore in sale and purchase of land. Every paisa is accounted for. This house has been built from that money. I am always blamed in fake cases by the police,” he says. Suba Singh is certain that nothing can happen in border villages without the police knowing about it. “The person who tells them (police) that a drone has come or dumped something, why does he not tell them that a drone is coming at so and so time,” he asks. However, he is not outrightly dismissing drone activity like many others but he suspects the hand of individuals from law enforcing agencies in it too.

“Many people in border villages are implicated in false cases. I am not saying everyone is innocent but many are. Recently they booked six people in a case of smuggling and at least one of them was innocent. People come and go in expensive cars without having any source of income and wear branded clothes,” says Suba Singh. Sitting in his Amritsar house, member of parliament (MP) from Khadoor sahib constituency, Jasbir Singh Gill, says the drone activity in the border areas is worrying. “We all know that Pakistan does not have a friendly attitude towards us. There is a need for maintaining a strict vigil in the border areas and to ensure that the peace and stability in Punjab is not destroyed using these modern means of infiltration,” he says.

The drone effect on Kartarpur Sahib corridor

The border town of Dera Baba Nanak is roughly 75 km from Rajatal village. And the place where the Kartarpur corridor came up in November 2019, inaugurated with much fanfare. However, it was operational only for four months before it was closed down in March 2020 as the Covid-19 pandemic raged across the world. However, the reopening of the corridor has not met with much enthusiasm among the security agencies because of the drone problem on the borders. Despite repeated requests by the Punjab government for re-opening the corridor, it has stayed shut. In August 2021, an IAF unmanned aerial vehicle (UAV) crashed near Kalanaur, not

far from Dera Baba Nanak, causing panic in the area. The UAV was keeping an eye on the activities on the Pakistani side of the border amidst the increased drone activities seen in the area.

Inside Gurdwara Darbar Sahib in Dera Baba Nanak, not far away from the border, the devotees are still hopeful for the corridor to be opened before the birth anniversary celebrations of Guru Nanak Dev in November. Baldev Raj, a retired BSF sub-inspector, says there has been some talk of the corridor opening. The new deputy chief minister-cum-home minister of Punjab, Sukhjinder Singh Randhawa represents the Dera Baba Nanak constituency and has been a big votary of the corridor's opening. "*Sarkar diyaan gallan sarkar jaane. Oss paase waale ta kehnde ne kholo* (Only governments know what they are thinking. The people on the other side (Pakistan) are saying open it)", says Rattan Lal.

The opening scene of the 2016 movie '*Udta Punjab*', which focussed on the drugs problem in the state, shows a young man on the Pakistani side of the border using his discus throwing skills to fling a packet of drugs across the border fence. This technique and many others are now passe in the age of quadcopters or drones. The border fence is now redundant.

Recent drone activity in border villages

Oct 2021: Bohar Wadala, Chauntra and Kashyam Barman in Gurdaspur district

Sept 2021: Rajoke, Tarn Taran district

Aug 2021: Daleke, Tarn Taran district

August 2021: Hoshiarnagar, Amritsar district

July 2021: Pallopatti, Khalra, Tarntaran District

June 2021: Abaad, Dera Baba Nanak, Gurdaspur district

March 2021: Bamial, Pathankot district

Recoveries of arms and ammunitions from drone drops

The Punjab Police recovered 11 hand grenades from Salach village in Gurdaspur district in December 2020. In July 2021, a large cache of 48 foreign made pistols were recovered from a car in Kathunangal village in Gurdaspur district. These are reportedly dropped by drones in three locations in Gurdaspur and Tarn Taran district along with 80 kg heroin. In August 2021, the former DGP Dinkar Gupta disclosed that tiffin bomb IEDs, five hand grenades and more than 100 cartridges were recovered from a border village in Amritsar.

The border fence

The 461-km-long border fence runs along the Indo-Pak border in Punjab. It came up between 1988 to 1993, during the years of militancy in Punjab, when Pakistan was found to be giving weapons training and supplying arms and ammunition to Sikh separatist groups operating in Punjab. The fence has three-layered barbed wire, concertina razor wires and high voltage cobra wire running through it. The fence is floodlit during the night and is patrolled by BSF personnel night and day. Prior to drones, many contraptions have been devised by smugglers to beat the fence. These include plastic pipes and ladder/swing systems which can put over the contraband over the fence without touching it.

<https://indianexpress.com/article/cities/chandigarh/drone-attacks-in-punjab-a-relook-7909568/>

Wed, 11 May 2022

Intelligence bureau issues warning to other agencies over formation of 'Lashker-E-Khalsa'

Intelligence Bureau has warned other concerned intelligence agencies and state police over the formation of the group 'Lashker-E-Khalsa' which is active on social media to recruit people. The intelligence inputs accessed by ANI read that the Pakistan intelligence agency ISI (Inter-Services Intelligence) has made a social media presence in the name of LeK to establish a new group and recruit people to destabilize peace in the country. "A Pakistani Intelligence Operative using pseudonym "Amar Khalistani" is actively making efforts to cultivate new recruits through a Facebook ID to plan terrorist activities in the country," read the document. "It has also been learnt that ISI is planning to establish a new outfit namely "Lashker-E-Khalsa" very soon in which they will recruit Afghan nationals for terrorist activities in India especially Jammu and Kashmir," it added.

The document further reads that Pakistani intelligence operative (PIO) "Amar Khalistani "is reportedly managing multiple Facebook pages under the name of "Azad Khalistan and Kashmir". Pakistan's spy agency Inter-Services Intelligence (ISI) has re-activated its Kashmir-Khalistan (K2) desk to bring pro-Khalistan supporters and anti-India supporters in Kashmir at a common platform. The idea behind K2 desk is to exploit sentiments in Punjab and Kashmir. On Monday, an explosion was reported at the Punjab Police Intelligence Headquarters in sector 77 at around 7:45 pm. No damage has been reported. Senior officers rushed to the spot and an investigation is underway.

<http://www.indiandefensenews.in/2022/05/intelligence-bureau-issues-warning-to.html?m=1>

The Tribune

Wed, 11 May 2022

Nuclear command & control

MAY 11, 1998, was a momentous day for India when it successfully carried out the first nuclear weapon test with PM Atal Bihari Vajpayee at the helm of national affairs. The nuclear Rubicon had been crossed and Vajpayee acknowledged the contribution of his predecessors who nurtured this dormant nuclear capability for decades in the face of severe global restrictions and technology denial regimes. How secure is a nation that has acquired nuclear weapons and what has been the Indian experience over the last 24 years? This question has come into focus due to the Ukraine war and the dominant view is that Russia would not have carried out the February 24 invasion if Kyiv had nuclear weapons. An assault on territorial integrity in the manner that Ukraine has been subjected to would have been 'deterred' if it had retained its nuclear weapons.

However, challenges to territorial integrity do occur despite the possession of nuclear weapons and the 1969 Sino-Soviet border clash is illustrative.

In the Indian case, acquiring nuclear weapons in 1998 did not prevent the Kargil war of 1999 or the Galwan territorial skirmish of June 2020, and furthermore, all the terror attacks of the last 20-plus years. This is a reiteration of the tenet that nuclear weapons have only one role — the ‘core mission’ — to deter an adversary from even contemplating use of such weapons of mass destruction (WMD) capability. In the regional context, once China acquired nuclear weapons in 1964, Indian sovereignty was rendered vulnerable and Delhi’s anxiety at the visible strategic asymmetry was further exacerbated by the trauma of 1962.

May 11, 1998, assuaged India’s insecurity to a considerable extent — with the caveat that the credibility of deterrence is a 24X7 combination of tangible weapon and delivery capability; efficacious command and control; appropriate WMD safety protocols; and discrete politico-diplomatic signalling to certain interlocutors as exigencies emerge. To its credit, India has enhanced its composite WMD capability over the last two decades and the induction of INS Arihant, the indigenously designed and built ballistic missile capable, nuclear armed and propelled submarine (SSBN) is a major punctuation. This underwater platform, built in India with assistance from Russia has given Delhi the much sought after second-strike capability.

The Indian commitment to no-first-use (NFU) but an assured retaliation in the event of a nuclear exigency is rendered more credible with an underwater deterrent. The capability is nascent and the missile profile modest — but the path being traversed is judicious and will improve India’s composite strategic capability in the long run. The one area that merits objective review is the opaque command and control (C2) of India’s WMD capability. This critical apex politico-military management among nuclear weapon capable states is generally shrouded for security considerations but can be discerned by professionals in the peer group. It is a judicious combination of proven military capability — often under a strategic forces command (SFC) with a designated military commander; and the harmonisation with the apex political leadership that has the sole control and onerous responsibility of deciding when to use the apocalyptic nuclear ‘button’. Only those officials directly in the WMD loop would be able to assess the efficiency index of C2.

The dialectical element of the nuclear weapon is that while it is not to be used — except in the core mission function — the competence to use it in a seamless manner has to be well oiled within the higher defence lattice of the national security grid. Clarity of nuclear C2 roles at the highest level is imperative and here the Indian organisational chart is ambiguous, and on occasion, contradictory when it relates to the office of the Chief of Defence Staff (CDS). Till the appointment of the first CDS in 2020, the chain of command for C2 was that the SFC commander reported to the Chairman of the Chiefs of Staff Committee — the senior-most serving chief — and the latter was part of the executive council (EC) of the nuclear chain. The EC is chaired by the National Security Adviser (NSA) to the PM and this body reports to the political council (PC) headed by the PM and the ‘sole body which can authorise the use of nuclear weapons’.

However, an anomalous situation prevailed when the post of the CDS was instituted in relation to C2. The December 2019 press note said in addition to other hats, the CDS would also ‘be the Permanent Chairman of the Chiefs of Staff Committee’. Thus as the Chairman, COSC, the CDS would be the reporting authority for the SFC commander — as in the pre CDS template.

However, the same note added that the ‘CDS will not exercise any military command, including over the three Service Chiefs, so as to be able to provide impartial advice to the political leadership.’ The advisory role is reiterated when it is added that the CDS will ‘function as the Military Adviser to the Nuclear Command Authority’. The NCA comprises the PC and the EC. Oddly enough, the document adds that ‘Tri-service agencies/organisations/commands related to Cyber and Space will be under the command of the CDS.’ This formulation of the command function of the CDS is contradictory.

Thus the convoluted inference is that in relation to the nuclear capability — the CDS has an advisory role as part of the EC. The extrapolation from the current C2 then is that the SFC commander (three star) reports directly to the NSA as part of the EC and onwards to the PM, hence by-passing the CDS. This is an anomalous arrangement, for it vests the NSA with a command function, and the locus of the Defence Minister is only as part of the PC along with other Cabinet ministers. The role and locus of the CDS in relation to the C2 merits critical review. One hopes that this will receive appropriate attention when the next CDS is appointed. The current void could be a constraint in maintaining the highest degree of efficiency and effectiveness apropos the Indian nuclear deterrent.\

<https://www.tribuneindia.com/news/comment/nuclear-command-control-393629>

THE ECONOMIC TIMES

Tue, 10 May 2022

Northern Army commander lauds contributions of veterans, serving soldiers towards nation's security

Northern Army commander Lieutenant General Upendra Dwivedi on Tuesday lauded the efforts and heroism of war veterans in forcing the Pakistan to retreat back from the Akhnoor sector during the 1965 and 1971 wars. He also lauded the contributions of the local populace during the twin wars and honoured their sacrifices for the nation. Invoking the bravery of war veterans of Akhnoor, particularly first Victoria Cross awardee of Jammu and Kashmir and soldier of 2nd World War, Jamadar Prakash Singh Chib, Lt Gen Dwivedi said he was proud to visit the Akhnoor belt known for its valour in maintaining the sovereignty of the country. To honour the sacrifices and services of Indian Army veterans and 'veer naris' (brave women), an ex-servicemen rally was organised by Crossed Swords division of White Knight corps at Akhnoor military station, said Jammu-based defence spokesman.

Lt Gen Dwivedi graced the occasion accompanied by Lt Gen Manjinder Singh, GOC, White Knight Corps, Maj Gen V S Sekhon, GOC, Crossed Swords division and a large number of army veterans and veer naris. The Army Commander interacted with the veterans and lauded them for their contribution towards the security and prosperity of the nation. He emphasised on the Indian Army ethos in upholding the highest traditions of valour and devotion to duty in maintaining the sovereignty of the country. The event also highlighted contributions of the local populace during the 1965 and 1971 wars and honoured their sacrifices for the nation. Sunita Dwivedi, Regional President WWA, Northern Command felicitated the veer naris and widows for their unflinching support and contribution as pillars of strength to the soldiers serving in far

flung areas. The events was followed by interaction, medical check-up and grievances redressal of various issues, the defence spokesman said. Nearly 800 ex-servicemen, 200 Veer naris & widows from far-flung areas of Akhnoor, Sunderbani, Jaurian and Rakhmuthi were present on the occasion, he said. The event will go down as a memorable chapter in the history of Akhnoor military Station, displaying personified bonhomie and gratitude towards the service of ex-servicemen for defending the territorial integrity of the nation over the years, the spokesman said.

https://m.economictimes.com/news/defence/northern-army-commander-lauds-contributions-of-veterans-serving-soldiers-towards-nations-security/amp_articleshow/91469386.cms



Tue, 10 May 2022

Boeing, AIESL to set up MRO of critical equipment on key Boeing Defence platforms in India

Critical equipment including the P-8I operated by the Indian Navy and the 777 VIP aircraft operated by the Indian Air Force, are among the key platforms of Boeing which can now be maintained, repaired and overhauled in India. On Tuesday, Boeing announced its plans to collaborate with AI Engineering Services Ltd. (AIESL) which is a Directorate General of Civil Aviation (DGCA) approved MRO, for the setting up of Maintenance, Repair and Overhaul (MRO) of critical equipment on key Boeing defence platforms in India.

This venture has been announced under the US based Boeing India Repair Development and Sustainment (BIRDS) initiative. Under this initiative the plan is to make India the regional MRO hub for providing the MRO facilities to the different Boeing platforms being used in India as well as exploring collaboration in repair and overhaul of commercial common 737NG equipment which is fitted on the P-8I fleet as well as the landing gear.

More about the MRO

This will help in faster turnaround, exceptional and operational capability and mission readiness for the Indian armed forces. This is also in keeping with Indian government's Aatmanirbhar Bharat vision of making the country a regional MRO hub, top Boeing official has said while announcing the collaboration. Expressing its commitment to provide critical support to Indian Armed Forces, under BIRDS hub initiative, Sharad Agrawal, CEO, AI Engineering Services Ltd., said, "Such collaborations would drive forward our vision for strengthening MRO capabilities in India, for India." This MRO will help to provide an in-country and alliance of suppliers which will be led by Boeing in India and create a competitive MRO ecosystem for repair, maintenance, skilling, engineering, and sustainment services of defence and commercial aircraft.

And, according to an official statement issued at the end of the announcement, the hub has been growing capabilities in India in the areas of heavy maintenance, component repairs, skilling and training of MRO maintainers. As has been reported earlier, the important aspect of BIRDS is the

training programmes which help in increasing skilled manpower. This is done by developing sub-tier suppliers and medium, small and micro enterprises (MSMEs) in an effort to build high quality MRO capabilities in the country.

Boeing President & CEO visits India

To explore deeper participation in India's efforts in self-reliance and Make in India, especially in the defence sector, last week, Boeing President and CEO Dave Calhoun was in India and had called on Prime Minister Narendra Modi. According to reports, Boeing top officials accompanied by Sir Michael Arthur, President Boeing International, and its India head Salil Gupte had met with other top officials. The agenda was far more serious than the scaling up the MRO facilities of various Boeing platforms, the leasing of aircraft, the six P-8i aircraft which have been put in cold storage and the 114 aircraft competition for Indian Air Force (IAF).

Reports in the public domain indicate that the Boeing CEO was here because of the show cause notice received from the Ministry of Defence against the company's failure to implement the offset deal as per the contract of a prior deal. The offset agreement states that 30 percent of the value of the order given to the US aerospace giant has to be put back in India in various sectors that have been identified under the Defence Procurement Procedure, Ministry of Defence.

What was Boeing expected to put back?

Under the P-8I offset obligation (India has received 12 of these aircraft and the plan to get additional six has temporarily been put on hold by the Ministry of Defence). And based on the information available in the public domain as per offset requirements of the government, around USD 730 million had to be put back – direct or indirect.

Background

In 2019, on September 23, the Comptroller and Auditor General (CAG) had tabled a report in Parliament in which it had noted that vendors made offset commitments to get contracts “but later they were not they are not earnest about fulfilling these commitments and raised new issues which delayed offset implementation.” The CAG report listed cases of 36 Rafale fighter aircraft from France's Dassault Aviation, a contract with US giant Boeing to buy 10 military transport C-17 III aircraft and 80 helicopters from Russian Rosoboronexport (ROE).

<https://www.financialexpress.com/defence/boeing-aiest-to-set-up-mro-of-critical-equipment-on-key-boeing-defence-platforms-in-india/2519181/lite/>



Wed, 11 May 2022

India's first Air Force heritage centre at Chandigarh set to take flight on Independence Day

The Air Force Heritage Centre is all set to take flight on this year's Independence Day. The country's first IAF Heritage Centre, which will house vintage aircraft is being set up at the erstwhile Government Printing Press building in Sector 18. Speaking about it, a senior UT

official said, “Efforts are on to complete the museum work before August 15. Air force officers will play the role of guide. People will be able to know about the valour of the defence forces, stories of war and the weapons used.” The centre is set to have eight attractions in total, including aircraft models and weapon displays. The biggest attraction, however, will be its very own flight simulator. In addition, informative exhibits including aero engines, aircraft, kiosks and other air force artefacts, including machines/fixtures, films on achievements and personalities and guides, will also be set up. A souvenir shop will also be set up at the museum.

The 1971-fame Gnat vintage aircraft, which shot many Pakistani Sabre aircraft down had reached the centre earlier. An MiG 27 is expected to arrive within a week. The heritage centre will be maintained by the UT administration, while the weapons and other equipment will be set up by the air force. The administration had shut down the Government Printing Press in 2019. It was then decided to house a vintage car museum at the heritage building. The same was tipped as a dream project of former administrator VP Singh Badnore. Later, the administration added the setting up of a heritage furniture item museum alongside the vintage car museum.

Facing criticism to preserve and protect the city’s heritage furniture items, the administration proposed that one of the floors in the proposed vintage car museum could be used to showcase the heritage furniture. Another section was planned to be a space for organising auctions of spare heritage furniture items. On August 27, 2021, the UT administration and the air force also agreed upon the building for a vintage aircraft museum in the presence of Badnore.

<https://www.hindustantimes.com/cities/chandigarh-news/indias-first-air-force-heritage-centre-at-chandigarh-set-to-take-flight-on-independence-day-101652210260037-amp.html>



Tue, 10 May 2022

Army looks to take Stryker vehicles out of Alaska

Reestablishing the 11th Airborne Division in Alaska could entail cutting Stryker vehicles from a brigade there and adding personnel to create an operational headquarters. But the changes are expected to be cost-neutral in the immediate future and even the manpower added to the upgraded headquarters would come out of the cannibalized Stryker brigade, should that plan move forward, Army Secretary Christine Wormuth told the Senate Appropriations Committee Tuesday.

“We will be looking at basically having that division headquarters have sort of the same types of capabilities that you see in the 173rd in Italy, for example,” Wormuth said. The 173rd Airborne Brigade is a strategic response force for U.S. European Command, hinting at the kind of roles Alaska-based soldiers could eventually play in their own region. Army officials said last week that they’re planning to reflag U.S. Army Alaska as the 11th Airborne Division, a storied unit that fought in New Guinea and the Philippines during World War II before it was deactivated in 1965. The change could breathe new life into two brigade combat teams currently based in Alaska, one of which is an airborne unit and the other a mechanized unit manning the eight-wheeled Stryker armored vehicles.

“We are looking at potentially taking the Strykers out of Alaska,” Wormuth said. “We have not made a final decision about that, but if we do that, we will basically take them and look at the ones that we can reuse elsewhere or basically use for parts.” Because a Stryker brigade has more personnel assigned to it than a typical brigade, the extra billets could be added to the new operational headquarters, according to Wormuth. The headquarters is currently set up for administrative tasks. “There won’t be cost immediately associated with that particular step,” she added. “We won’t need to do new military construction, for example, to house people at this time. So, I don’t think that these changes are going to have large price tags, but we will be continuing to put money in the budget for things like the CATV [Cold-Weather, All-Terrain Vehicles].”

CATV prototypes underwent testing in Alaska late last year and are intended to replace the Small Unit Support Vehicle, which is 1960s-era technology that was purchased by the Army in the 1980s. New vehicles are part of a slew of changes being made to Army units in Alaska after the service rolled out its Arctic strategy in 2021. Like many Arctic strategy documents produced by government agencies in recent years, the Army’s plans warn of a region where climate change is expected to open new shipping lanes and offer access to energy and mineral resources. China, which considers itself a “near-Arctic nation,” has interest in the region. But Russia is the country with the largest amount of land above the Arctic Circle and, like the United States, it is protective of that territory.

The Army’s Arctic strategy suggested establishing a two-star general-led operational headquarters in Alaska to manage Arctic-focused combat brigades outfitted with tracked vehicles, tents, sleds and other equipment to help soldiers navigate deep snow and rugged terrain. The strategy also discussed plans to put a multidomain task force in Alaska that combines intelligence, cyber, space and electronic warfare to deny access to enemy forces — potentially valuable in a region where remote sea lanes and flight routes are needed to traverse great distances. Arctic warfare also requires different equipment. Most soldiering gear and vehicles are tested at about minus 30 degrees Fahrenheit. But soldiers in the Arctic face much worse conditions, including temperatures that drop below minus 65 degrees Fahrenheit. That causes problems for even the rugged Stryker vehicle.

<https://www.defensenews.com/news/your-army/2022/05/10/army-looks-to-ditch-stryker-vehicles-in-alaska/>



पत्र सूचना कार्यालय
भारत सरकार

विज्ञान एवं प्रौद्योगिकी मंत्रालय

Wed, 10 May 2022 11:36 AM

जैविक नमूनों के इलेक्ट्रॉन टोमोग्राफी पर राष्ट्रीय कार्यशाला

अखिल भारतीय आयुर्विज्ञान संस्थान (एम्स), नई दिल्ली नौ मई से 13 मई, 2022 तक पंचदिवसीय कार्यशाला और प्रशिक्षण कार्यक्रम (ऑफलाइन) का आयोजन कर रहा है। प्रशिक्षण कार्यक्रम का आयोजन डीएसटी, एसटीयूटीआई, डीएसटी एसएफआई और डीबीड एसएचएजे कार्यक्रमों के तहत क्षमता-निर्माण के लिये हो रहा है। कार्यशाला में इलेक्ट्रॉन टोमोग्राफी (आरटी-एंड-क्रायो) का परिचयात्मक ज्ञान प्रदान करने पर ध्यान दिया जायेगा। इसमें प्लंज फ्रीजिंग, क्रायो-अल्ट्रामाइक्रोटॉमी या क्रायो फोकस्ड-आयन बीम, ग्लो डिसचार्ज, ग्रीडिंग सेल्स ऑन ग्रीड्स, ट्रांसफर ऑफ ग्रीड टू दी ईएम, हैंडलिंग, टिल्ट सीरीज डाटा संकलन, आईएमओडी के साथ उनका प्रसंस्करण तथा ई-टोमो सॉफ्टवेयर के इस्तेमाल से नमूनों की तैयारी शामिल है। कार्यशाला को सैद्धांतिक/प्रणाली आधारित व्याख्यानो तथा प्रत्यक्ष प्रैक्टिकल सत्रों के साथ संचालित किया जायेगा।

कार्यशाला का उद्घाटन कल एम्स, नई दिल्ली के निदेशक प्रो. रनदीप गुलेरिया ने किया था। उद्घाटन के समय एम्स, नई दिल्ली के डीन अनुसंधान प्रो. सुब्रत सिन्हा, भारत सरकार के बायोटेक्नोलॉजी विभाग की डॉ. गरिमा गुप्ता और एम्स के एनाटॉमी विभाग के प्रमुख प्रो. ए. शरीफ उपस्थित थे। उद्घाटन समारोह में प्रो. मनदीपा बनर्जी, आईआईटी दिल्ली; प्रो. सुनील कटेरिया, जेएनयू; डॉ. गोपाल झा, एनआईपीजीआर, नई दिल्ली; डॉ. एनके प्रसन्ना, वरिष्ठ वैज्ञानिक, सीएसआईआर-एनआएससीपीआर, नई दिल्ली; डॉ. प्रणय तंवर, बीआरए आईआरसीएस, एनआईएमएस, नई दिल्ली; प्रो. टीसी नाग, प्रभारी, इलेक्ट्रॉन माइक्रोस्कोप फैसिलिटी, एम्स, नई दिल्ली; डॉ. सुभाष चंद्र यादव, अतिरिक्त प्रोफेसर, एनाटॉमी विभाग, एम्स, नई दिल्ली तथा डॉ. रवि प्रकाश, वैज्ञानिक, इलेक्ट्रॉन माइक्रोस्कोप फैसिलिटी, एम्स, नई दिल्ली भी उपस्थित थे। डॉ. सुभाष चंद्र यादव ने धन्यवाद प्रस्ताव प्रस्तुत किया।

<https://pib.gov.in/PressReleasePage.aspx?PRID=1824112>



New low-cost Iron Aluminide coatings can increase corrosion resistance in harsh media to four times of mild Steel

Scientists have developed low-cost Fe-based intermetallic powders that can be used as a corrosion-resistant coating for materials exposed to harsher environments like high temperature in thermal power plants where oxidation, corrosion, and wear and tear takes place simultaneously. The coatings showed 4 times increased corrosion resistance in the aqueous corrosive media than the mild steel. Wear and corrosion cause major damage over a range of service temperatures. Hence, there is a need to protect the component surface with a suitable material for enhanced economic viability. Such surface coating on a turbine blade can enhance the service life and hence increases the operation hours of turbine.

At present, thermally sprayed Chromium Carbide-Nickel Chromium Powder and Tungsten Carbide-Cobalt (Cr_3C_2 -NiCr and WC-Co) (cermet) coatings have been widely used for superior wear and high-temperature oxidation resistance applications like thermal power plant turbine blades, aerospace engine blades, landing gear shafts, steel rolls in the paper industry. This is mainly attributed to their hardness, toughness, and better corrosion resistance under exposure to up to 550°C in the case of WC-Co coatings and up to 850°C for CrC-NiCr coatings. However, the powders are expensive due to presence of Co and Ni elements. Besides, Cr is toxic in its hexavalent state. Replacement of these coatings with simple Fe-based coatings with novel microstructural constituents is very promising. In this regard, iron-based solid phases involving two or more metallic or semimetallic elements (intermetallics) can play a major role owing to their hardness and better corrosion resistance. However, their deployment is rather restricted by low ductility.

A team of scientists at the Centre for Engineered Coatings (CEC), International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI), an autonomous R&D Centre of the Department of Science and Technology (DST), has addressed this by synthesizing Fe-based intermetallic powders and utilized the same for depositing the coatings using detonation spray coating (DSC) technique. Besides, ARCI has developed gas atomized Fe aluminide powder and deposited it on mild steel substrates by DSC without any cracks or spalling. The coatings have demonstrated 4 times increased corrosion resistance in the aqueous corrosive media than the mild steel.

The coatings exhibited better corrosion resistance when Cr and Al are in a solid solution with Fe than in the Fe -rich phases. The coatings have demonstrated an increased wear resistance by 30-40% than the mild steel under solid particle erosion wear mode, implying that FeAlCr coatings can be used for high-temperature erosion resistance applications. More studies are currently underway to qualify the FeAlCr coatings for fireside corrosion protection of boiler components in collaboration with the NTPC, to enhance boiler life.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1824170>



Tue, 10 May 2022

Revolutionary new qubit platform could transform quantum computing

The digital device you are using to view this article is no doubt using the bit, which can either be 0 or 1, as its basic unit of information. However, scientists around the world are racing to develop a new kind of computer based on the use of quantum bits, or qubits, which can simultaneously be 0 and 1 and could one day solve complex problems beyond any classical supercomputers. A research team led by scientists at the U.S. Department of Energy's (DOE) Argonne National Laboratory, in close collaboration with FAMU-FSU College of Engineering Associate Professor of Mechanical Engineering Wei Guo, has announced the creation of a new qubit platform that shows great promise to be developed into future quantum computers. Their work is published in the journal *Nature*.

“Quantum computers could be a revolutionary tool for performing calculations that are practically impossible for classical computers, but there is still work to do to make them reality,” said Guo, a paper co-author. “With this research, we think we have a breakthrough that goes a long way toward making qubits that help realize this technology’s potential.” The team created its qubit by freezing neon gas into a solid at very low temperatures, spraying electrons from a light bulb onto the solid, and trapping a single electron there. While there are many choices of qubit types, the team chose the simplest one — a single electron. Heating up a simple light filament such as you might find in a child’s toy can easily shoot out a boundless supply of electrons.

One important quality for qubits is their ability to remain in a simultaneous 0 or 1 state for a long time, known as its “coherence time.” That time is limited, and the limit is determined by the way qubits interact with their environment. Defects in the qubit system can significantly reduce the coherence time. For that reason, the team chose to trap an electron on an ultrapure solid neon surface in a vacuum. Neon is one of only six inert elements, meaning it does not react with other elements. “Because of this inertness, solid neon can serve as the cleanest possible solid in a vacuum to host and protect any qubits from being disrupted,” said Dafei Jin, an Argonne scientist and the principal investigator of the project.

By using a chip-scale superconducting resonator — like a miniature microwave oven — the team was able to manipulate the trapped electrons, allowing them to read and store information from the qubit, thus making it useful for use in future quantum computers. Previous research used liquid helium as the medium for holding electrons. That material was easy to make free of defects, but vibrations of the liquid-free surface could easily disturb the electron state and hence compromise the performance of the qubit.

Solid neon offers a material with few defects that doesn’t vibrate like liquid helium. After building their platform, the team performed real-time qubit operations using microwave photons on a trapped electron and characterized its quantum properties. These tests demonstrated that solid neon provided a robust environment for the electron with very low electric noise to disturb

it. Most importantly, the qubit attained coherence times in the quantum state competitive with other state-of-the-art qubits. The simplicity of the qubit platform should also lend itself to simple, low-cost manufacturing, Jin said.

The promise of quantum computing lies in the ability of this next-generation technology to calculate certain problems much faster than classical computers. Researchers aim to combine long coherence times with the ability of multiple qubits to link together — known as entanglement. Quantum computers thereby could find the answers to problems that would take a classical computer many years to resolve. Consider a problem where researchers want to find the lowest energy configuration of a protein made of many amino acids. These amino acids can fold in trillions of ways that no classical computer has the memory to handle. With quantum computing, one can use entangled qubits to create a superposition of all folding configurations — providing the ability to check all possible answers at the same time and solve the problem more efficiently.

<https://scitechdaily.com/revolutionary-new-qubit-platform-could-transform-quantum-computing/>



Tue, 10 May 2022

National institutes of health launch clinical trial of Epstein-Barr Virus Vaccine

The National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health (NIH), has launched an early-stage clinical trial to evaluate an investigational preventative vaccine for Epstein-Barr virus (EBV). EBV is the primary cause of infectious mononucleosis (“mono”) and is associated with certain cancers and autoimmune diseases. The Phase 1 study is one of only two studies to test an investigational EBV vaccine in more than a decade. It will be conducted at the NIH Clinical Center in Bethesda, Maryland.

EBV is a member of the herpes virus family and one of the most common human viruses. It spreads through bodily fluids, most notably saliva. In the United States, an estimated 125,000 cases of infectious mononucleosis occur each year; approximately 10% of those people develop fatigue lasting six months or longer. Roughly 1% of all EBV-infected individuals develop serious complications, including hepatitis, neurologic problems, or severe blood abnormalities. EBV also is associated with several malignancies, including stomach and nasopharyngeal cancers and Hodgkin and Burkitt lymphomas, as well as autoimmune diseases, such as systemic lupus erythematosus and multiple sclerosis.

“A vaccine that could prevent or reduce the severity of infection with the Epstein-Barr virus could reduce the incidence of infectious mononucleosis and might also reduce the incidence of EBV-associated malignancies and autoimmune diseases,” said NIAID Director Anthony S. Fauci, M.D.

Led by principal investigator Jessica Durkee-Shock, M.D., of NIAID's Laboratory of Infectious Diseases, the study will evaluate the safety and immune response of an investigational EBV gp350-Ferritin nanoparticle vaccine with a saponin-based Matrix-M adjuvant. The experimental vaccine was developed by the Laboratory of Infectious Diseases in collaboration with NIAID's Vaccine Research Center. The Matrix-M adjuvant was developed by the biotechnology company Novavax, based in Gaithersburg, Maryland. The vaccine works by targeting EBV glycoprotein gp350, which is found on the surface of the virus and virus-infected cells. EBV gp350 is also the primary target for neutralizing antibodies found in the blood of people naturally infected with EBV. Ferritin, a natural iron storage protein found in cells of all living species, is considered a promising vaccine platform because it can display proteins from the targeted virus in a dense array on its surface. The adjuvant is intended to enhance the immune response induced by the investigational vaccine.

The study will enroll 40 healthy volunteer adults ages 18 to 29 years, half of whom have evidence of prior EBV infection and half of whom do not have evidence of prior EBV infection. Participants will be given a series of three 50-microgram injections of the experimental vaccine in the upper arm muscle, followed by 30 to 60 minutes of observation after each dose. The second and third doses will be administered 30 days and 180 days after the initial dose, with follow-up visits between each vaccination and phone calls between visits. Participation is expected to be required for 18 to 30 months, and the trial is expected to last four years. More information about this study is available using the identifier NCT04645147 on ClinicalTrials.gov.

<https://scitechdaily.com/national-institutes-of-health-launches-clinical-trial-of-epstein-barr-virus-vaccine/amp/>

