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रूस से दो सौ बहुउद्देश्यीय हेलिकॉप्टर खरीदेगा भारत

जनसत्ता ब्यूरो
नई दिल्ली, 12 नवंबर।

रूस से दो सौ बहुउद्देश्यीय एमआइ-171ए2 हेलिकॉप्टर खरीदेगा भारत। इस समझौते का प्रारूप तैयार है और जल्द ही इस पर दस्तखत किए जाएंगे। भारत और रूस की कंपनियों का संयुक्त उपक्रम देश में

ही ये हेलिकॉप्टर निर्मित करेगा। रक्षा मंत्रालय के अनुसार, रशियन हेलिकॉप्टर्स कंपनी के साथ बातचीत अंतिम दौर में है। जनवरी तक दस्तखत होंगे। यह कंपनी भारत में हेलिकॉप्टर के पुर्जे जोड़ने और रखरखाव के लिए तकनीकी मदद देगी। दो इंजनों वाले ये हेलिकॉप्टर हल्के और विभिन्न हथियारों को ढोने में सक्षम हैं।

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THE TIMES OF INDIA

Mon, 13 Nov, 2017

Forces likely to shoot down new versions of Tejas, Arjun

May Pitch For Acquisition of Fighters, Tanks via Make-In-India Route

New Delhi: The armed forces have virtually given the thumbs down to the proposed advanced versions of the indigenous Tejas light combat aircraft and Arjun main-battle tank by strongly pitching for mega acquisitions of foreign single-engine fighters and futuristic armoured fighting vehicles through the 'Make in India' route under the 'strategic partnership (SP)' policy.

The Army last week issued the preliminary tender or request for information (RFI) to global armament giants for an initial 1,770 futuristic tanks called the future ready combat vehicles (FRCVs) geared for "rapid dominance in an expanded battle space", while the IAF is getting set to do the same for 114 single-engine fighters soon.

This comes in the backdrop of the defence ministry finalising the SP policy in May to boost the country's fledgling defence production sector, which envisages Indian private sector companies producing cutting-edge weapon systems in collaboration with global arms majors through joint ventures and technology transfers, as earlier reported by TOI.

The going will, however, not be easy for IAF and Army. For one, the annual defence budgets now have very little money for new projects with the bulk of the capital outlay being used for "committed liabilities" or instalments of deals inked earlier. IAF's single-engine fighter project, which will be a direct dogfight between the Gripen-E (Sweden) and F-16 (US) jets, for instance, will alone cost an estimated Rs 1.15 lakh crore.

For another, the DRDO-defence PSU lobby is putting up stiff resistance, leading the government to question the need for the single-engine fighter project. "Questions have also been raised whether such a major project should be given to the private sector. Hindustan Aeronautics Ltd (HAL), in turn, says it can deliver a much better single-engine Tejas," said a source.

DRDO contends the forces continue to cold-shoulder indigenous platforms in their hunger to acquire foreign ones. Instead of ordering say around 500 Arjun tanks, which would have stabilised production lines, achieved economies of scale and paved the way for development of a futuristic MBT, the Army has inducted only 124 Arjun Mark-I tanks till now.

The Army is not willing to order 118 Arjun Mark-II tanks, costing over Rs 6,600 crore, till they clear field trials. "The FRCV project, if it takes off, will kill the indigenous FMBT project," said a scientist.

But all this cuts little ice with the forces, which say the DRDO-defence PSU lobby


“over-promises and then under-delivers” with huge time and cost overruns. “Can operational military readiness be sacrificed at the altar of indigenisation?” asked a lieutenant general.

IAF, for instance, says Tejas is yet to become combatready or achieve “final operational clearance” after being in the making for over three decades. “Moreover, with its limited range and weapon carrying capacity,

the Tejas simply does not give IAF the punch and cost-effectiveness it needs. Tejas, which has just about 50% of the capabilities of an F-16 or Gripen in terms of endurance, payload etc, will have to fly under the protection of other fighters during conflicts,” said an officer.

Grappling with just 33 fighter squadrons when 42 are need to take care of the “collusive threat” from China and Pakistan, the IAF feels the singleengine fighter project is

DESI DEFENCE DREAMS DASHED?



TEJAS LIGHT COMBAT AIRCRAFT:

Project Sanctioned: **1983**

Induction: **Only 5 Tejas** (with initial operational clearance) till now

Import Content: **40%**

Overall Project Cost: **over ₹70,000 crore** (includes development costs of IAF, naval variants & trainers, engines etc as well as production cost of 123 jets for IAF)

PROBLEMS

- Not combat-ready. Final operational clearance postponed to June 2018
- Limited range & endurance. Radius of action just 400-km
- Limited weapons payload (3 tons). High maintenance
- Upgraded 83 Tejas Mark-1A not in sight

ARJUN MAIN BATTLE TANK:

Project Sanctioned: **1974**

Inducted: **124 Mark-I tanks** (2 regiments) for Rs 3,311 crore over last decade

Import Content: **55%**


COST:

- Initial Development Cost: **₹306 cr** (Mark-I).
- ₹182 cr** (Mark-II)

- 124 Mark-I tanks inducted for **₹3,311 cr**
- Procurement of 118 Mark-II tanks to cost over **₹6,600 cr**

PROBLEMS

- Mark-I weighs 62-tonne. Cannot cross bridges & culverts in Punjab/Northern deserts
- Mark-II (with 89 improvements) weighs even more at 67-tonne
- Poor Serviceability. Cannot shoot straight



necessary to maintain adequate force-levels till an entirely new Tejas Mark-2 becomes a reality.



Mon, 13 Nov, 2017

Farewell to Russian arms!

By Sandeep Dikshit

Can the visit of US personnel to a Russia-built Indian aircraft carrier INS Vikramaditya turn out to be the last nail that killed the warmth in Indo-Russia defence ties?

For the last 15 years, India and Russia have been locked in a defence relationship that seems unnatural as political ties were drifting. If the product was a problem, both sides sorted out their differences in high-voltage shouting matches, but always behind closed doors. The flow of arms from Russia continued. There was an

element of comfort because both sides looked at the regional geopolitics from the same lens even though their political outlook of their ruling elites was diverging.

But the wedges that have increased in frequency are indicative of an imminent reset. During PM Modi's tenure, it began with acute Indian discomfort over Russia's transfer of military hardware to Pakistan. Russian President Vladimir Putin's once did shoot back with, "who gave you that idea?" when asked if India-Russia ties were being taken to the cleaners.

India-Russia rift

Putin rarely holds back his views but he held himself back because Moscow was on the verge of some major successes in non-defence areas where the Indo-Russian ties have traditionally floundered. Once Russia had bagged contracts for nuclear plants as well as entered the Indian petrochemical sector with the buyout of a debt-ridden Indian oil company, it engaged Pakistan in military exercises.

This discord has gone up by a notch with two reports of Russian protestations over violation of confidentiality in the military field. Photographs back the Russian assertion that American security officials spent an inordinate time on the INS Vikramaditya, called Admiral Gorshkov when it was in Russian hands. The second claim is as unsubstantiated but far more serious — that US officials secretly toured a Russian nuclear submarine on lease with the Indian Navy.

In the world of armed forces, confidentiality is the key to healthy manufacturer-user ties. India can rightly say that Russians are misplaced in pointing fingers as the aircraft carrier is fully-owned and paid for by the Indian Navy. The same cannot be said about the visit to the nuclear submarine, if it ever took place, but the Russian discomfort is evident.

Past case

This was not the case some years ago when Israelis boarded Russian-made warships to install radars and missile systems. There was a protest, but seemingly, more for the record. A few years earlier, the Russians went in for a partnership with the Israelis for the AWACS (Airborne early Warning and Control Systems) after realising that their technology fell short of Indian needs.

New scenario

What changed in the last few years? Moscow is clearly factoring in the politics of repeated embraces and warm words between PM Modi and US President Donald Trump; the bills in the US Houses for making India a non-NATO ally, and India's preoccupation in partnering with Japan, the US and Australia in South China Sea to ring-fence China, currently Russia's closest ally.

Russia can hardly fault India for exploring its alliance options, especially when it has a weak footprint in the region. Hardly a Russian warship finds it geopolitically advantageous to dawdle in the Indian Ocean. More so, the Indian-Russian defence ties have undergone too many vicissitudes to turn the page over without a serious conversation between the principals of both countries. There was much acrimony over the crippling shortage of spares throughout the 1990s but the understanding diplomacy placed the blame on the chaos following the disintegration of the Soviet Union.

Despite a right wing Atal Bihari Vajpayee-led government whose natural inclination was to look towards the West, the Russian defence industry got a breath of life. By then, it was clear the gifted but ageing scientists in Russia's famed defence design labs were unable to keep up with the new trends. However, trust was missing in the US-India relationship because of US' post-Pokhran sanctions of 1998 and there was desperation for new products because of Narasimha Rao-Manmohan Singh's preoccupation with restoring the economy.

It is a different scenario now. There is no advanced weapon that the US, Israel or France will not like to transfer. The transfer of technology will certainly remain a headache but the Russians, like their defence manufacturing peers in any part of the globe, are also equally unwilling transferers. The only advantage in keeping faith with the Russians was that their defence products did not come with political strings attached. They still don't, but that perception is steadily eroding.

चीन के बढ़ते सैन्य दखल को रोकेगा चार देशों का समूह

● भारत, आस्ट्रेलिया, अमेरिका और जापान ने साझा रणनीतिक मुद्दों की पहचान की

आसियान देशों की बैठक के मौके पर भारत समेत दुनिया के चार देशों के समूह ने पुख्ता आकार लेना शुरू किया है। भारत, आस्ट्रेलिया, अमेरिका और जापान— ये चार देश रणनीतिक रूप से महत्वपूर्ण हिंद-प्रशांत महासागरीय क्षेत्र में चीन के बढ़ते सैन्य दखल को रोकेंगे। आतंकवाद पर अंकुश लगाने और क्षेत्रीय संतुलन की दिशा में गंभीरता से काम करेंगे। ये देश साझा रणनीतिक और कारोबारी हितों के मुद्दों की पहचान करने में जुटे हैं।

विदेश मंत्रालय ने इस बैठक का विस्तृत ब्योरा जारी किया है। विश्व स्तर पर इस समूह की कवायद को बड़ा घटनाक्रम माना जा रहा है। आतंकवाद और सुरक्षा के बड़े खतरों से निपटने के लिए यह समूह हर स्तर पर आपसी सहयोग कायम करेगा। फिलीपींस की राजधानी मनीला में रविवार से शुरू हुई दो दिवसीय आसियान और पूर्वी एशिया बैठक के मौके पर चारों देशों के राजनयिकों ने बैठकर आपसी सहयोग के मुद्दों पर गंभीर चर्चा की। मनीला में भारत के प्रधानमंत्री नरेंद्र मोदी, अमेरिकी राष्ट्रपति डोनाल्ड ट्रंप, जापान के प्रधानमंत्री शिंजो आबे और आस्ट्रेलियाई प्रधानमंत्री मैल्कॉम टर्नबुल समेत अन्य राष्ट्राध्यक्ष पहुंच गए हैं। नरेंद्र मोदी सोमवार को ट्रंप और आबे

● आतंकवाद पर अंकुश और क्षेत्रीय संतुलन के लिए काम करेंगे

के साथ द्विपक्षीय बैठकें करेंगे। विदेश मंत्रालय के अधिकारियों के अनुसार, चार देशों का यह समूह क्षेत्र में शांति-स्थायित्व और समृद्धि को बढ़ावा देने के लिए एक-दूसरे से संबद्ध दृष्टिकोण और मूल्यों को साथ लेकर चलेगा। मंत्रालय ने एक बयान में कहा, सभी देश इस बात पर सहमत हुए कि मुक्त, खुला, समृद्ध और समावेशी हिंद-प्रशांत क्षेत्र, क्षेत्र के देशों और कुल मिलाकर दुनिया के लिए दीर्घकालीन हितों को पूरा करता है। अधिकारियों ने क्षेत्र को प्रभावित करने वाले आतंकवाद और प्रसार जैसी साझा चुनौतियों के समाधान के अलावा संपर्क बढ़ाने के लिए विचारों का आदान-प्रदान किया। भारतीय अधिकारियों ने देश की एक्ट ईस्ट पालिसी को रेखांकित किया, जो भारत-प्रशांत क्षेत्र में गतिविधियों का प्रमुख आधार है।

चार देशों के समूह को गठित करने की कवायद 10 साल पहले शुरू की गई थी। लेकिन काम अब शुरू हुआ है। जापान के विदेश मंत्री तारो कोने ने पिछले महीने कहा था उनका देश चार देशों के समूह के गठन का उनका देश पक्षधर है। भारत ने इस पेशकश का समर्थन किया। अमेरिका और आस्ट्रेलिया कार्य स्तर पर साथ आ गए हैं। मनीला में हुई

● प्रधानमंत्री मोदी की ट्रंप और आबे के साथ शिखर बैठकें आज

इस बैठक में भारतीय विदेश मंत्रालय के दो अधिकारियों— संयुक्त सचिव (दक्षिण) विनय कुमार और संयुक्त सचिव (पूर्व एशिया) प्रणय वर्मा ने हिस्सा लिया।

चीन ने यह कहते हुए इस कवायद पर सावधानी से प्रतिक्रिया जताई है कि उम्मीद है कि चारों देश किसी तीसरी पार्टी के हितों को नुकसान नहीं पहुंचाएंगे। चीन दक्षिण चीन सागर के लगभग पूरे हिस्से पर दावा करता है जबकि वियतनाम, फिलीपीन, मलेशिया, ब्रूनेई और ताइवान इसका विरोध कर रहे हैं। अमेरिका विवादित दक्षिण और पूर्वी चीन सागर पर दावे को लेकर चीन पर अंतरराष्ट्रीय नियमों के उल्लंघन का आरोप लगाता रहा है। अमेरिका रणनीतिक रूप से महत्वपूर्ण भारत-प्रशांत क्षेत्र में भारत की बड़ी भूमिका का समर्थन करता रहा है। जापान के कदम पर प्रतिक्रिया देते हुए भारत ने कहा था कि वह उन मुद्दों पर एक जैसे विचार वाले देशों के साथ काम करने को तैयार है जिससे उनके हित आगे बढ़ते हों।



The AI battlefield

By Amandeep Singh Gill

We need global norms to address the rise of machine autonomy in armed conflict

In the Mahabharata, Krishna wielded what would today be called a lethal autonomous weapon: the Sudarshana Chakra would track its target to the ends of the earth, eliminate it and return to its owner.

Such machines could soon be made for real. On November 13, a United Nations (UN) group of experts in Geneva kicks off the first formal inter-governmental discussion on what machine autonomy means for the laws of armed conflict and the future of international security. I have the honour to chair this group, on behalf of 125 states party to the Convention on Certain Conventional Weapons.

Krishna, being a god, had the wisdom not to deploy his awesome weapon — at least, not directly. He used it to block out the sun, which tricked opposing warriors into dropping their protective shield. Ancient India had rules of war, just as we do: they required fighting to cease at sunset.

Throughout history, the capacity to wield new technologies — from gunpowder to nuclear weapons to long-range missiles — has changed how wars are fought, and the strategic balance between attack and defence maintained.

Shaped by technology

The norms around what is considered acceptable in warfare have also evolved in response to new technologies. Since the 19th century, those norms have been codified in international humanitarian law, which is more or less universally accepted as regulating armed conflict among civilised nations.

Recent advances in artificial intelligence (AI) are throwing up a new challenge to these norms: if the weapon fuses with the wielder, who do they apply to and how? Should such a possibility even be allowed?

Reality might not have yet caught up with popular culture depictions of “killer robots” and “conscious synths” demanding their rightful place in society; indeed, such depictions can be a distraction from the complex challenges that do exist. But many technology leaders are worried about autonomous systems taking life-and-death decisions without “meaningful human supervision or control”. The American tech billionaire Elon Musk and over 100 others recently signed a letter warning that the weaponisation of AI-based technologies risks opening a Pandora’s box.

These are not the only concerns about AI. Technologists and ethicists are also grappling with such questions as legal liability when autonomous vehicles share the streets with pedestrians, predictive analytics subverting due process, and the algorithmic entrenchment of human biases.

Walking a tightrope

But AI applications are already a growing reality in areas such as health, finance and retail. Civilian applications of AI technologies will undoubtedly continue apace. And as has been the experience with other dual-use technologies, AI developed for civilian purposes could be repurposed.

How, then, to deliver on the promise of AI while protecting the hard-won tenets of international humanitarian law and respecting the legitimate security and commercial interests of states and industry? This is the question we will be grappling with this week in Geneva.

Mr. Musk’s letter called on the UN to “find a way to protect us from all these dangers”. Some will query if the UN can succeed. The multilateral system is often derided for its slow pace, its obsession with procedure and its opacity to the wider public. In many areas of technological complexity, alternative governance models have emerged, such as the ‘multi-stakeholder’ approach to Internet governance.

A new approach

However, in an era of diffusion of power and mistrust among the major powers, multilateral inter-governmental forums remain the only way to extend norms across the globe. For bad or for worse, governments still decide matters of war and peace. And the UN still offers a neutral venue to bring different points of view together.

The discussions in Geneva are an opportunity to test a new approach, one we might call ‘distributed technology governance’. This means the multilateral system’s search for durable international norms needs to integrate national regulatory approaches and industry self-regulation.

Each level in this chain of subsidiarity — international humanitarian law, national regulations, and industry self-regulation — needs to move in full cognition of the other two. We need to find ways for them to enjoy their respective sovereignty, while working in unison to deliver what the international community expects.

When Alan Turing, the British scientist who can rightfully be called the father of AI, first speculated on the promise of thinking machines, he pointed out their potential for making us think about ourselves — our faults, frailties and foibles. Aspiring to the wisdom of Krishna may be expecting too much, but we should welcome the fact that AI challenges us to learn in new ways about ourselves as individual sentient beings — and as nations and societies increasingly brought together in an interconnected globe.

Amandeep Singh Gill, India's Ambassador and Permanent Representative to the Conference on Disarmament, is Chair of the Group of Governmental Experts of the Convention on Certain Conventional Weapons (CCW) on emerging technologies related to lethal autonomous weapon systems

MAIL TODAY

Mon, 13 Nov, 2017

US, S Korea naval drill sends warning to Pyongyang

The United States and South Korea on Saturday started joint naval exercises that will involve three US aircraft carriers in what military officials describe as a clear warning to North Korea. The four-day drills that began in waters off South Korea's eastern coast come as President Donald Trump continues a visit to Asia that has been dominated by discussions over the North Korean nuclear threat.

The battle groups of the USS Ronald Reagan, the Theodore Roosevelt and the Nimitz will successively enter the exercise area during the drills that run until Tuesday, South Korea's joint chiefs of staff said. The three carriers will be likely together in the drills around Monday, according to a South Korean military official, who didn't want to be named, citing office rules. The exercises will also involve 11 US.

Aegis ships and seven South Korean naval vessels, including two Aegis ships. The Aegis technology refers to missile tracking and guidance. They will aim to enhance combined operation and aerial strike capabilities and also display "strong will and firm military readiness to defeat any provocation by North Korea with dominant force in the event of crisis", Seoul's military said in a statement.

It's the first time since a 2007 exercise near Guam that three US carrier strike groups are operating together in the Western Pacific, according to the US Navy's 7th Fleet. The US carriers will also participate in separate exercises with three Japanese destroyers on Sunday, according to Japan's Maritime Self-Defense Force. The United States has been sending its strategic assets, also including longrange bombers, to the region more frequently for patrols or drills amid accelerating North Korean efforts to expand its nuclear weapons programme. In recent months, North Korea has tested intercontinental ballistic missiles that could reach the US mainland with further development and has conducted its most powerful nuclear test.

THE HINDU

Mon, 13 Nov, 2017

Big birds vie for a pie of the sky at Dubai air show

By Jacob P.

Emirates bets bigs on Dreamliners; Qatar airline keeps off event, indicating regional tensions; several new features at expo

The Dubai Air Show opened on Sunday, and in the first big-ticket development for the day, Emirates announced the purchase of Boeing 787-10 Dreamliner aircraft worth some \$15.1 billion, even as the prospect of the airline also buying some 20 Airbus A380 superjumbos was clearly in the air.

The Boeing 787-10 as well as the Airbus A380 are on display at the show prominently.

Asked about a possible Airbus A380 deal at an interaction at the airline's swanky chalet at the show venue, Emirates chairman Ahmed bin Saeed Al Maktoum said, "We were comparing two apples," and added that Emirates found the Boeing 787 to be a good option. The Boeing deliveries will begin in 2022.

Qatar Airways was conspicuously absent at the biennial event, indicating regional tensions. Through the air show, Dubai is seeking to push its long-held ambition of developing itself as a global aviation hub, as part of preparations for a post-oil boom scenario.

Already the busiest international air traffic hub, Dubai is planning to spend at least \$36 billion to build a facility in a 50-square mile logistics and transport zone south of the city. The current air show site is part of this area.

Emirates on Sunday also unveiled first-class private suites, measuring some 40 sq ft, in an industry first. The passenger suites in the middle aisle will come in its Boeing 777 flights.

Covering virtually the full spectrum of the industry, the air show this time has a number of new features complementing the usual show formats, including an unmanned aerial vehicle (UAV) summit, a space pavilion, and a cargo logistics zone.

Vast display

The static display features over 160 commercial, business and military aircraft from around the world. New for this year are the Sukhoi Superjet 100 and the Japanese Air Force's Kawasaki C 2.

FlyDubai, the value-for-money offshoot of the Emirates, is showing its Boeing 737 MAX 8 too. The Dubai-based airline has ordered 76 aircraft of the kind, and is set to launch limited services with MAX 8 by November-end.

In an air display, military and commercial aircraft roared across the skies for a couple of hours in the afternoon, under a blazing sun, watched by a throng of craning necks.

Started in 1986, the biennial air show has emerged as the third most important event of its kind, after Farnborough and Paris. This year the event will run till November 16.

Brahmos Aerospace and Falcon Aviation marked a prominent presence in an otherwise thin Indian participation. Pavilions featuring products or services from both China and Pakistan were prominent.

(The author is attending the Dubai Air Show on an invitation of FlyDubai)

दैनिक जागरण

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तुर्की ने खरीदा अत्याधुनिक एस-400 नाटो में खलबली

इस्तांबुल, रायटर : तुर्की ने रूस से अत्याधुनिक एस-400 मिसाइल डिफेंस सिस्टम खरीद लिया है। सतह से आकाश में मार करने वाली मिसाइलों से लैस इस सिस्टम को अमेरिका की थाड मिसाइल डिफेंस सिस्टम की टक्कर का माना जाता है। तुर्की की इस खरीद से उत्तरी अटलांटिक संधि संगठन (नाटो) में खलबली मच गई है। वरिष्ठ कमांडर

ने साफ कहा है कि रूसी मिसाइल डिफेंस सिस्टम को नाटो की हथियारों की तैनाती में शामिल नहीं किया जाएगा। यह तुर्की का खुद का मामला है, इसलिए वह डिफेंस सिस्टम का इस्तेमाल करेगा। नाटो देशों की चिंता को कम करने के लिए तुर्की के रक्षा मंत्री नूरेटिन कैनिक्ली ने कहा है कि उनका देश अपना भी

मिसाइल डिफेंस सिस्टम बनाएगा। इसके लिए उसने यूरोपीय सहयोगियों फ्रांस और इटली के साथ बुधवार को समझौते पर दस्तखत किए हैं। द्वितीय विश्वयुद्ध के बाद बने शीतयुद्ध के हालात में अमेरिका की अगुआई में नाटो का गठन हुआ था जबकि सोवियत संघ के नेतृत्व में वारसा संधि हुई थी।

Citizens with mobiles as mosquito monitors

From audio of buzzing wings recorded by citizens, new technique seeks to identify mosquitoes for worldwide surveillance

By Harikrishnan Nair

The buzz of a mosquito, however annoying, is a useful identification tool, because mosquitoes have a species-specific wingbeat frequency. Scientists have now set out to use it as a surveillance tool, with help from citizens around the world— and their mobile phones.

All a citizen needs to do is point her mobile at a mosquito, whether it is in free flight or trapped, record at least a second's duration of sound, and upload the audio on a website, so that Stanford University researchers can feed it into Abuzz, a new system that will identify the species in seconds.

The researchers describe Abuzz in a study published in eLife. "The challenge was to find instruments that could record these sounds clearly enough to measure the pitch, but that were still cheap and sturdy enough to use in mosquito-infested environments," the study says.

All that Abuzz requires is a mobile with an Internet connection. Modern phones also record additional parameters such as time and location — a requirement for surveillance. "This adds valuable secondary information to acoustic data that is useful for species identification and spatio-temporal mapping," says the study, suggesting that using phones may be a productive strategy for sampling mosquito population.

"The data will be mapped online on a world map; users can search own or other people's data. Also, user accounts will have data mapped by them — so they are excited to map more," lead author Manu Prakash told The Indian Express by email. Haripriya Mukundarajan, Felix Hol, Christine Kurihara and Rebecca Konte were the other researchers.

Mosquito surveillance is of particular significance to India, with its prevalence of vector-borne diseases. "The biology of every mosquito species is different and so is their breeding habitat. Surveillance helps in targeting our measures, including insecticides, and also to check mosquito resistance," said Dr Kalpana Baruah, joint director of the National Vector Borne Disease Control Programme.

She said the new method appears novel, but added its operational feasibility would have to be tested before she could comment on it.

Prakash said the system was tested in India. "I was in India for Diwali and tested this in Delhi," he said. "Delhi is filled with *Aedes aegypti*; and I recorded many mosquitoes and trained locals to do the same. We have been running workshops around the world. We will soon be starting an online training for anyone who is interested in participating." An app is in the works, Prakash said.

For the study, the researchers tested the accuracy of eight mobile sets, their cost ranging from \$20 to \$700. Between one phone and another, there was very little variation in the wingbeat frequencies recorded. Field trials were conducted in a tropical village in Madagascar — with CDC light traps placed in the same locations — and in California.

"Mapping the distributions of two genera of mosquitoes across the village revealed considerable heterogeneity in the proportions of *Anopheles* and *Culex* mosquitoes," the study says. "This was concordant with the data from CDC light traps... Although the ratio of the two kinds of mosquitoes varied between acoustic recording and conventional trapping at each location, there was a qualitative correspondence between the two methods in terms of the relative number of mosquitoes at a location, and the more numerous species."

"What we present in our paper is the widest survey of mosquito acoustics done," Prakash told The Indian Express. "It focuses on 20 most important vectors that transmit human diseases. The goal of engaging citizens

around the world is to first expand this database to include all known species of mosquitoes. We are quickly growing the number of species in our database, but we have a long way to go. In the first phase; we will also be recruiting super users who work in the field and both ‘record’ and actually catch the mosquito for identification by an expert.”

The study notes, however, that mobile phone microphones are short-range devices. It recommends that the mosquito be brought within optimal range to ensure the audio serves the purpose.

Prakash said they worked on compensating for possible corruption in the recording. “Sound bouncing off is not an issue,” he said. “Background noise is; say if someone is talking at the same time. We developed clipping algorithms that take a baseline data and trim it to collect only mosquito sounds out of the same. Users can also trim data manually before sending.”