

Delhi keen on combat drones, but settles for US spy version for now

Highlights

- UAVs are major force-multipliers for surveillance & real-time imagery, data to direct fire at targets.
- Range from hand-launched micro UAVs to fighter-size UCAVs.
- Stealthy & cost-effective. No risk of aircrew being killed.

New Delhi: India's quest for advanced surveillance drones to keep a hawk-eye on the Indian Ocean Region will now be met through the proposed acquisition of Predator naval drones from the US. But what it really wants is combat drones or unmanned combat aerial vehicles (UCAVs) in the long run.

Akin to fighter jets but remotely controlled through satellites from thousands of miles away, combat drones are capable of firing missiles and precision-guided munitions on enemy targets before returning to their home bases to re-arm for the next mission.

Their game-changing impact on modern-day warfare can be gauged from the way the US has been extensively using Predator and Reaper armed drones to fire deadly 'Hellfire' missiles against Taliban targets in the Af-Pak region with devastating effect.

But India, as of now, is in talks with the US for only unarmed Predator or MQ-9B Guardian unmanned aerial vehicles (UAVs), which are high-altitude, long-endurance drones capable of flying non-stop for over 27 hours for intelligence, surveillance and reconnaissance missions. This, too, became possible only after India joined the 34-member Missile Technology Control Regime, which prevents proliferation of missiles and UAVs over the range of 300-km, in June 2016.

Ahead of PM Narendra Modi's ongoing trip to Washington, the Trump administration had cleared the sale of 22 MQ-9B Guardian drones manufactured by General Atomics to India, in what will eventually be a government-to-government deal after the US Congress is first notified and long-drawn bilateral negotiations are then held.

Though figures upwards of \$2 billion for the 22 drones, with their associated spares, maintenance and training package, are already being quoted, Indian government sources say the actual procurement process is yet to begin. "The US has just responded to our 'price and availability inquiry'. It's early days yet," said a source. While India is slated to become the first country outside the NATO alliance to get these drones, Washington is so far unwilling to sell actual combat or armed drones to New Delhi because it believes the move will disrupt the military balance in the region.

India, however, is on course to acquire 10 Heron-TP missile-armed drones for around \$400 million from Israel, even as PM Modi is scheduled to visit the Jewish state early next month, as was earlier reported by TOI. The IAF already has Israeli Harop "killer" drones, which basically act as cruise missiles to first detect and then destroy specific enemy targets and radars by exploding into them in kamikaze fashion. Some of the existing Indian fleet of Israeli Heron and Searcher-II UAVs have also been upgraded with "add-ons" to ensure they can undertake a combat mission over and above their current surveillance and precision-targeting roles.

The DRDO-Aeronautical Development Agency combine has also launched the Rs 2,650 crore "Ghatak" project to develop an Indian Unmanned Strike Air Vehicle, with the government approving an initial Rs 231 crore for its design and development of critical advanced technologies in May 2016. But it will take well over a decade for the Ghatak UCAV, which will weigh less than a fighter jet since it will be "more of a flying-wing

in design", to take to the skies. The IAF, incidentally, has proposed the creation of a separate cadre to handle UAVs, apart from the flying, technical and ground duty branches, in the future.

पंजाब केसरी

Tue, 27 June, 2017

13 सैटेलाइटों से दुश्मनों पर नजर

नई दिल्ली, (पंजाब केसरी): गत हफ्ते इसरो द्वारा अंतरिक्ष में भेजे गए कार्टोसैट-2 सैटेलाइट के साथ ही आर्मी द्वारा दुश्मनों पर निगाह रखने वाले सैटेलाइट की संख्या 13 हो गयी है। निगरानी व सीमावर्ती क्षेत्रों में मैपिंग के लिए उपयोग में आने वाले इन सैटेलाइट का मुख्य कार्य दुश्मनों पर नजर रखना होगा। जमीन के साथ समुद्र में भी ये सैटेलाइट अपनी पैनी निगाह रखने में कारगर हैं। इसके अलावा अब इमरजेंसी में अग्नि-5 मिसाइल का इस्तेमाल सैटेलाइट लांच करने के लिए भी किया जा सकता है। इसरो के अनुसार, 'इनमें से अधिकतर रिमोट सेंसिंग सैटेलाइट्स को पृथ्वी के ऑर्बिट के पास तैनात किया गया है। सैटेलाइट्स को पृथ्वी की सतह से लगभग 2001-2002 किलोमीटर ऊपर सन-सिंक्रनस पोलर ऑर्बिट में रखने से बढ़िया तरीके से पृथ्वी की स्कैनिंग होती है। हालांकि इनमें से

कुछ सैटेलाइट्स को जियो ऑर्बिट में रखा गया है।' हाल ही में लांच 712 किलोग्राम का कार्टोसैट-2 सीरीज का स्पेसक्राफ्ट एक रिमोट सेंसिंग सैटेलाइट है जो किसी निर्धारित जगह की निश्चित तस्वीर खींचने में सक्षम है। इसका रेजोल्यूशन 0.6 मीटर है, जिससे यह बारीक चीजों का भी पता लगा सकता है। सेना द्वारा निगरानी के लिए इस्तेमाल की जाने वाली 13 सैटेलाइट्स में कार्टोसैट-1 और 2 सीरीज और रिसैट-1 और रिसैट-2 शामिल हैं।' नेवी भी अपने वॉरशिप, सबमरीन, एयरक्राफ्ट और लैंड सिस्टम्स में रियल टाइम टैलीकम्युनिकेशन के लिए जीसैट-7 का इस्तेमाल करती है। भारत एंटी सैटेलाइट वेपन भी लांच कर सकता है जो दुश्मनों के सैटेलाइट को नष्ट कर सकती है। केवल अमेरिका, रूस और चीन के पास इस तरह के वेपन हैं। डिफेंस टैक्नोलजी एक्सपर्ट

और डीआरडीओ के पूर्व डायरेक्टर 'पब्लिक इंटरफेस' रवि गुप्ता ने कहा कि अग्नि-5 मिसाइल को सैटेलाइट लांच के लिए भी इस्तेमाल किया जा सकेगा। उन्होंने बताया 'अग्नि-5 बैलिस्टिक मिसाइल को विकसित किए जाने की प्रक्रिया के दौरान हासिल की गई तकनीकी क्षमताओं का इस्तेमाल जरूरत पड़ने पर 'सैटेलाइट लांच ऑन डिमांड' यानी मांग के अनुसार कभी भी सैटेलाइट लांच करने के लिए किया जा सकता है।' उन्होंने आगे कहा, 'इसी तरह इन तकनीकों को बैलिस्टिक मिसाइल डिफेंस सिस्टम के लिए इस्तेमाल होने वाली तकनीक के साथ मिलाकर एंटी-सैटेलाइट वेपन सिस्टम विकसित करने के लिए किया जा सकता है।'

THE  HINDU

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Scorpines to gain in endurance

By Dinakar Peri

Submarines will be retrofitted with new modules six years after induction

The Navy is planning to instal Air Independent Propulsion (AIP) modules on all six Scorpene submarines to extend their endurance. This will be done when the submarines go for normal refit which is six years after their induction. "Yes, the Navy plans to instal the AIP plugs during the refit for all the six submarines," defence

sources told The Hindu. However, officials said that it was a long and expensive process, involving re-designing, as it would entail opening up the hull of the submarine, then integrating the plug before resealing it.

“The AIP has to be ready and has to be validated and certified. Then the submarine design has to be redesigned as well since the plug has to be integrated. This means conducting the full set of trials and certifications before the submarine is back in service,” one official told The Hindu .

The first Scorpene submarine INS Kalvari is all set to join the Navy by August and would go for its normal refit in 2023. The remaining five submarines are expected to be inducted at nine-month intervals.

The official said preparation for the AIP provision has to begin right away to be able to meet the timelines. “It would require approval at the highest levels. That will also take time,” he added.

This also means that the time of the refit would be extended. Generally a normal refit takes between 12-18 months.

Increased performance

AIP module is not part of the original Scorpene contract but the Navy has been keen on having them fitted on the last two of the six Scorpene submarines being manufactured by the Mazagon Dock Limited (MDL) in Mumbai.

An AIP module is being developed by the Defence Research and Development Organisation (DRDO) and was supposed to be installed on the last two submarines before they roll out of the production line.

However, delay in the module’s development seems to have scuttled the plan.

The module enables conventional submarines to remain underwater for longer duration, greatly increasing their stealth characteristics. Bernard G. Buisson, Managing Director of DCNS, told The Hindu earlier that there was no chance of installing the plugs on the 5th and 6th submarines now and the only way would be installing them during the refit.

दैनिक जागरण

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भारत-अमेरिका की दोस्ती विश्व हित में : मोदी

वाशिंगटन, प्रेट्र : प्रधानमंत्री नरेंद्र मोदी ने कहा है कि भारत-अमेरिका की दोस्ती से हमेशा विश्व को लाभ मिला है। दोनों का उद्देश्य दुनिया को आतंकवाद, उग्र विचारधारा व गैर पारंपरिक सुरक्षा खतरों से बचाना है।

वॉल स्ट्रीट जनरल में प्रकाशित आलेख में मोदी ने कहा कि एक साल पहले जून में जब वह अमेरिका आए थे तब यूएस कांग्रेस के संयुक्त अधिवेशन में उन्होंने कहा था कि दोनों अपने अतीत से ऊपर उठकर एक नई इबारत लिखने की राह पर हैं। इस बार वह आए तो लग रहा है कि दोनों के बीच विश्वास तेजी से बढ़ा

है। एक दूसरे के राजनीतिक मूल्यों और समृद्धि में यकीन करने से संबंध मजबूत हो चुके हैं। बात चाहे साइबर स्पेस के नियम गढ़ने की हो, भारत-प्रशांत क्षेत्र में रहत कार्य चलाने की या फिर अफ्रीका में शांति स्थापना करने वाले लोगों के प्रशिक्षण की बात हो, हर जगह हमने बेमिसाल काम किया है। मोदी ने कहा कि दोनों देशों को मिलकर सुनिश्चित करना होगा कि समुद्री क्षेत्र सुरक्षित रहे और सबके लिए बहाल हो। दक्षिण चीन सागर का जिक्र करते हुए उन्होंने यह बात कही। इस समुद्री क्षेत्र पर चीन अपना एकाधिकार मानता है। मोदी ने कहा कि दोनों देशों के व्यापारिक संबंध

115 अरब डालर सालाना तक पहुंच चुके हैं। इसमें और बढ़ोतरी होने की संभावना है। भारतीय कंपनियों ने अमेरिका के निर्माण उद्योग में 15 अरब डालर का निवेश कर रखा है जबकि अमेरिकी कंपनियां यहां 20 अरब डालर का कारोबार कर रही हैं। उन्होंने कहा कि जीएसटी लागू होते ही एक जुलाई से भारत 1.3 अरब लोगों के समग्र बाजार के तौर पर स्थापित हो जाएगा।

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China worried over possible sale of US drones to India

Beijing: China is concerned over the possible sale of US surveillance drones to India, which will help New Delhi keep a closer watch over the strategically important Indian Ocean, a top Chinese disarmament strategist has said.

“The transfer of surveillance drones will increase India’s capability to have a view over the entire Indian Ocean,” said Han Hua, who is the director of centre for arms control and disarmament at the school of international studies at Beijing’s Peking University.

Han said strategic analysts were closely following the United States-India relationship since the two countries signed the civil nuclear deal, which she said was a symbol of the nature of the strategic partnership between the US and India. “In that sense, China is concerned,” she said.

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Chinese army blames India as troops face off in Sikkim

Beijing: The Chinese army accused on Monday the Indian military of provoking tension along the Line of Actual Control in Sikkim, where the two sides were reportedly involved in a tense confrontation earlier this month.

Indian and Chinese troops scuffled near the Doka La area in the first week of June, PTI reported earlier in the day quoting unnamed sources, before soldiers from People’s Liberation Army (PLA) damaged bunkers on the Indian side.

The stand-off in Sikkim comes at a time when Prime Minister Narendra Modi is in Washington and is expected to negotiate a deal to buy American surveillance drones and reinvigorate strategic ties, moves that could rile Beijing.

The confrontation in Sikkim snowballed with the Chinese side deciding to stop last week the Kailash Mansarovar yatra through Sikkim that Indians take to travel to Tibet, according to the report.

The PLA had a different sequence of events, accusing Indian soldiers of interfering in its sovereignty.

“Recently, the Chinese side in the Donglang area for road construction, was blocked by the Indian Army line,” a late-night statement from the PLA said. “The construction of the abovementioned roads by the Chinese side is entirely a sovereign act in its own territory, and the Indian side has no right to interfere.”

For decades, ties between India and China have remained fraught over stretches of their disputed Himalayan border and competing geo-political ambitions. The two sides fought a short but bloody border war in 1962.

On Monday, the PLA said the problem persisted despite a meeting between the two sides and the Indian military “unilaterally provoked trouble”.

“China is committed to developing bilateral relations between China and India, but also firmly defend their legitimate rights and interests. It is hoped that the Indian meet China halfway and do not take any complication of the border issue and jointly maintain the good momentum of development of bilateral relations,” the statement said.

According to the PTI report, the Indian Army twice asked the Chinese to join a flag meeting after the confrontation. Both requests were turned down before the Chinese side agreed to a meeting on June 20. It was then that they conveyed to their Indian counterparts that pilgrims would not be allowed to cross into Tibet.

The pilgrims were kept waiting till June 23 after which they returned to Gangtok, the capital of Sikkim, which is the only region where the border between India and China is demarcated, according to PTI.

The Line of Actual Control is the de-facto, 4,000-km long border that India and China share in regions that they both claim as their territory.

It is not the first time that a transgression has happened at Doka La, on the Sikkim-Bhutan-Tibet tri-junction.

Chinese forces had in November 2008 destroyed makeshift Indian army bunkers.

Earlier this year, Chinese helicopters entered Indian airspace in the Barahoti area of Uttarakhand.

पंजाब केसरी

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नासा ने की एलियन और दूसरी दुनिया की खोज

न्यूयॉर्क, (एजेंसी): क्या आपको इस ब्रह्मांड में हमारी दुनिया के अलावा भी कोई अलग दुनिया होने की बात रोमांचित करती है। क्या आप भी सोचते हैं कि एलियन नाम की कोई चीज होती है। अगर हां तो कुछ ऐसे ही सवालों के जवाब आपको जल्द ही मिल जाएंगे। क्योंकि नासा को इस बात के पक्के सबूत मिले हैं कि ब्रह्मांड में हमारी तरह कई और भी लोग हैं। नासा जल्द ही इस बात का खुलासा करने वाला है।

हैकरों और ऑनलाइन काम करने वाले एक समूह ने यह दावा करते हुए कहा है कि अमेरिका की अंतरिक्ष एजेंसी नासा ने दूसरी दुनिया, अंतरिक्ष और एलियन्स के अस्तित्व

का पता लगा लिया है और वह जल्द ही इसकी घोषणा कर सकता है। वहीं इस मामले में एक मीडिया रिपोर्ट में दावा करते हुए कहा गया है कि हैकरों ने अपनी वेबसाइट पर लिखा है नासा का कहना है कि एलियन आ रहे हैं।

एक गुमनाम व्यक्ति द्वारा जारी किए गए एक वीडियो में अंतरिक्ष यात्रियों और अंतरिक्ष विज्ञान में रुचि रखने वाले लोगों द्वारा इससे पहले एलियन्स के होने की बात कही गई है। इतना ही नहीं समय-समय पर

धरती के विभिन्न हिस्सों में एलियंस और उड़न तश्तरियों यानी अंतरिक्षयानों के दिखाई देने संबंधित सबूतों को भी पेश किया गया है। इस वीडियो में कहा गया है कि यह सारे प्रमाण बताते हैं कि अंतरिक्ष में ऊपर कुछ घटित होने वाला है। वहीं वेबसाइट की रिपोर्ट के मुताबिक इन अज्ञात लोगों ने नासा द्वारा हाल ही में की गई कुछ नई खोजों के अलावा अप्रैल में अमेरिकी संसद को एडवांसेस इन द सर्च फॉर लाइफ नामक शीर्षक पर नासा के एक प्रवक्ता द्वारा की गई टिप्पणियों के आधार पर ये दावे किए हैं।

नासा में विज्ञान मिशन निदेशालय के एसोसिएट एडमिनिस्ट्रेटर थॉमस जुर्बुचेन ने कहा है कि नासा की हाल की प्रगतियां, जैसे शनि के उपग्रह एन्सेलैडस में हाइड्रोजन की खोज और बृहस्पति के उपग्रह यूरोप के समुद्रों से हबल टीमों के आशाजनक नतीजे इस बात के संकेत हैं कि हम पहली बार एलियंस के अस्तित्व के प्रमाणों की खोज के पास हैं।

उन्होंने कहा कि एलियंस के अस्तित्व का प्रमाण खोजने के लिए पूरी दुनिया में चल रहे रिसर्च और अभियानों के मद्देनजर, हम इतिहास के सबसे गहन, अनोखी खोज के बेहद करीब हैं।

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NASA's Mars probe spots evidence of ancient lake

NASA's Opportunity Mars rover is examining the edge of a crater on the red planet that may once have been a lake of liquid water. The Opportunity rover found rocks at the edge of Endeavour Crater that were either transported by a flood or eroded in place by wind. The features were seen just outside the crater rim's crest above "Perseverance Valley," which is carved into the inner slope of the rim. Researchers plan to drive Opportunity down Perseverance Valley after completing a "walkabout" survey of the area above it.

The Opportunity mission has been investigating sites on and near the western rim of Endeavour Crater since 2011. The crater is about 22 kilometres across. "The walkabout is designed to look at what's just above Perseverance Valley," said Ray Arvidson, from Washington University in St Louis. "We see a pattern of striations running east-west outside the crest of the rim," said Arvidson, Deputy Principal Investigator of the Opportunity mission. A portion of the crest at the top of Perseverance Valley has a broad notch.

Just west of that, elongated patches of rocks line the sides of a slightly depressed, east-west swath of ground, which might have been a drainage channel billions of years ago. "We want to determine whether these are in-place rocks or transported rocks," Arvidson said. "One possibility is that this site was the end of a catchment where a lake was perched against the outside of the crater rim," he said.

"A flood might have brought in the rocks, breached the rim and overflowed into the crater, carving the valley down the inner side of the rim," he added. "Another possibility is that the area was fractured by the impact that created Endeavour Crater, then rock dikes filled the fractures, and we're seeing effects of wind erosion on those filled fractures," Arvidson said. In the hypothesis of a perched lake, the notch in the crest just above Perseverance Valley may have been a spillway.



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Former ISRO chief to head new national education policy body

NEP Will Lay Down the Outline For Course Curricula, Make Suggestions On How Resources Are Managed

NEW DELHI: Krishnaswamy Kasturirangan, one of India's most renowned space scientists, will head an expert panel that will draw up the country's new education policy, the Union government announced on Monday.

Kasturirangan is among nine people who will lay out the roadmap for education from elementary schools to higher research to open education in what will be announced as the National Education Policy (NEP).

"The diversity in the panel will help it understand the range of issues that have to be kept in mind for drawing up such a key policy", a source said. The work on the NEP will begin "immediately".

Kasturirangan headed the Indian Space Research Organisation in the 90s and has been awarded the country's second-highest civilian honour: the Padma Vibhushan.

With him will be retired IAS officer KJ Alphons, who played a key role in helping Kerala's Kottayam and Ernakulam districts achieve 100% literacy, Fields Medal-winner Manjul Bhargava and Babasaheb Ambedkar University vice-chancellor Ram Shanker Khureel, a distinguished agriculture scientist who has done significant work for making education more inclusive of the marginalised.

Alphons is currently a BJP member.

"Dr MK Shridhar, former member secretary of the Karnataka State Innovation Council, Dr TV Kattimani, an expert on language communication, Dr Mazhar Asif, professor of Persian at Guwahati University, and former

Uttar Pradesh director of education, Krishan Mohan Tripathi also bring a wealth of experience to the panel,” officials said.

The committee also includes Vasudha Kamat, former vice chancellor of Mumbai’s SNDT university.

The National Education Policy will lay down the outline for how course curricula will be drawn up, make suggestions on how resources are managed and give inputs on spending.

The previous education policy, the National Policy on Education framed in 1986 and modified in 1992, was responsible for decisions such as standardising the process of admissions through entrance examinations.

Consultations on the policy started during the tenure of the previous HRD minister Smriti Irani. The process soon ran into controversy after some of the suggestions were found to be regressive by educationists.

The HRD ministry also formed a committee two years ago under former cabinet secretary TSR Subramanian for inputs on the policy. Sources said those will also be used.



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Who’s afraid of neutrinos?

By Ravi Kuchimanchi

The India-based Neutrino Observatory would greatly advance scientific research

Which one of us would not have applauded Galileo in January of 1610 when he trained his telescope for the first time on Jupiter and observed four dots alongside it? Within days he noticed that the dots seemed to be going around Jupiter... they were its four largest moons!

Today, very large telescopes send us iconic images of distant galaxies and of faint remnants of the light produced by the Big Bang. The light from the moons of Jupiter was always falling on earth.

It took a telescope to detect it because it was so feeble and could not be seen with the naked eye. Interesting things, telescopes. They observe something that is already there. They do not produce what they observe.

Just like light

There are two other things that, like light, can travel great distances in the universe, and therefore can be usefully observed. The first of these are gravitational waves. Predicted by Einstein’s famous theory, these waves travel at the speed of light and are produced when very heavy objects such as black holes collide. Gravitational waves were first detected in September 2015 by the Laser Interferometer Gravitational-Wave Observatory (LIGO). As the waves passed, LIGO measured that they expanded and contracted the earth a tiny bit for a fraction of a second.

The measurement told us that the colliding black holes were 30 times the mass of the sun, 1.3 billion light years away, and during the collision, the mass of three suns just vanished to produce the energy of the gravity wave that spread across the universe. However, LIGO did not produce the waves that it observed.

They were produced by cataclysmic events, and we wouldn’t want to be anywhere near them, but observing them through LIGO is like receiving a postcard from that collapsing, tragic part of the universe that even light cannot escape from.

The only other particles that can zip through the universe at speeds very close to that of light are called neutrinos. The biggest nuclear reactor that most life on earth derives energy from is the sun. Like all nuclear reactors, in addition to giving out energy (heat and light), the sun also emits neutrinos. We have all seen sunlight. Can we also observe the billions of neutrinos the sun emits every second?

In the mid-1960s, when solar neutrinos were observed through the first neutrino telescopes, it quietly unleashed one of the biggest revolutions in our knowledge of the laws of physics that govern the universe.

Raymond Davis and John Bahcall detected that only half the neutrinos that the sun was emitting towards the earth were actually reaching us.

The reason? As they travelled the distance from the sun to the earth, the neutrinos were changing from electron-neutrino type that the sun was emitting to muon-neutrino type, and thus escaping detection. All the laws and forces of nature that we know of, other than gravitation, are described by what physicists call the Standard Model. It predicted that neutrinos, which come under three types or flavours — tau-neutrino, electron-neutrino and muon-neutrino — would not oscillate from one flavour to another.

The discovery that they do meant that the Standard Model or the basic laws of physics had to be further modified. Thus, through the neutrino detectors we are actually observing the fundamental laws of physics at the cutting edge.

The proposed India-based Neutrino Observatory (INO) aims to observe muon neutrinos that are continuously produced in the atmosphere when cosmic rays strike the earth. Since every type of matter particle has an anti-matter partner particle associated with it, there are also anti-neutrinos that the INO can observe.

Anti-neutrinos also come in three flavours and can oscillate from one to the other. An important question in the mystery of trying to piece together the laws of physics is: do anti-neutrinos oscillate or flip their flavours at exactly the same rate as neutrinos do, or are there slight differences in their rates? In other words, do laws of physics treat matter and anti-matter exactly the same way as far as the neutrinos are concerned or do they treat them differently?

While the INO will not by itself provide an answer to this question, its measurements will — by determining the order of the neutrino masses and thereby help other neutrino experiments that are already under way or being built in other parts of the world. The INO, by observing the rates at which neutrinos and anti-neutrinos oscillate, will make a substantial contribution to the quest to unravel the secrets of the ultimate laws of physics.

Nothing to fear

Unfortunately, some activists and political parties in Tamil Nadu have made baseless allegations that the INO, which is just like a telescope, causes radioactivity and have compared it with the dangers of having a nuclear power plant or radioactive material in the neighbourhood. This cannot be true since the neutrinos, whether they are naturally occurring in the atmosphere or from the sun, or are emitted by far away man made nuclear reactors and sent in beams of neutrinos with few GeV energy, are very feeble and weakly interacting particles that we can't even see or feel without the help of an observatory.

Beams of neutrinos are being sent to the NOvA neutrino detector in the U.S. and to the T2K neutrino detector in Japan every day. Moreover, being the lightest matter particles, the neutrinos do not decay into any other particles, as everything else is heavier — so they are not like uranium which decays radioactively into smaller atoms. All the INO would do is to provide the lens to observe neutrinos as they are too feeble or faint to be detected by the naked eye. It does not create a radiation hazard or put us in harm's way.

While we should ensure that the tunnel is dug with proper environmental safeguards and the project has various clearances, raising the spectacle of radiation hazards and comparing it with nuclear or thermal power plants is spreading false fears and is unscientific.

Ravi Kuchimanchi is the founder of the non-profit Association for India's Development (AID)

Foldable, walking robot can aid space missions

Seoul, June 26: Scientists have built the first foldable walking robot that pops up when deployed, and could be used for future space missions as well as seabed exploration on Earth.

The robot, which the researchers call DeployBot, is assembled from eight modules: four for the body and one for each of the four legs. In their folded state, the modules lie flat, and after they are deployed, they pop up into a roughly square shape.

The modules are made of both rigid and flexible materials and contain embedded magnets that connect and lock multiple modules together. A shape memory alloy wire running through the square frame of each module is responsible for deploying and folding the modules,



Scientists have built the first foldable walking robot that pops up when deployed, and could be used for future space missions

which takes several seconds but can be done repeatedly. "The main advantage of this modular robot is robustness in various environments due to lack of mechanical sys-

tems such as motors and gears," said Sung-Hoon Ahn from Seoul National University in South Korea.

"Thus, problems facing motor-based robots, such as sealing and lubrication of mechanical systems in water or space environments, are not a problem for the smart actuator," Ahn was quoted as saying by "Phys.Org". The robot walks when an electric current is applied to shape-memory alloy wires embedded in its frame. The current heats the wires, causing the robot's flexible segments to contract and bend.

Sequentially controlling the current to various segments in different ways results in different walking gaits. No motors are required for the robot to move, researcher said.

— PTI