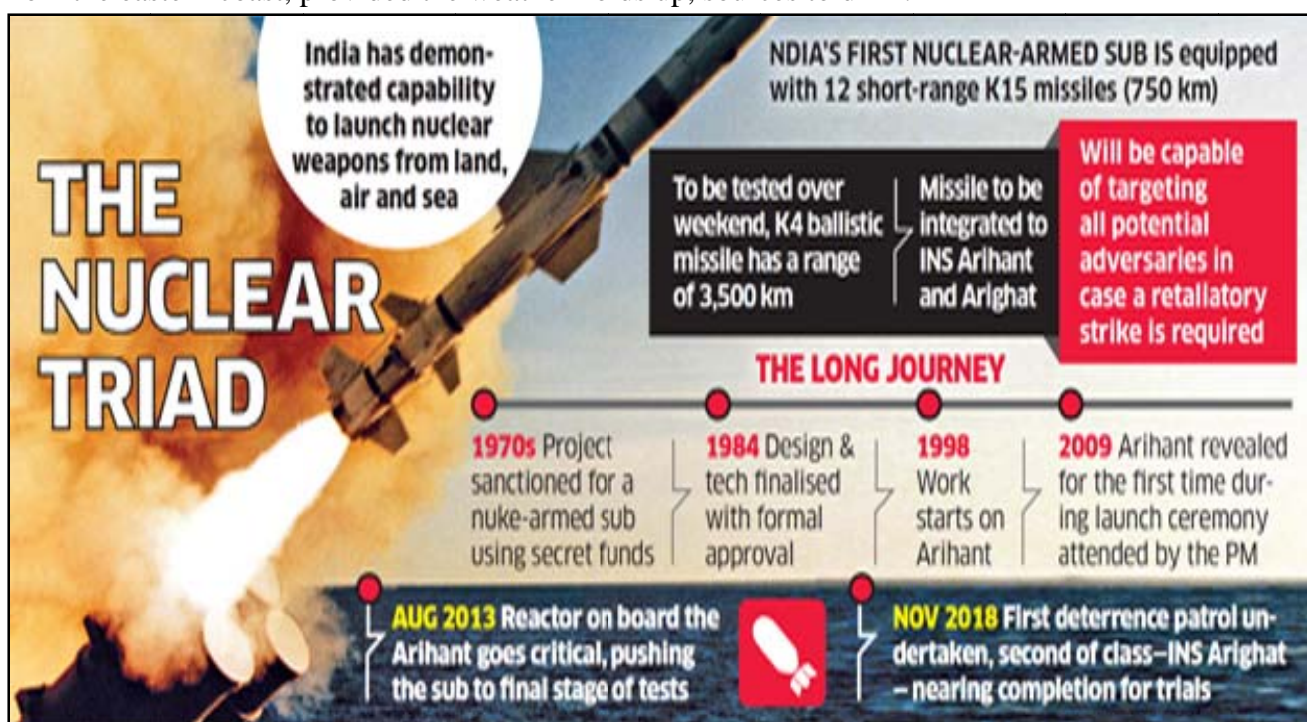


## Critical test for submarine-launched nuclear missile this weekend

*The 3,500-km range missile, designed for the Arihant class of nuclear submarines, will be tested from a fixed underwater pontoon as part of the developmental trials being conducted by the Defence Research and Development Organisation (DRDO)*

*By Manu Pubby*

New Delhi: India is set to test fire its most potent nuclear deterrence missile over this weekend in the Bay of Bengal, which will demonstrate a survivable second strike capability to target all potential adversaries. The test of the K4 submarine-launched nuclear capable missile is scheduled to take place from the eastern coast, provided the weather holds up, sources told ET.



The 3,500-km range missile, designed for the Arihant class of nuclear submarines, will be tested from a fixed underwater pontoon as part of the developmental trials being conducted by the Defence Research and Development Organisation (DRDO).

If the test goes through—an earlier window in November had to be cancelled as cyclone Bulbul hit the eastern coast—it would mark a significant step towards operationalising the nuclear capable missile. The last test of the K4 was attempted in 2017 and there has been an urgency to expedite the developmental process, given that India's second nuclear submarine, the INS Arighat, is nearing completion and would be ready for trials soon.

India has already notified seafarers and sent out a notice to airmen blocking a flight path of close to 3,000 km that stretches to the Indian Ocean in preparation for the test. The K4 has undergone three tests in the past and is considered to be the real game changer that would give India a second strike option.

While India does have an operational SLBM (the K15) onboard the INS Arihant, its range is capped at 750 km, limiting second strike options and with that, the effectiveness of the nuclear triad. Though

land-based Agni series of missiles have proved their worth with multiple tests over the past years and India has its Mirage 2000 fighters rigged to deliver strategic warheads, an underwater launched missile is widely considered to be the most potent second strike weapon.

Given India's no first use policy, the only time the country would launch strategic weapons would be if it comes under a nuclear strike from an adversary. In this situation, a submarine that is hidden deep in the sea, with the ability to target all potential enemies is considered to be the most effective tool. DRDO has also started work on the K5, a 5,000 km range SLBM that would be fitted onboard nuclear powered submarines as well, to match the range of the Agni V, India's longest range land-based missile.

A successful integration of the K5 would demonstrate that India has a credible triad in place – the ability for a strike by land, sea or air.

The most recent landmark on the strategic front was the first deterrence patrol by INS Arihant that was carried out in November last year.

<https://economictimes.indiatimes.com/news/defence/critical-test-for-submarine-launched-nuclear-missile-this-weekend/articleshow/72286330.cms>



*Fri, 29 Nov 2019*

## **DRDO BrahMos supersonic cruise missile successfully fired by Indian Navy**

On November 28, 2019, the Indian Navy successfully test-fired a DRDO (Defence Research and Development Organisation) developed BrahMos supersonic cruise missile in the Arabian Sea, news agency ANI reported.

BrahMos medium-range supersonic missile is a major force multiplier on the battlefield with impeccable multi-role and multi-platform (ships, aircraft or land) launch capabilities.

The BrahMos missile with pinpoint accuracy can be launched as far as 290 km from the target in either inclined or vertical configuration based on the type of the ship or user requirements.

In September this year, the missile featuring Indian propulsion system, airframe, power supply, and other major indigenous components, was successfully test-fired from ITR, Chandipur in Odisha.

In May this year, the IAF successfully fired the BrahMos air version missile from its frontline Su-30 MKI fighter aircraft. The IAF became the first Air Force in the world to have successfully fired an air-launched 2.8 Mach surface attack missile of this category on a sea target on November 22, 2017.

The integration of the weapon on the aircraft was a very complex process involving mechanical, electrical and software modifications on aircraft. The IAF has been involved in the activity from its inception. The software development of the aircraft was undertaken by the IAF engineers while HAL carried out mechanical and electrical modifications on the aircraft.

<https://www.navyrecognition.com/index.php/news/defence-news/2019/november/7726-drdo-brahmos-supersonic-cruise-missile-successfully-fired-by-indian-navy.html>

*Fri, 29 Nov 2019*

## **Defence Ministry to discuss projects worth over Rs 30,000 crore for light chopper, DRDO's AWACS**

New Delhi: The Defence Ministry is likely to take on Thursday a decision on the first "Make in India" project under Prime Minister Narendra Modi government's strategic partnership policy for manufacturing of naval utility helicopters for the Navy. In a meeting today, the Defence Ministry will also discuss a DRDO-Indian Air Force project to develop two Airborne Early Warning and Control Systems (AWACS). The project would be worth over Rs 6,000 crore with almost equal funding from both the organisations.

"The first project under the Strategic Partnership policy is scheduled to be taken up for discussion by the Defence Acquisition Council headed by the Defence Minister today," government sources said here. Under the strategic partnership policy, the Modi government wants to promote indigenous industry in manufacturing world class military hardware and the manufacturing of naval choppers is the first project to have been undertaken as part of it.



Sources said the Navy has decided on the four strategic partners for the project and the DAC will take a final call on names of shortlisted vendors. The Indian vendors shortlisted for the project by the Navy include Tata, Adani, Bharat Forge and Mahindra Defence Systems who will have to tie up with French Airbus Helicopters, American Sikorsky and Russian Rosoboronexport.

The European firm has offered two of its choppers for the programme. Along with the chopper programme, the Defence Ministry is also likely to discuss an Army project to acquire around 20,000 night sighting devices for assault rifles of Army troops, the sources said.

The Defence Acquisition Council is the apex body in the Defence Ministry for deciding on acquisition projects of the three services and the Indian coast guard (ANI)

(This story has not been edited by Devdiscourse staff and is auto-generated from a syndicated feed.)

<https://www.devdiscourse.com/article/national/761775-defence-ministry-to-discuss-projects-worth-over-rs-30000-crore-for-light-chopper-drdos-awacs>



## DIAT plans to make Pune hub of quantum technology in country

*Quantum technology concerns the study, control and manipulation of quantum principle-based systems with the goal of achieving information processing, secure communication and superior sensors beyond the limits of classical systems*

Pune: The Defence Institute of Advanced Technology (DIAT) is planning to make Pune a hub for quantum technology in the country. “The plan is to make Pune a hub for quantum technology. There is a big talent pool available in and around Pune and we thought it apt to take the lead and project Pune as a hub for quantum technology. The focus is on security and defence application of quantum technology, along with other areas, too,” said DIAT Vice Chancellor Dr CP Ramanarayanan on Thursday.

He was speaking at an event to announce the International Symposium on Quantum Information Technology (ISQIT 2019), being jointly organised by DIAT, DRDO, NTRO and JATC of IIT-Delhi between December 2 and 5 in Pune. DIAT is a city-based deemed university under the Department of Defence Research and Development of the Ministry of Defence.



Ramanarayanan said the aim is to make DIAT the nodal agency in the country for research in quantum technology.

“The idea behind this conference is that at the end of each session, we want to identify the area where there is a technology gap and the areas in which foreign universities are willing to work with us. We will be the nodal agency in this regard. This conference is being hosted by our parent organisation DRDO supported by NTRO, IIT Delhi, IIT Bombay, TIFR and many key academic institutions in India. 40 scientists from DRDO, 15 from NTRO, 10 from IIT Delhi and more along with delegates from Army, Navy, Air Force and the joint Cyber Command. The plan is to make Pune a hub for quantum technology. We want to make this conference a yearly affair and plan to invite the Google chief for the event next year.”

Quantum technology concerns the study, control and manipulation of quantum principle-based systems with the goal of achieving information processing, secure communication and superior sensors beyond the limits of classical systems. It is a deeply interdisciplinary field, lying in the crossover of areas such as quantum physics, condensed matter physics, computer science, mathematics and electrical and electronics engineering.

Elaborating on the plan, Ramanarayanan said, “The first aim will be to pool the talent in this country. We will enable academic institutions where this talent is available to work together. Being affiliated to the central ministry, we will be able to bring these institutions together to work on common goals.”

The conference will be attended by DRDO Chairman G Satheesh Reddy, NTRO Chairman Satish Chandra Jha, Director General of Sudhir Kamath, Director General (Micro Electronic Devices and Computational Sciences) M H Rahaman, experts from various DRDO laboratories like ANURAG, SAG, CAIR and DYSL-QT, experts from DIAT, C-DAC Pune, TIFR Mumbai, IIT Delhi, IIT Madras and IIIT Pune.

Manisha Nene of DIAT, who is the co-convenor for the event, said, “The four verticals that the conference will focus on are quantum computations and algorithms, quantum communication, quantum sensing and post-quantum cryptography. We hope that the knowledge and research shared by the experts in these areas will benefit all stakeholders. This event will help to formulate the roadmap to bring India to the forefront of progress in quantum technologies applicable to defence, medical and other civilian applications.”

MTEch in quantum technology at DIAT Ramanarayanan said, “We have an MTEch programme in artificial intelligence and from the coming academic year, we are starting an MTEch course in quantum technology also. Maybe, we will be first to do so in the country. Foreign faculty will be also roped in for the course. The students will be from both services and civilian backgrounds.”

Nene added, “The course aims to develop skill sets on utilising quantum computing capabilities. The global IT giants have already put in efforts toward development of this technology. The course will also focus on the physics aspect as sensing and communication depends a lot on it.”

Ramanarayanan said DIAT has recently signed MoUs with several foreign agencies, including one with French aviation major Dassault. “They want our students to work with Dassault. Once the students complete the two-year postgraduation course here, they will continue with a one year course in France and move to work for the company either in France or at its design centre in Pune,” he said.

<https://indianexpress.com/article/cities/pune/diat-plans-to-make-pune-hub-of-quantum-technology-in-country-6141984/>

**hindustantimes**

*Fri, 29 Nov 2019*

## **International symposium on quantum information technology in Pune from December 2**

Pune: An international symposium on Quantum Information Technology (ISQIT 2019) is being jointly organised by the Defence Institute of Advanced Technology (DIAT), Defence Research and Development Organization (DRDO) and Joint Advanced Technology Centre (JATC-IITD) from December 2 to December 5 in the city.

The event will be attended by Dr G Satheesh Reddy, Secretary DD (R&D), Chairman DRDO and Satish Chandra Jha, Chairman NTRO. Dr Sudhir Kamath, Director General (MED, COS and CS), MH Rahaman, Director JATC-IIT Delhi and Dr CP Ramanarayanan, vice-chancellor, DIAT, will also be present as patrons of the event.

Academic and industry experts from India and all over the world will assemble to discuss the worldwide progress and effectiveness of the current initiatives of India through invited talks, technology tutorials and closed-door panel discussions during the four days of the event. Accordingly, the future road map of India will be discussed upon to make India one of the world leaders in quantum technologies.

Quantum technologies concerns the study, control and manipulation of quantum systems with the goal of achieving information processing, secure communication and superior sensors beyond the limits of the classical world.

It is an interdisciplinary field, lying in the crossover of areas such as quantum physics, condensed matter physics, computer science, mathematics or electrical engineering. Having a genesis that can be traced back to the origins of quantum theory itself —with the discovery of quantum features as quantum superposition, entanglement and no-cloning, the field of quantum technology is the new

technology frontier. Quantum technologies support entirely new modes of computation, provably secure communications, simulation capabilities unattainable with classical processors, sensors and clocks with unprecedented sensitivity and accuracy, or the pioneering generation of certified genuine randomness.

The organising committee has experts from various DRDO laboratories, including ANURAG, SAG, CAIR and DYSL-QT, experts from DIAT, C-DAC Pune, TIFR-Mumbai, IIT-Delhi, IIT-Madras and IIIT-Pune.

The co-convenor of the event Dr Manisha J Nene, DIAT, Pune and the director of DRDO lab, DYSL-QT, on quantum technology are hopeful that the event will help India in formulating the future road map to bring India to the forefront of progress in quantum technologies applicable to defence, medical and other civilian applications.

<https://www.hindustantimes.com/pune-news/international-symposium-on-quantum-information-technology-in-pune-from-december-2/story-EliKvpEvoWm0apSvb2DmIK.html>

## Business Standard

Fri, 29 Nov 2019

# Far better than DRDO missile: Israel's Rafael makes strong pitch for Spike

*In January 2018, India had cancelled a \$500-million purchase of Spike LR missiles just two weeks before Prime Minister Benjamin Netanyahu was to ink the deal on a visit to New Delhi*

*By Ajai Shukla*

New Delhi: On Wednesday, the Indian Army successfully test-fired the Israeli Spike LR anti-tank guided missile (ATGM), which can home in on, and destroy, enemy tanks at ranges up to 4 km.

On Thursday, Rafael Advanced Defense Systems, which builds the Spike, boldly stated: “With confidence in the Spike missile established, the Indian Army may need to revisit their plans” to develop an Indian anti-tank missile.

This is an unusually bold statement, since foreign vendors usually tread softly around New Delhi’s sensibilities and avoid giving procurement advice.

In January 2018, India had cancelled a \$500-million purchase of Spike LR missiles just two weeks before Prime Minister Benjamin Netanyahu was to ink the deal on a visit to New Delhi. Army chief General Bipin Rawat said at that time that the purchase was cancelled because the Defence Research and Development Organisation (DRDO) was going to develop and supply an indigenous ATGM.

Since the DRDO missile would be ready only by 2022, “the Indian Army procured a limited quantity of Spike LR missiles, so as to meet the urgent operational requirement”, said Rafael in a press release on Thursday.

Two of these ATGMs were fired at Mhow on Wednesday. Witnessed by top infantry generals, including Rawat, both struck their targets.

Encouraged by that success, Rafael now claims the DRDO’s missile will be only a ‘third-generation’ ATGM, while the Spike LR is a fourth-generation missile.



“Both the DRDO’s ATGM programme, as well as the invitation to Indian industry to develop a 3rd Gen missile will need a rethink, as having a 4th Gen missile will put the plan for development of a 3rd Gen missile questionable,” stated Rafael’s unusually forthright statement.

The Israeli firm explained why its ATGM was better than what the DRDO is developing. “Spike LR is a 4th Gen missile, which (has) fire and forget capability (that does not require the firer to keep the enemy tank in his cross hairs until impact). The missile also has the ability to... switch to a different target mid-flight, should he want to do so.”

Rafael argued that the Spike LR’s inbuilt seeker allows the firer to engage tanks by both day and night. “The dual seeker adds to the missile’s reliability, already established at more than 90 per cent during the field evaluation by the Indian Army in 2011. As of date, more than 5000 Spike missiles have been fired so far worldwide, with the overall hit percentage being more than 95 per cent”, claimed Rafael.

India is the 33rd country to have the Spike missile as part of its inventory.

For decades now, the army’s infantry (foot-soldiers) units have been equipped with 2nd Gen missiles like the French MILAN, which had a range of under 2.5 km.

In 2011, the defence ministry floated a tender for 321 ATGM launchers and 8,356 missiles worth an estimated \$500 million (~3,600 crore).

Rafael was required to discharge offsets worth 30 per cent of that value and to transfer technology to Bharat Dynamics for building 30,000 more Spike missiles in India.

Over the preceding two years, Rafael has strengthened its case by putting in place the tools to manufacture the Spike LR in India, in a joint venture (JV) with the Kalyani Group in Hyderabad. “The JV is capable of manufacturing Spike missiles in India, and will also look at export opportunities from India”, stated Rafael on Thursday.

By 2016, Spike LR had cleared user trials and the defence ministry had completed price negotiations. At the last minute, however, the government decided in favour of indigenous manufacture.

Now, with the DRDO programme under way and reportedly making good progress, Rafael has moved boldly to make its case for the Spike.

[https://www.business-standard.com/article/defence/far-better-than-drdo-missile-israel-s-rafael-makes-strong-pitch-for-spike-119112801630\\_1.html](https://www.business-standard.com/article/defence/far-better-than-drdo-missile-israel-s-rafael-makes-strong-pitch-for-spike-119112801630_1.html)

## THE ECONOMIC TIMES

Fri, 29 Nov 2019

# From DRDO to BPCL, India’s first underwater drone, EyeROV Tuna, finds many takers

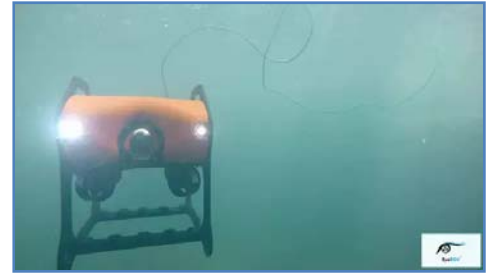
*Kerala-based startup develops India's first commercial portable drone that can be used for underwater inspections. Today, the robot comes very handy for location scouting for search and rescue mission, surveillance for the defence sector and for r..*

*By Pranbihanga Borpuzari & Geetha Jayaraman*

When the Defence Ministry started the Innovations for Defence Excellence (iDex) programme last year, one startup stood out. An underwater robotic drone called EyeROV could spot a crack in the hull of a ship or damage to an oil pipeline and seemed like a great fit for the defence organisations.



iDex was started to create an ecosystem to foster innovation and technology development in Defence and Aerospace by engaging with innovators and startups to deliver technologically advanced solutions for modernizing the Indian Military. A passion for robotics and to innovate something path-breaking was the driving force behind the development of EyeROV – India’s first commercial underwater robotic drone by two IIT post graduates. It was a match, waiting to happen.



Co-founder of IROV Technologies – Kannappa Palaniappan P was working as an on-board scientist with the National Institute of Ocean Technology, Chennai, when he came across a Herculean task to survey the ocean floor and inspect the ship’s hull with an enormous drone weighing a tonne. This got him thinking that when we have the resources to develop a cost efficient satellite like Chandrayan, we can surely develop a portable drone that can be used for underwater inspection, surveillance and for search and rescue operations.

“When Kannappa suggested the idea of developing a simple machine to inspect the ship hull as compared to the many sophisticated bulkier equipment available in the market, we thought of developing a miniature version that can go up to 300 meters,” shares Johns T Mathai, CEO and co-founder, IROV Technologies, who worked in Samsung R&D Institute India and Grey Orange Pvt Ltd before foraying into the entrepreneurial venture.

In 2016, they pitched the idea to the Maker Village in Kochi, Kerala. Mathai says, “The idea got selected for the incubator program and we started working on the initial proof of concept and prototype.”

### **Finding depth**

Their product EyeROV TUNA is India’s first commercial remotely operated underwater drone, which can send real-time video of ships and other underwater structures to help with their repair and maintenance. “The drone can navigate up to a depth of 50 meters to take real-time HD video images to examine underwater, thus eliminating the need for costly and riskier manual inspection by divers,” explains Mathai.

He adds that the rover is very light, which can be easily accessed and controlled with the supporting tether and connected to a laptop or a joystick. “A camera is fitted on the ROV (remotely operated vehicle) to give live video feed of the harsh and critical underwater environment. The drone moves at a speed of two knots, has a 6000 lumens LED lamps and a three hour plus battery life,” says Mathai.

The EyeROV TUNA weighs less than 10 kg and can be used to inspect ship hulls, ports, dams and nuclear power plants. Talking about the significance of EyeROV, Mathai says, “This product comes very handy for location scouting for search and rescue mission, surveillance for the defence sector and for research sectors like fishery and oil & gas.”

For a hardware startup finding funding is usually the biggest problem, unlike a software startup states Mathai and adds, “Designing a prototype is way different from designing an actual product. The costing can go exponentially high.”

They developed the first prototype within seven months of inception, but failed because of various reasons. “The water environment is generally very hostile compared to the environment in space. You have various challenges like very high currents, zero visibility, so it is very tough for a normal prototype to survive in such hostile conditions,” points out Mathai.

The company got initial funding from BPCL project Ankur Startup Scheme and Kerala Startup Mission Idea Grant Scheme. They also received their first order from the Naval Physical and Oceanographic Lab under DRDO. “We received the order based on the second prototype. Though the prototype was not as per their requirement, but they gave us the order along with their requirement.



Our idea was to develop a commercially viable product and since there was a demand for the same we had an advantage. That propelled us to a great extent.”

### **A sea of opportunities**

Oil and gas industry is another major sector that the company is trying to capture as they have many underwater structures and pipelines that connects the refinery and the dock. “These pipelines and offshore structures are to be inspected on a regular interval for any kind of damages.”

This four year old company has also worked with the Mumbai Port Trust for identifying wreckage of ships. “We used our technology to find out sunken ship near the port. Within 3 days we were able to spot seven wrecked ships in the surrounding, which divers could have taken around a month or so to complete,” expresses Mathai.

Apart from cameras, EyeROV also use sonar technology to inspect the water environment. “The portable micro-class ROV can be used for underwater survey and visual inspection of submerged structures at depths up to 100 meters. We use sonar technology because in India the water bodies are generally very murky and sometimes it is very difficult to capture anything underwater, even in a close range. There are two types of sonar – imaging sonar and side scan sonar. Imaging sonar provides data of what is in-front while the side-scan sonar shows the bottom area.”

The startup has successfully completed numerous projects like surveying dams for the Kerala State Electricity Board, oil pipeline bridge for BPCL and are working with the Fire and rescue department of Karnataka and Kerala state amongst others.

With a specialised data analytics platform, EyeROV aims to spread their wings outside India capturing the global market and compete with the existing products. “Most of the companies that currently operate just collect the data and share it with the client. Generally, these videos are about six to eight hours long. So, it is very difficult for a person to sit and analyse. What we do is, we make the findings into a 3D image or a user intrusive platform where they can click and see. We focus on data analytics and present to the client a user friendly result. We are also working on image enhancement. We have an expertise in data analytics,” states Mathai.

<https://economictimes.indiatimes.com/small-biz/startups/features/from-drdo-to-bpcl-indias-first-underwater-drone-eyerov-tuna-finds-many-takers/articleshow/72271519.cms>