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All low earth satellites in reach of ASAT missile: DRDO chief

'Extensive simulations conducted before test, debris don't pose threat to ISS'

By Dinakar Peri

New Delhi: The anti-satellite (ASAT) test, Mission Shakti, conducted last week is a "deterrence capability" and the missile can cover all satellites in Low Earth Orbit (LEO), Dr. Satheesh Reddy, Chairman of the Defence Research and Development Organisation (DRDO), said on Saturday.

"The test happened as per design. We don't need any more tests in this orbit as of now. The guidance and control algorithm has been developed to do interception at 1,000 km above the earth. This test covers all LEO satellites, including those for military use," Dr. Reddy said, adding that hitting multiple satellites was feasible. He was addressing a press conference on the ASAT test.

On March 27, a live satellite in LEO of 300 km was shot down using a modified interceptor of the Ballistic Missile Defence system.

On the issue of militarisation of space, Dr. Reddy said space had gained importance in the military domain. "When a country like India has done an exercise like this and shown capability of interception of a target, you have shown the capability for such operations. Best way of defence is to have deterrence."

Giving details of Mission Shakti, Dr. Reddy, the chief architect of the ASAT test, said the first discussion on the test started in 2014 and the "formal detailed presentation was made in 2016 and post that we took two years to develop the system."

On the timing of the test, Deputy National Security Adviser Pankaj Saran said it was a "technologically and scientifically driven one."

'NASA ties continue'

On concerns raised by the U.S. space agency, National Aeronautics and Space Administration (NASA), Mr. Saran said, "NASA is continuing its cooperation with India, including in the manned mission to space. We have had several statements from the U.S., as far as India is concerned the official position is contained in the State Department statement."

To questions on the debris created by the test, Dr. Reddy said extensive simulations were conducted and there was no threat to the International Space Station (ISS). "LEO was chosen based on simulations with primary objective being to minimise debris. It was intentionally done at 280 km altitude so that debris decay fast," Dr. Reddy said, adding that the interception was designed to hit at an angle so that minimal debris go up and also have minimal velocity. "Some of the debris have already decayed. Our simulations show all debris will decay in 45 days," he added.

The major challenges in the mission were to achieve "hit to kill" against a live satellite with an accuracy with less than 10 cm. All critical technologies for the test were developed indigenously and about 90% of the entire test in indigenous, Dr. Reddy added.

About 150 scientists worked round-the-clock in the past six months and about 2,000 components were sourced from 50 private industries.

https://www.thehindu.com/news/national/all-low-earth-satellites-in-reach-of-asat-missile-drdo-chief/article26756012.ece

The Indian EXPRESS

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Debris to clear in 45 days, no risk to space station, says DRDO

Asked whether the DRDO had the permission of the Election Commission (EC) for the briefing, officials said they had the "necessary clearance"

The Defence Research and Development Organisation (DRDO) on Saturday held a detailed briefing on India's Anti-Satellite Test (A-SAT), defending both its timing and the government revealing it to the world.

Asked whether the DRDO had the permission of the Election Commission (EC) for the briefing, officials said they had the "necessary clearance".

Amidst the Opposition going to the EC over the test, and Prime Minister Narendra Modi himself announcing it to the nation, DRDO Chairman G Satheesh Reddy gave a detailed representation on 'Mission Shakti', with graphics. Addressing a packed auditorium here, he said the timing of the test was "technologically and scientifically driven" and said tests of this nature couldn't be kept a secret. He also ruled out any future A-SAT missile tests in the lower Earth orbit by India, saying these were not needed any more.

Reddy said India had chosen an orbit of less than 300 km for Mission Shakti for "capability demonstration" and to avoid threat of debris to global space assets. "The chosen orbit was nearly 120 km below the International Space Station (ISS) orbit. There was no possibility of hitting the ISS with A-SAT debris. Even NASA spoke about a 10-day risk period that is over today," Reddy said, adding that their radars had spotted the debris after the test and these would dissolve within 45 days.

On Tuesday, the US space agency had termed India shooting down a satellite, one of its own, a "terrible thing" saying the mission had created about 400 pieces of orbital debris which posed a threat to the ISS.

However, NASA appears to have climbed down since. In a letter to ISRO Chairman K Sivan sent on April 4, as reported by PTI from Washington on Saturday, NASA Administrator James Bridenstine said that "based on the guidance received from the White House", he looked forward to continuing to work with ISRO on a host of issues, including human space flights.

It was Bridenstine who had attacked India over the test. In his letter, which PTI said it had seen, Bridenstine added, "As we made clear, space debris is a serious issue for the United States. As it is a growing threat, it is the responsibility of all nations who operate in space… We will continue to monitor the remaining debris from your test as it relates to the safety of our human spaceflight activities especially at the International Space Station."

The DRDO's presentation came amidst the Opposition's complaint to the EC over Modi's address to the nation on A-SAT, saying it violated the poll code of conduct. The EC, however, had given the PM a clean chit on the issue.

Reddy said Saturday, "A mission of this nature after a test is conducted can't be kept a secret. A satellite is tracked by many stations across the world."

Asked when the DRDO had got the nod for the project, Reddy said the first discussion on A-SAT started in 2014 and the formal detailed presentation was made in 2016. "After the formal approvals in 2016, we started work on this project."

Mission planning involved extensive simulation to ensure no damage due to debris, he said, adding that the high risk period of the first 10 days got over on Saturday.

He added that the interceptor developed by India had the capability to intercept satellites up to an orbit of 1,000 km. “An orbit of around 300 km was chosen for the test… The debris created following the intercept will decay in 45 days. Debris won’t cause a problem to any existing space asset. We have some amount of mechanism to look at these objects. In fact, our radars picked up the debris immediately after the test.”

Lauding the DRDO for the sucess of ‘Mission Shakti’, Reddy said, “Space has gained importance in military domain. When a country like India has done an exercise like this and shown capability of interception of a target, you have shown capability for such operations. The best way of defence is to have deterrence.”

Asked about weaponisation of space, the DRDO Chairman said it is a decision the government had to make. “If a space command and centre needs to be formulated, it is the decision of the government.”

More than 150 scientists had taken part in the mission and around 40 of them were women, the DRDO said.

On March 27, the PM had announced that India had entered the elite club of nations to possess the capability to hit a target in space, saying the other countries with such a capability are the US, Russia and China.

Addressing a town hall meeting on April 1, NASA chief Bridenstine had questioned India’s A-SAT mission, saying, “it is a terrible, terrible thing to create an event that sends debris and an apogee that goes above the International Space Station”.

In his letter to ISRO on April 4, Bridenstine wrote, “Recently, we sent you a letter indicating a suspension of activities under the NASA-ISRO Human Space Flight Working Group… As part of our partnership with you, we will continue to work on issues using the NASA-ISRO Human Space Flight Working Group, Planetary Science Working Group, US India Earth Science Working Group and the Heliophysics Working Group.”

https://indianexpress.com/article/india/debris-to-clear-in-45-days-no-risk-to-space-station-says-drdo-5662948/

Sat, 06 April 2019

Decoding China’s ballistic missile defence (BMD) and anti-satellite (ASAT) systems efforts

The Chinese conduct their tests from their test site in Korla, Xinjiang. Since the hit-to-kill vehicles can be used for BMD and ASAT, the site probably services both functions

By Manoj Joshi

China began its efforts in the area of ballistic missile defence (BMD) and anti-satellite (ASAT) systems by taking a two track approach, one where it opposes them on the grounds that they will undermine nuclear stability. At the same time, China also developed a range of options that related to both capabilities.

It must be noted, though, that ASAT and BMD capabilities are not identical. It is relatively easier to predict the trajectory of a satellite than a ballistic missile. Likewise, satellites offer a greater radar cross-section than a missile target.

The Chinese began research in missile interception in 1964, but the programme was given a crucial boost with its inclusion in the prestigious Project 863 in the late 1980s. The 2001 US withdrawal from

the Anti-Ballistic Missile (ABM) Treaty only served to encourage Beijing on the path of developing its own BMD/ASAT systems.

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The Chinese BMD effort is a natural outcome of its pursuit of air defence systems against aircraft and cruise missiles. Over the years, China's radar and long-range SAM systems have given it a limited capability against the shorter-ranged ballistic missiles, just as they had done in the case of the United States. In recent decades, they have developed substantially.

China has benefited from the Soviet and Russian technology and in recent years, the two countries have come closer to each other in anti-missile cooperation. In December 2017, for example, they had a joint computer simulated ABM exercises.

BMD systems involve the ability to detect the incoming missile, track it and intercept it using your own weapon, be it missile or laser system. They can be intercepted as they take off in the boost phase, or when their rockets burn out and the re-entry vehicle is moving on a ballistic trajectory in space, and finally when they re-enter the atmosphere and head to their target in the terminal phase. Over the years, the Chinese have developed capabilities in all these areas. These, in turn, has given the Chinese the abilities in the ASAT domain.

According to observers, as of today, the tests conducted by China and the equipment like radars and missiles that they have developed indicates that "these are not isolated technology demonstrations" but systems which are meant to be deployed operational systems.

Chinese missile systems

To start with, Chinese capabilities took a quantum leap in 1993 with the import of the S-300 system from Russia. The 48N6E2 missile of this system is optimised to destroy short-range ballistic missiles. In recent years, China acquired the S-400 with its ability to deal with missiles with ranges up to 3,500 km. In actual fact, their ability to deal with ballistic missiles are limited to short-range missiles.

China's own HQ-9 long-range SAM, a derivative of the S-300, can handle ballistic missiles of 500 km range. This has been used to develop the HQ-19 (and its ASAT derivative the SC-19) missile, to kill interceptor. China has tested this missile several times and can deal with missiles of the range of 1,000-3000 km.

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The HQ-19/ SC-19 is all right for medium-range missiles and LEO satellites, but for interception at higher altitudes, the Chinese are developing the Dong Neng missiles aimed at mid-course interception. Multiple tests of the DN system have taken place since 2010.

Chinese radars

Chinese work on of Large Phased Array Radars (LPAR) began in the 1970s. In recent years' evidence has emerged of very substantial Chinese advances in the LPAR field which are crucial for any kind of BMD and ASAT capability.

The US says that China's JL-1A and JY-27A radars are aimed at tackling the ballistic missile threats, with the former being able to precision track multiple ballistic missiles. It is an anti-missile radar with 2D digital active phased array system, while the latter is a land-based long-range air surveillance and guidance meter-wave 3D radar.

In October 2017, a report in a Chinese website revealed a large P-band radar with a detection range of 5,000 km. The aim of the radar, which is based on the periphery of the country, reportedly Shandong peninsula, is to intercept and track strategic missiles launched from the direction of Japan, South

Korea and Guam. The report also spoke of the setting up of an X band radar in Helongjiang. The main task of this radar is to guide intercepts of targets detected by the P-band long-range radar.

While the JL-1A is likely to be the X-band radar, experts say that it is not clear what is the designation of the P-band radar that has been set up in Shandong province of China.

The Chinese conduct their tests from their test site in Korla, Xinjiang. Since the hit-to-kill vehicles can be used for BMD and ASAT, the site probably services both functions. Missiles are launched from the nearby Shuangchengzi Space and Missile Centre (SSMC).

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Chinese tests

In January 2007, China launched a hit-to-kill vehicle from Xichang satellite launch centre in Sichuan, at a defunct Chinese weather satellite in orbit 800 km above the earth. The impact generated over 3,000 pieces of trackable objects and ten times that number of pieces that can't be tracked. These are a serious threat to other satellites and the International Space Station and created an international furore.

Subsequent tests have been non-destructive and have used other modes such as tests by timing capabilities. That is, putting a missile at a location at the precise time signaling an intercept.

- **January 2007** ⁓ *China launched a hit-to-kill vehicle from Xichang satellite launch centre in Sichuan.*
- **11 January 2010** ⁓ *China conducted a mid-course ballistic missile defence test by launching the SC-19 from near Korla.*
- **27 January 2013** ⁓ *China conducted its second mid-course BMD test. Like the January 2010 test, the event was announced by the Chinese who also noted that the "test is defensive in nature and targets no other country."*
- **13 May 2013** ⁓ *DN-2 conducted a "high altitude science" mission. But the US said was designed to deal with satellites in medium to high earth orbits where GPS and communications satellites are placed.*
- **23 July 2014** ⁓ *The test was its third in four years. The US State Department termed it as a "non-destructive test" of an anti-satellite weapon. The Chinese spokesman, however, insisted that it was that of a land-based missile interceptor.*
- **15 October 2015** ⁓ *China tested a DN-3 vehicle for an ASAT test from Korla.*
- **27 July 2017** ⁓ the DN-3 was tested for the second time from the SSMC.
- **7 February 2018** ⁓ *China announced the success of a third mid-course land based missile interception test, also conducted from Korla.*

According to Ankit Panda, citing US official sources, the missile tested is the DN-3 which hit a DF-21 MRBM.

In addition to these tests using hit-to-kill systems which are now at the stage of deployment, the Chinese have also tested other ASAT techniques which, given their dual-use nature are difficult to categorise as such. In 2006, the Chinese also reportedly "painted" a US satellite using a ground based laser.

- **2010** ⁓ *One Shijian satellite bumped into another, causing a change in the orbit of the other. This could have been part of an experiment involving docking, or the test of another technique of ASAT operations.*
- **2013** ⁓ *A Chinese satellite with a robotic arm grappled with a target satellite and again this could be an experiment relating to the Chinese space station, but observers noted that this also gave Beijing an ASAT capability.*

- **June 2016** ↴ *The Aolong-1 satellite was launched, equipped with a robotic arm to remove space debris.*

Since the 2007 test, China has avoided an overt ASAT test, but the US assessment is that several of its BMD tests have, indeed, been for the former purpose.

According to one analyst, these were more by way of "developing and understanding" missile technology rather than a user-test of a deployable system. The Chinese have been willing to acknowledge their successful BMD tests, but avoid any reference to ASAT ones.

Since the 2007 test, China has avoided an overt ASAT test, but the US assessment is that several of its BMD tests have, indeed, been for the former purpose.

When it comes to Chinese systems and tests, there is always room for ambiguity. The first major uncertainty in relation to a test is as to whether it is a BMD test or an ASAT one. Then, there are issues relating to dual use space activity such as satellite inspection, refueling or the use of robotic arms for satellite capture or repair.

India

Joseph Trevithick says that the SC 19 is more akin to the US THAAD, useful to take out missiles in their terminal phase. He notes that these tests could be related to Agni missiles that India has deployed, the Agni II MRBM and the Agni III IRBM and is still testing the Agni IV and V. It is significant that China's 5 February 2018 BMD test took place several weeks after India's first pre-induction trial of its Agni V which is claimed to be an ICBM.

Of even greater significance, perhaps, was the revelation, just three days after the Indian test, that the Chinese had established a large anti-missile radar on the Qinghai plateau north-east of the Tibet Autonomous Region. The news was put out through the CCTV programme. It said that the anti-missile radar was an X band facility with the ability to track multiple targets. The Hong Kong news source that picked it up reported that it could pick up any target in South Asia at a range of 4,000 kms and pass it on to the SC-19 system for destruction.

https://www.orfonline.org/expert-speak/chinas-bmd-asat-progress-49578/

THE TIMES OF INDIA

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DRDO places order for product incubated by Maker Village

Kochi: The two-day National Deeptech Conclave 'Hardtech 19' organized by Maker Village concluded at Technology Innovation Zone, Kalamassery, here on Saturday.

Defence Research and Development Organisation (DRDO) has initiated a purchase order of 'advanced spray coater', which has developed by Delgado Coating and Technology Solutions and incubated by Maker Village, here. The purchase order was handed over by defence production secretary Dr Ajay Kumar to Delgado CEO R Sree Kumar at the conclave.

The energy saving device is used in solar cells as transparent electrode, touch-Screen devices (mobiles), flat panel displays, organic light-emitting diode (OLED's), energy saving smart windows, nano-coating and bio-medical coatings over needles and surgical stents. It will slash the production cost by 30% compared to the present technology used by other countries.

Ajay Kumar launched the improved and upgraded 'robotic arm' developed by Sastra Robotics. The product is 100% safe with functions similar to that of human arm.

Sastra CEO Aronin P said that this robotic arm is three times more powerful than the presently available product.

In her inaugural address at the conclave on Friday, Union telecom secretary Aruna Sundararajan said, “The telecom sector is gearing up for 5G era and innovative startups in Kochi can tap the opportunity”. Tnn

https://timesofindia.indiatimes.com/city/kochi/drdo-places-order-for-product-incubated-by-maker-village/articleshow/68757983.cms

MAIL TODAY

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SLBM starting trouble

File photo of a K-15 SLBM being tested from a submerged pontoon off Vizag

INDIA'S March 27 test of the anti-satellite missile (ASAT) has enthused the DRDO and boosted its flailing ballistic missile shield, the Project AD from which the ASAT weapon was derived. The ASAT success test should also give the DRDO confidence to tackle what has been one of its biggest stumbling blocks in recent years — the K-4 submarine launched ballistic missile (SLBM).

The 4000-km range two-stage nuclear-capable K-4, in development for nearly a decade has suffered multiple misfires in 'pop up' tests in the Bay of Bengal. The repeated failure of the 11-metre long missile to deploy after its launch from a specially designed submerged pontoon, has been traced to the failure of a certain onboard structural component. The failures will hopefully be rectified in future missile tests. The delay is not unusual and are part of the learning curve, scientists say. An SLBM is the most complicated of all strategic systems and reason why only a handful of countries have perfected it. An ordinary ballistic missile is ground launched, arcs out into space to re-enter the atmosphere and fall on its target. A ballistic missile fired from a submerged vessel first has to deal with a 10-metre column of water exerting a pressure of 2 kgs per square centimetres on it. After the missile breaks the sea surface, it has to transit two other mediums, air and space – before re-entering the atmosphere to hit its target. It took Russia, a country with over half century of SLBM technology close to a decade and repeated test flight failures, to perfect the Bulava SLBMs which now equip the Borei class SSBNs.

The success of the K-4 (the K stands for former President and missile scientist Dr APJ Abdul Kalam) is critical for the third leg of India's nuclear triad of ground, air and undersea nuclear weapons. The INS Arihant, India's first SSBN, completed its first deterrent patrol last November with a full load out of a dozen 750 km range K-15 missiles. The submarine needs the longer ranged K-4, of which it can carry four missiles, if the platform is to maintain safe distance from its intended targets. The K-4's realisation will also be key to two other parallel SLBM programmes underway at the DRDO, the K-5 and K-6. The 5000 km range K-5 is meant to equip the third and fourth SSBNs in the Arihant series — S-4 and S-4* while the 6000-km K-6 is to arm the three 12,500-ton SSBNs which will start construction after the fourth Arihant-class boat is completed by 2022.

Few countries have perfected the SLBM strategic system due to its complexity

Thanks to these long-legged missiles, these boats can launch second strikes at potential adversaries from the depths of the Bay of Bengal, providing a true submerged and survivable nuclear deterrent. There is hence, clearly a lot riding on the success of the K-4.

—The writer is Executive Editor, India Today.