#SWARAJYA

Wed, 01 May 2019

Indian Air Force to get DRDO's smart anti-airfield weapon laced with hi-tech features for combat superiority

The Defence Research and Development Organisation (DRDO) is working hard to develop a smart anti-airfield weapon for the Indian Air Force and is expected to commission delivery by 2020, *New Indian Express* has reported.

The weapon is being developed for the last four years at DRDO's Research Imarat Centre in Hyderabad. It is equipped with an inertial navigation system which uses motion sensors, gyroscopes to continuously calculate a moving object's position.

This weapon is designed to restrict enemy troop movement, penetrate canopies and demolish bunkers to achieve combat superiority.

The weapon is also capable of sending back target images for better damage assessment at the time of the airstrike.

So far the smart anti-airfield weapon also known as SAAW has been successfully tested 17 times and boasts of an accuracy of 7 to 20 metres.

As reported earlier, SAAW is integrated with a live warhead and is capable of destroying various targets using precision navigation.

https://swarajyamag.com/insta/indian-air-force-to-get-drdos-smart-anti-airfield-weapon-laced-with-hi-tech-features-for-combat-superiority

THE HINDU

Wed, 01 May 2019

India's ASAT test a response to growing space threats: France

'Outer space becoming an arena of rivalry between nations'

By Dinakar Peri

New Delhi: Stating that defence and offensive space technologies are being developed with various aims of spying, gaining control, deactivating service and destroying, French Envoy in India Alexandre Ziegler has supported India's Anti-Satellite (ASAT) missile test as a response to these growing threats.

"India shared the same observation and desire to act, which is actually reflected in Prime Minister Narendra Modi's announcement of the ASAT missile test on March 27 this year. It is obvious that it was a clear response to an assessment of growing threats in the outer space. And that's an assessment that we share…," Mr. Ziegler said addressing the 5th Kalpana Chawla annual space policy dialogue organised by the Observer Research Foundation (ORF) that began on Monday.

Debris concerns

He also observed that outer space has become an "arena of rivalry between major powers."

At the same time, he said there was common concern on space debris. Satellites today have to avoid almost 6,00,000 debris of over 1cm travelling at speed faster than a bullet, he stated.

On March 27, India shot down a live satellite in the Low Earth Orbit (LEO) of 300 km using a modified interceptor of the Ballistic Missile Defence (BMD) system. Officials had stated that the LEO was particularly chosen to minimise space debris.

India and France, which have been cooperating in the area of space for several decades, had announced the setting up of a constellation of satellites for maritime surveillance of the Indian Ocean. Mr. Ziegler said as part of this, the two countries are co-developing a constellation 10-15 satellites that could help "monitor the maritime traffic in the Indian Ocean."

Maritime surveillance

"It is part of the joint vision that we signed. It is a civilian project," he stated.

In this regard, Rod Hilton, Deputy High Commissioner of Australia, said his country was keen to be part of the broader maritime security cooperation and was working with India and France. "We have signed technology cooperation agreements with the Indian Space Research Organisation (ISRO) and space situational awareness is part of that," he said.

As space gets increasingly crowded, Mr. Ziegler also called for the need to regulate space traffic on the lines of air traffic or railways. He said France shares India's view on the use of outer space for peaceful purposes and said, "We therefore refuse any destabilising arms race, which would be detrimental to all of us."

https://www.thehindu.com/news/national/indias-asat-test-a-response-to-growing-space-threats-france/article26996218.ece

THE | DIPLOMAT
Read The Diplomat, Know the Asia-Pacific

Wed, 01 May 2019

Why India's ASAT test was reckless

Publicly available data contradicts official Indian assertions about its first anti-satellite test

By Marco Langbroek

India conducted its first successful anti-satellite (ASAT) test, dubbed "Mission Shakti," on March 27, 2019. Using a so-called PDV Mark II missile, a modified version of India's Prithvi Defense Vehicle (PDV) anti-ballistic-missile interceptor, India's Defense Research and Development Organization (DRDO) destroyed the Microsat-r satellite orbiting at 285 kilometers in altitude. Microsat-r (COSPAR designation 2019-006A) was a 740 kilogram satellite launched by India two months earlier to serve as a target for the test.

In the aftermath of the test, accusations quickly emerged — including from NASA administrator Jim Bridenstine — that the debris generated by the test endangered other satellites. India was quick to claim it had acted "responsibly." The Indian government pointed out that the test was performed at low altitude, below 300 km, in order to avoid creating debris at the altitudes of operational satellites in Low Earth Orbit (many of which orbit at altitudes between 400 and 1200 km).

In a press conference, DRDO chairman Dr. Sateesh Reddy, in addition, claimed that the kill-vehicle hit Microsat-r in what he described as an "almost direct hit in the same plane," i.e. head-on. This was done — or so it was claimed — in order to minimize the ejection of debris fragments into higher orbits. The Indian government maintains that the test yielded a negligible risk to operational satellites at higher altitudes. It has claimed that most debris fragments re-entered into the Earth's atmosphere within two days of the test, and that all of it would re-enter within 45 days.

But are these Indian government claims true? An in-depth analysis of publicly available data from both DRDO and U.S. military sources shows that this test wasn't conducted as "responsibly" as the Indian government claims. Debris did end up orbiting at higher altitudes well within the altitude range of operational satellites, including the International Space Station (ISS). The debris fragments currently being tracked by the U.S. military's tracking network will take considerably more than 45 days to re-enter into the atmosphere. Moreover, telemetry data included in a video released by the Indian DRDO indicates that the kill vehicle did not hit the target satellite head-on as the DRDO claims, but under a clear upwards angle, which would eject fragments to higher orbits.

The Timing of the ASAT Test

From information released by the DRDO, we know that the PDV-Mk II missile was launched from the missile test range at Abdul Kalam island (formerly known as Wheeler island) on the Indian coast around 11:09 a.m. Indian Standard Time (5:39 a.m. GMT). This time was independently confirmed by U.S. military sources, likely based on observations by their space-based infrared system (SBIRS) early warning satellites. Indian sources say the missile had a flight-time of 168 seconds. From a video released by DRDO showing the kill vehicle's impact into Microsat-r as imaged by an earth-based infrared camera on the Indian coast, we can pinpoint the intercept time at 5:42:15.5 GMT. This would place the launch as having taken place around 5:39:27 GMT. The orbital position of the target satellite at 5:42:15.5 GMT, the moment of intercept, was within a kilometer of 18°.715 N, 87°.450 E at an altitude of 284 km.

An OSINT Treasure Trove

Shortly after the test, DRDO released a propaganda video that contains two highly interesting fragments of video footage from the actual test. One is a short sequence of images from the infrared target seeking camera on the missile itself. The other is a sequence of footage taken by an earth-based infrared camera on the Indian coast.

It is the latter footage that contains a lot of information useful for the purpose of this analysis and is, in fact, an OSINT treasure trove. A clock running in the footage yields an accurate time of the kill vehicle impact. But more importantly, the footage appears to contain telemetry information from the missile: azimuth (direction), elevation, and range (distance) to the camera. The footage covers the last 2.7 seconds of the missile's flight up to impact, and some 2 seconds after the impact as well, showing the expanding debris cloud.

Based on U.S. tracking data from U.S. Strategic Command's Combined Space Operations Center (CSpSOC), we know the position of Microsat-r, the target satellite, at the time of impact. We therefore can use the missile's azimuth, elevation, and range information in the video frame showing the impact moment to find the location of the earth-based camera. This camera was located on the Indian coast near 21°.34 N, 86°.91 E, some 15 km southwest of Chandipur ITR. This location is near the point where the forward prolonged trajectory of the target satellite crossed the Indian coast. As the satellite position has an approximately 1 km uncertainty inherent to orbital elements in CSpOC's two-line element (TLE) set format, there is a similar uncertainty in the camera location.

Knowing the camera location, we can next use the telemetry data in the frames to reconstruct the trajectory of the missile during the last 2.7 seconds prior to impact with Microsat-r, and compare it to the trajectory of Microsat-r itself.

In order to do this, we can create a flat plane through the camera sensor, tangent to the earth surface at the camera location. Azimuth, elevation and range data from the footage then give us Cartesian positions and elevations with respect to this reference plane. In this way, we don't have to be bothered by the earth's curvature, and it greatly simplifies calculations. We are only interested in the relative geometry of the satellite and missile tracks, so this approach is sufficient.

In the diagrams that follow, positions are expressed as delta X and delta Y (in km) in the reference plane with respect to the camera location, and altitude over the reference plane (note: this is not the same as the altitude above the earth's surface). The Y-axis points north, the X-axis east. As we had to work with limited resolution frames extracted from a YouTube video, occasional errors in deciphering the telemetry numbers cause some small occasional jitters in the reconstructed missile trajectory. Nevertheless, the results are very consistent.

The first diagram shows the missile and satellite trajectories when viewed top-down (i.e. "from above"): black is the missile and red the satellite. The solid lines give the trajectories up to the moment of impact, the dashed lines give post-impact trajectories. The approximately 1 km positional error in the satellite's trajectory is indicated in grey.

Seen from this perspective, the hit appears to be almost head-on, with the missile first crossing the satellite trajectory from the east and then impacting while homing in slightly from the west, relative to the satellite's movement vector. The latter is, as we will see, in keeping with two other lines of evidence.

When we look at the missile trajectory from a vertical perspective, i.e. "from the side", the situation looks quite different, with interesting implications. It becomes clear that, far from hitting "head-on," the missile hit with a clear upwards angle of approximately 48 degrees with the horizontal (or 135 degrees with respect to the satellite's direction of movement).

This runs counter to DRDO chairman Sateesh Reddy's assertion of a "head-on" hit designed to reduce the risk of debris being ejected into higher orbits. An impact coming from below increases the risk of fragments being ejected to altitudes above the target satellite's original orbit.

A second line of evidence — footage from the infrared target seeking camera on the missile itself — also indicates a hit coming from below, in an upwards direction. The last frames of this footage show the infrared silhouette of the satellite, including its solar panels. They appear to show the latter full-on:

Would the impact have been "head-on," i.e. moving into a direction opposite to the satellite's movement vector, the solar panels should not have been visible full-on, but edge-on, given the sun-satellite-missile geometry at that moment. Solar panels are normally pointed toward the sun. A hit under an upwards angle, by contrast, would show the solar panels almost head-on, as in the footage. Hence, like the earth-based footage, the footage from the missile target seeking camera contradicts a "head-on" hit. These two lines of evidence are therefore consistent, supporting the same conclusion: that DRDO's claims about the nature of the intercept were not entirely true.

Interestingly enough, and perhaps unintentionally telling, the DRDO propaganda video has an animation of the intercept that at one point also features a steep upwards angle, consistent with a direct ballistic ascent.

Expanding Debris Cloud

After the kill vehicle hit the satellite, an expanding debris cloud was created that quickly spread. Knowing the position of the camera, we can actually plot the trajectory of the target satellite on the infrared imagery of this rapidly expanding debris cloud. We see the cloud expanding along the satellite track, notably in a forward direction (which is logical, as with an impact coming from below, the forward momentum from the 7.8 km/s moving satellite is the largest contributor to debris fragment speed vectors).

Relative Speed of Impact

From the telemetry-based trajectory reconstruction, the missile reached a speed on the order of 3.1 to 3.4 km/s. Taking into account the 7.8 km/s orbital speed of the satellite, as well as the directions of their movement vectors, a relative speed in the order of 9.9-10.0 km/s on impact is indicated. This is close to the 9.8 km/s value given by U.S. military sources. It is less than the relative speed indicated in the missile's target seeking camera footage (10.45 km/s).

Post-Impact Trajectory

Interestingly enough, the footage also includes two seconds of missile telemetry after the impact, suggesting part of the missile survived the impact. This post-impact trajectory is indicated by the dashed line in the trajectory reconstructions. In the vertical plane, we see the missile rip through the position of the satellite, the missile remnant continuing its upwards movement, perhaps under a slightly reduced angle. In the horizontal plane (i.e. seen from “above”) we see the missile remnant being clearly deflected westwards by the force of the impact, pretty much like a billiards ball hitting another ball under an oblique angle. This indicates a hit which, seen in the horizontal plane, came under a slight angle with the satellite’s movement vector. This matches information gleaned from tracked debris fragments, as I will outline below.

Debris Fragments Created

The U.S. military’s satellite tracking network, run by CSpOC, has reported it is tracking several hundreds of debris fragments created by the test. At the date of writing, CSpOC has published orbital elements for 84 of these fragments. As these 84 fragments concerns a subset of larger, well tracked fragments out of a much larger not-well or not-at-all tracked fragment population only, these orbits constitute the tip of an iceberg. The orbital elements illustrate the large spread in orbital altitudes of the debris fragments created by the test. The image below shows the orbits of these fragments (red), with the orbit of the ISS (white) shown as comparison:

One insightful way to present the orbital altitudes of these fragments and assess these at a glance is through a so-called “Gabbard” diagram. Such a diagram shows, for each fragment, the lowest point in its elliptical orbit (its perigee, in red) and the highest point in its orbit (its apogee, blue), as well as the time it takes to complete one orbit around the earth.

While the perigees of the debris fragments are distributed near the altitude of the ASAT test (285 km), the apogees spread over a large range in altitude, up to as high as 2,250 km. Some 79 percent of the tracked fragments have apogee altitudes above the orbital altitude of the International Space Station. The strongest concentration is between 200 km and 900 km altitude (see also the bar diagram), well into the realm of the orbital altitudes of many commercial as well as scientific and military satellites. Hence, these fragments clearly are an impact-threat to other satellites, in contrast to Indian government claims of minimal risks. Close approach tools like SOCRATES show that several debris fragments already have had close approaches to other satellites since the test, and that such potentially dangerous close approaches will continue to happen over the coming weeks and months.

These results should not come as a surprise, to India or anyone else. In 2008, the United States conducted “Operation Burnt Frost,” an ASAT demonstration on the malfunctioned USA 193 satellite. That intercept, like the Indian ASAT test, was at low altitude (247 km), but a significant number of fragments nevertheless ended up in much higher orbits.

Orbital Lifetimes of the Fragments

How long will it take before most of the debris created by the Indian ASAT test is cleared from orbit? The Indian government claims most fragments re-entered within hours to days, and that the rest will re-enter within 45 days of the test.

The vast majority of very small fragments created by the ASAT test will likely indeed have re-entered within hours to days of the test. But as we already have seen, there are still plenty that did not. For these, we can estimate orbital lifetimes from the decay parameters of their orbits and an educated guess of future solar activity (solar activity influences the density of the outer layers of the atmosphere). I used SatEvo software and current solar activity values to estimate the re-entry dates of the currently tracked fragments. It suggests that a significant number — almost 50 percent — of the tracked fragments have orbital lifetimes well beyond the 45 days claimed by the Indian government, as the diagram below clearly shows. Rather than 45 days, a better estimate for the maximum debris lifetime would be 45 weeks. Some fragments might even linger on until almost two years after the test.

Ejection Velocities

The orbital data for the 84 debris fragments tracked by CSpOC can be used to calculate the ejection velocities of these fragments. The ejection velocity, or delta V, is the extra velocity that was required to eject these fragments into their current orbits, and can be calculated from the change in orbital altitude and orbital inclination for each fragment. For the 84 fragments for which orbital elements are currently available, I calculate ejection velocities in the range of 10 to 300 meter/second, with a few having ejection speeds up to 500 meter/second. The range of ejection velocities is similar to that of the 2008 ASAT demonstration on USA 193 by the Americans. The peak in the delta V distribution of the Indian ASAT test is, however, shifted toward higher ejection velocities compared to the 2008 American ASAT demonstration: the distribution peaks near 100 m/s, while for the 2008 USA 193 intercept it peaks near 40 m/s. On average, the ejection speeds in the Indian ASAT test hence appear to have been somewhat higher than in the 2008 American test, creating peak debris densities at somewhat higher altitudes as a result. The difference might result from a difference in impact angle: the American ASAT test reportedly featured an impact on a downward angle, while the Indian test featured an upwards impact angle, as the above analysis shows. Some caution is in order here, though, as instrumental detection bias might have an unknown influence on the range of orbital altitudes mapped so far.

Orbital Inclinations

As seen in a horizontal plane (i.e. from "above"), the kill vehicle was not exactly moving counter to the satellite, but under a very slight angle, with the kill vehicle coming slightly from the west with regard to the satellite's movement vector. The clear westward deflection of the missile remnant after the impact, also points to this.

This hit under a small angle from the west is also born out by the orbits of the resulting debris fragments. The distribution of orbital inclinations of these fragments (the angle their orbits make with the equator) shows a shift towards smaller inclinations, by 0.5 degrees or more, compared to the original Microsat-r orbit. This again points to an impact coming from slightly west of the satellite's vector of movement.

Conclusions

We can draw a number of conclusions from this analysis. The main conclusion is that the ASAT test was conducted in a less responsible way than originally claimed by the Indian government. First, the missile hit the target satellite on a clear upwards angle, rather than "head-on" as claimed by DRDO. Second and third, the test generated debris with much longer orbital lifetimes (up to 10 times longer), which ended up at much higher altitudes than the Indian government is willing to admit.

As much as 79 percent of the larger debris fragments tracked have apogee altitudes at or above the orbit of the International Space Station. Most of the tracked debris generated by the test orbits between 300 km and 900 km altitude, well into the range of typical orbital altitudes for satellites in Low Earth Orbit. As these debris fragments are in polar orbits, they are a potential threat to satellites in all orbital inclinations at these altitudes. Indeed, several close approaches to satellites have already happened. This threat will persist for up to half a year (rather than the 45 days claimed by the Indian government), with a few fragments lingering on (much) longer, up to almost two years.

The analysis underlines that a 'harmless' ASAT test involving a real intercept of an orbiting target does not exist. The Indian ASAT test and the earlier 2008 American ASAT demonstration show that even intercepts at low altitude create lots of debris that is ejected into higher orbits. And the Indian government in this case made it worse by hitting Microsat-r under an upwards angle, rather than head-on or under a downward angle. As such, this ASAT test was reckless.

(Dr. Marco Langbroek is a Space Situational Awareness consultant from the Netherlands)

https://thediplomat.com/2019/05/why-indias-asat-test-was-reckless/

NDTV

Wed, 01 May 2019

India set to get defence cyber agency to fight Pak, Chinese hackers

Defence Cyber Agency is one of the three agencies along with the Special Forces and Space to be set up as per the clearance given by PM Modi

New Delhi: In a bid to bolster its capabilities to tackle threats emanating from hackers, mostly from China and Pakistan, India is all set to have Defence Cyber Agency (DCA) by next month. This agency will be headquartered in the capital.

Senior Navy officer Rear Admiral Mohit Gupta will be the first head of this agency -- DCA.

"We are working to raise the Defence Cyber Agency in May itself. The work has almost been completed. A new building has been hired in the national capital which will act as the headquarters of the formation," sources in the Defence Ministry said.

Agreed upon by the Defence Ministry and the three services, it was decided that the cyber agency would be headed by Rear Admiral Gupta. The Navy is expected to announce his formal appointment anytime, sources said.

DCA is one of the three agencies along with the Special Forces and Space to be set up as per the clearance given by Prime Minister Narendra Modi during the Combined Commanders' Conference in Jodhpur last year.

The DCA will include a lot of existing capability from the armed forces that will help tackle threats in the cyber domain and will also have the elements of DRDO working in it, sources said.

While the cyber agency is ready to be launched with its headquarters in New Delhi, the setting up of the Space agency will take some time as the structure for it is still being discussed.

The Special Forces agency would be headed by a Major General rank officer of the Army and is likely to come up at Agra. Agra already has a Para brigade and the wherewithal to airlift Special Forces operatives in large numbers as the base co-exists with an Indian Air Force (IAF) transport aircraft squadron specialising in these operations.

One of the top Army officers, Eastern Army Commander Lt Gen MM Naravane had recently stated that the units of the Cyber agency will be spread across the country.

"There will be units or cells or dedicated officers at every headquarter to deal with the aspect of cyber security," he had said.

According to defence sources, "Efforts are made by hackers, especially from Pakistan and China to break into the military systems to steal information and create disruption."

The tri-services Integrated Defence Staff is also holding an exercise with NTRO, RAW, National Security Council and DRDO where cyber attacks would be launched on critical military infrastructure and the authorities concerned would thwart them using their tools and skills in the domain.

https://www.ndtv.com/india-news/india-set-to-get-defence-cyber-agency-to-fight-pak-chinese-hackers-2030798

DECCAN HERALD

Wed, 01 May 2019

Centre for excellence in Bangalore Varsity

By Sandesh M S

Bangaluru: The Central University of Karnataka, Gulbarga, has come forward to establish a Centre for Excellence in microwave antennas and optoelectronics at the Bangalore University's (BU) Jnana Bharathi campus.

The centre will be a collabaration of the Defence Research and Development Organisation (DRDO), Indian Space Research Organisation (ISRO) and various departments of the BU.

"Rs 300 crore is proposed to be spent to develop the Centre for Excellence. This is a central government project where we will be granting 25 acres of land on lease to the state's lone Central University. This will help the students of various streams at BU, " confirming the development, BU vice-chancellor Venugopal K R told DH.

Various BU departments such as physics, mathematics, electronics, electronics and communication engineering, electrical and electronics engineering and computer science engineering stand to benefit.

Both students and faculties will have access to better research, practical work and infrastructure. The project will bring down the burden on the university to establish special practical classes and laboratories.

"As this is a joint collabaration of the DRDO and ISRO, students will be industry-ready. Antennas will be useful for communications and optoelectronics will be useful in electrical systems, " Venugopal added.

The proposal for granting land is already approved in the syndicate and is now waiting for government nod. Soon aer getting the green-signal, the project will take o. The Centre for Excellence will cater to more than two thousand students in various departments.

"BU is the lone state varsity which is giving more importance to electronics and communications. We have proposed the centre as more departments stand to benefit, " a senior Central University oicial told DH.

https://www.deccanherald.com/city/bengaluru-infrastructure/centre-for-excellence-in-bangalore-varsity-731551.html

BW EDUCATION

Wed, 01 May 2019

Economy growth of the country depends on the growth of Science and Technology: DRDO Director General

237 Conferred degrees at LBSIM's 23rd Annual Convocation

Lal Bahadur Shastri Institute of Management (LBSIM) held its 23rd annual convocation at Dwarka Campus, New Delhi. Dr Tessy Thomas, Distinguished Scientist & Director General (Aero System), DRDO, well- known as "India's Missile Woman", graced the ceremony as the Chief Guest. The convocation viewed 237 students passing from the three PG Diploma Management streams, in which 169 students were from PGDM (Full-time), 8 students from PGDM (Part-time) and 60 students from PGDM (Finance).

Delivering the convocation address, Dr Tessy Thomas, Director General (Aero System), DRDO said, "The economic growth of the country depends on the growth of Science and Technology. India has provided its power in the field of science and technology by exploring space. She added the true leader is someone who earns respect through his rightful actions and mass following without any dictatorship. A leader must inspire others to follow his footsteps and become the guiding light for humanity".

The convocation witnessed gold medallists for academic excellence in their respective streams. The meritious students were Divyanshi Sharma PGDM (Full-time), Aishwarya Singla PGDM (Finance) and Vimal Kumar Srivastav PGDM (Part-Time). The Lalita Shastri Memorial Award for overall excellence went to Divya Chopra and Amit Chopra Memorial Award for contribution to Social Service and Extracurricular Activities went to Saurabh Maloo. The ceremony also presented awards, scholarships and recognition to students from all the three streams for their contribution and excellence in the academics and co-curricular activities.

Anil Shastri, Chairman, LBSIM said *"*World is transforming, rapidly in every sector but core in science & technology. India has more potential to adopt new things as compared to other countries, but students need to be part of this. He emphasized on the optimum utilization of all energies toward a definite goal and contribute to the development of the nation. He also paid his tribute to the brave soldiers of our countries for their sacrifice*"*.

Dr D.K Srivastav, Director, LBSIM presented the institute's annual report and congratulated students for making the institute as well as their family proud. The campus was a scene of festivities and emotional moments with farewell parties, group photos, selfies and celebrations. The family members of the students exchanged notes of the success of their wards and immensely enjoyed the convocation ceremony.

http://bweducation.businessworld.in/article/Economy-Growth-Of-The-Country-Depends-On-The-Growth-Of-Science-And-Technology-DRDO-Director-General/01-05-2019-169980/