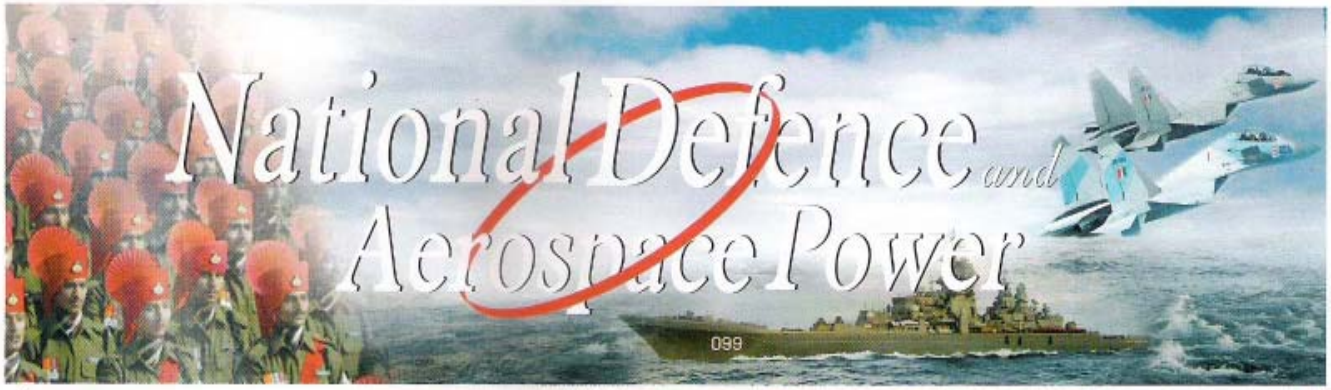

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Longer Reach and Enabling More Options: AGNI V

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India on April 19, 2012 morning successfully tested the 5000 kilometre Agni V missile. With this success, India has entered an elite group of countries capable of producing such long range missile. It was developed by India's Defence Research and Development Organization (DRDO) and modelled off Agni-III, a two-stage missile with a range of 3,500 kilometres that India first tested successfully in April 2007. The two missiles share the same size, shape, and height according to V.G. Sekaran, the Director of the Advanced System Laboratory (ASL) at DRDO.[1] Agni V falls in the category of Inter-mediatory Range Ballistic Missile (IRBM) as its declared range is 5000 km. An ICBM should have a range of 5500 km. However, a Chinese researcher has claimed that Agni V is capable of reaching at least 8000 km. Du Wenlong, a researcher at China's PLA Academy of Military Sciences, told the Global Times that Agni-V "actually has the potential to reach targets 8,000 kilometres away". Du added that "the Indian government had deliberately downplayed the missile's capability in order to avoid causing concern to other countries".[2] The basis of this argument is unknown but DRDO sources have claimed that the missile can be easily upgraded to a much longer range weapon.

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The missile uses a combination of Ring laser gyro Inertial Navigation System (RINS) and a Micro Inertial Navigation System (MINS). For the first time a redundant micro-navigation system was used in Agni-V.[3] This guidance along with its control system gives the missile double digit accuracy. The missile uses carbon composite to reduce its weight thereby increasing its range. Top DRDO scientists said on Friday that Agni-V Long Range Ballistic Missile (LRBM) is designed to carry only a single warhead and added that development of Multiple Independently targeted Re-entry Vehicles (MIRVs) would be a separate project.[4]

The launch is reported to be a depressed trajectory launch where the missile attained an apogee of 600 km.[5] In a depressed trajectory the apogee is achieved at low altitudes, causing warheads to streak towards their targets at relatively flat re-entry angles and relatively high re-entry speeds. Depressed trajectory missile shots can complicate the task faced by missile defence; they also reduce the time of flight needed to strike targets that are well within the range of the missile.[6] But the problem with a depressed trajectory is that the missile enters with a higher re-entry speed which generates more heat. The successful launch of Agni V is an indication to the fact that the missile was able to withstand such high temperature. Moreover the depressed trajectory may lead to reduced accuracy. So if the Agni V is launched in a standard trajectory then the accuracy may further improve.

Since the missile is solid fuelled, will be canisterised before deployment and both road and rail mobile it will have higher mobility and hence has a better chance of survival from enemy counter strikes. Also a canisterised solid fuelled missile has a longer storage life. If the missile is ejected using a gas generator from the canister, then the missile could be launched from any pre-surveyed launch location without the need for any pre-built launch site. However, observation of Agni V launch video suggests that the missile may need a slight angle orientation towards the direction of the target.

Agni V is primarily for enhancing India's nuclear deterrence against China. Till recently, the longest range missile India had was Agni-III with a range of 3000-3500 km. This range was not sufficient to reach targets on the extreme eastern and north-eastern region of China. Most of the important economic centres of China lay on its eastern sea board. With the successful test

of Agni V India is now capable of hitting any part of China. This raises the threat level for China from India. However, India maintains its 'No First Use' policy. The Circular Error Probability (CEP) of this missile is reported to be 80 meters[7]which is more than sufficient for a nuclear strike. For a nuclear role very high accuracy is not required.

It is observed by many that since Agni V has high accuracy it should be armed with small low yield nuclear weapons instead of a high yield weapon to prevent any unwanted damage. But looking at the extensive area of the Chinese missile facilities, a single high yield nuclear weapon might be necessary (for high altitude blast). Looking at the Chinese nuclear missile capability, attention needs to be paid to the Chinese MRBMs and IRBMs and ICBMs deployment areas. In case of a nuclear exchange these missile sites should be the primary target to degrade the enemy's nuclear counter strike capability. Looking at the Delingha missile facility for example, the facility is spread around roughly 300 to 350 square kilometres. To destroy this huge facility including the missile and its supporting equipment an atmospheric blast attack profile is necessary in which the high energy Gamma Rays would fry all the electronics of the missile and the supporting equipment thereby disabling the missiles. For targeting Chinese missiles, continuous real time surveillance is required as the new Chinese missiles are road mobile. India has to increase the number of surveillance satellites in orbit and deploy other surveillance system to provide continuous surveillance. Our second strike should not only include soft targets, but should also focus on degrading their nuclear strike capability by destroying their launch vehicles. So sufficient number of this long range missile should be deployed to achieve this objective. This would further enhance our nuclear deterrence.

Right now, Indian nuclear deterrence is based on land based missiles and aircrafts. The third leg of the Indian nuclear deterrence, which is the sea based deterrence, is still in the process of testing and development. Moreover, India's only Submarine Launched Ballistic Missile (SLBM), Sagarika is a 700 km range missile.

Indian nuclear deterrence has not yet come full circle. Right now, Indian nuclear deterrence is based on land based missiles and aircrafts. The third leg of the Indian nuclear deterrence, which is the sea based deterrence, is still in the process of testing and development. Moreover, India's only Submarine Launched Ballistic Missile (SLBM), Sagarika is a 700 km range missile. Even this missile is not yet tested from a submarine. The indigenous Arihant SSBN may be armed with the nuclear capable Sagarika. But only when the missile is tested successfully for a considerable number time from an actual submarine will the reliability of this missile be proved. The effectiveness of the sea based deterrence will be much better if the range of the SLBM is increased. Because, the longer the range of the SLBM, the longer the distance the submarine can operate away from enemy territory to fire the missile, thereby reducing its vulnerability. The Chinese Jin class submarine can fire the JL-2 missile which has a range 8000 km. This missile can be launched from the South China Sea or even from the Yellow Sea and still could hit any part of India. With the success of Agni V, India has demonstrated the capability to design a longer range SLBM as Agni V is a canister launched missile and the same principle is used to eject a missile from a canister and a submarine launch tube. The difference would be that a more powerful gas generator needs to be used and the missile has to be modified a little to account for hydrodynamics, as the missile would have to travel through water before it surfaces. With further efforts Agni V can be converted into a SLBM thereby enhancing our sea based deterrence. The SLBM version of Agni V can be launched in a depressed trajectory to attain Short Time of Flight (STOF) and also to defeat enemy BMD systems. But the bigger problem is designing or modifying a submarine to launch this missile.

Nuclear deterrence is the primary objective and once the missile achieves that objective the missile should be improved to be used for conventional operations. Because once deterrence is strong the chances for a nuclear exchange is considerably less even during a limited armed conflict. So the hard developed technological capability should be best utilised. Moreover, a long range missile is the best weapon for stand-off strikes. A conventional missile becomes more effective with the increase in its accuracy. The lesser the Circular Error Probability, the more effective a conventional missile will be. So the CEP of Agni V should be reduced to the extent of say some 30 to 40 meters to make it highly effective. Agni V has a payload capacity of more than one ton. With such a large payload capacity more conventional explosives could be packed in the missile. Choices may vary from High Explosives (HE) to sub-munitions to fragment warheads to strike strategic military and economic targets at longer ranges. Also, the capability for conventional ballistic missile strikes against high value political targets might act as deterrence.

After the successful test DRDO chief V.K. Saraswat said "Agni V's launch has opened a new era. Apart from adding a new dimension to our strategic defence, it has ushered in fantastic opportunities in, say, building ASAT weapons

and launching mini/micro satellites on demand". He also said , "An ASAT weapon would require reaching about 800km altitude... Agni V gives you the boosting capability and the 'kill vehicle', with advanced seekers, will be able to home into the target satellite".[8] India maintains that it is against any weaponisation of space. But in view of the demonstrated ASAT capability of China, this policy needs a rethink. Chinese military modernisation is aimed at preparing itself to fight a modern war under hi-tech condition. Chinese military is working towards establishing a C4ISR system to fight future wars. Satellites are an important part of any C4ISR system. Presently, China is moving towards reducing the revisit time of its satellites by increasing the number of Earth Observation satellites in orbit. In future, the Chinese military will be entirely dependent on its C4ISR architecture. Denying the usage of this system will hamper Chinese military operations severely. So, it is imperative for India to develop ASAT capability. Apart from kinetic energy kill vehicles, research should also be directed to develop Directed Energy Weapons to take out enemy satellites. The said capability to launch micro and mini satellites on demand would enable India to quickly put satellites in orbit in case its main satellites are destroyed. However, China is also pursuing efforts towards launch on demand capability by development of a smaller solid fuel road mobile rocket series, called the Pioneer (Kaituozhe/KT), the KT-1 is a four-stage booster based on the military DF-21(used to launch the ASAT) and is designed to launch satellites weighing less than 100 kgs into 300 km polar orbit while the KT-2 is based on the DF-31 ICBM capable of lifting upto three 100 kg or one 400 kg payload. After an unsuccessful first test in September 2002, KT-1 was successfully launched in September 2003. In addition, efforts are on since 2000 to develop an air launched variant of the KT-1. To be carried by a modified H-6 bomber the KT-1 would be released at an altitude of 3 km to place a 50 kg payload into LEO.[9] So India has to speed up work in this area as India is lagging far behind China in this Capability.

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However, it has to be noted that, as Chinese Global Times mentioned, the Chinese nuclear capability are much stronger and reliable than India's. The Chinese have deployed long range missiles that are capable of hitting any part of India. The U.S security organisations maintain that the Chinese nuclear capable missiles are not yet MIRV'ed and that it is all a single warhead missile. China has the technical capability to develop multiple reentry vehicles (MRVs) and multiple independently targetable reentry vehicles (MIRVs) but has chosen not to deploy such systems on its missiles. In March 2006, NASIC listed all Chinese long-range ballistic missiles with a single warhead, and the 2008 Pentagon report says only that China continues to research MIRVs.[10] DRDO scientists are working to MIRV Agni V. According to DRDO sources, an MIRV payload would be significantly heavier, since it would consist of several nuclear warheads, each of them weighting about 400 kilogrammes. A 5-warhead MIRV, therefore, would weigh two tonnes. The next missile will have a composite first stage as well, making it lighter and, therefore, able to carry a heavier payload than the 1.5 tonne payload of the current Agni 5.[11]

Agni V once deployed will be a reliable system as it has features that make it difficult to be intercepted by Ballistic Missile Defence (BMD) systems. Since Agni V launch has demonstrated the capability to be launched on a depressed trajectory, which reduces its flight time, it shortens the reaction time of the enemy systems to intercept the missile. Also the excess energy of the missile in a depressed or a minimum energy trajectory could be used to manoeuvre the missile during its flight to confuse enemy BMD systems. When Agni V is MIRVed it would further complicate the task of the BMD systems.

It will take some years to deploy a sufficient number of this missile for the enhanced deterrence to take effect. Work should be speeded up to deploy more number of this nuclear capable missile. Also, efforts should be directed to deploy enough number of conventionally armed Agni V missiles to increase deterrence at the conventional level. Chinese Central Television (CCTV) has questioned India's infrastructure capabilities and pointed out some drawbacks. The missile weighs 50 tonnes. Due to India's poor infrastructure, the country's bridges and roads cannot bear the weight of the missile. So far, it can only be launched from a fixed position. Even though it was successful, it will

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take a long time to build an operational missile force.[12] These are valid arguments. A missile system can be mobile. But if its mobility is restricted due to poor infrastructure then the missile loses its advantage of reduced vulnerability. So the Indian defence establishment has to gap the hole in these areas as soon as possible to improve deterrence. It is understandable that the first test was postponed from Wednesday evening to Thursday morning due to bad weather. But DRDO has to ensure that the missile is an all weather weapon. Moreover, more tests are required to prove the reliability of the missile. DRDO should not be complacent with the first success. DRDO has to expedite the development work on the MIRV and the equivalent SLBM variant of the Agni V.

Notes

[1] Zachary Keck,"India Fires Agni-V Missile,"*The Diplomat*,April 19, 2012.

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[7] "Indian Eyes Agni VI toDouble Range",*The Asian Age*, April 20, 2012.

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