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FIRST SUCCESSFUL INTERCEPT OF AN ICBM CLASS TARGET: A BRIEF ASSESSMENT OF GMD

Arjun Subramanian P

The United States Missile Defence Agency (MDA) had conducted the first ever successful live-intercept of an ICBM class target with its Ground-based Midcourse Defence (GMD) system.¹ The target was launched from Kwajalein Atoll while the interceptor was fired from Vandenberg Air Force Base in California.² The GMD system was specifically designed to intercept incoming ICBM targets. But, until now the system was only being tested against lower range targets of the class of IRBMs and MRBMs. The GMD is the primary homeland missile defence system as the US faces a possible threat of nuclear attack primarily from intercontinental range ballistic missiles.³

Among all the missile defence systems with the United States, including terminal and midcourse theatre missile systems, the GMD is the least performing in terms of test results. Out of 17 tests as of April 2017 only 8 were claimed to be successful which gives a success rate of 0.49. Moreover, out of the 17 tests seven were tested

in operational configuration of which only 3 were successful.⁴ These 17 do not include the tests where there was a target malfunction. Some of these tests were scripted where the target missile itself transmitted its position to increase the probability of interception.⁵ There were also several cases of the interceptor and the kill vehicle malfunctioning before and after launch.⁶

But despite this unimpressive test record, US officials have always expressed confidence in the capability of the system to defend the US homeland against incoming ICBMs.⁷ The MDA also does not give out details on the target being used in the tests. The GMD was actually designed and built to neutralise the Soviet nuclear ICBM threat. However, going by the test results, since the entire GMD setup appears to be ineffective against the Russian and Chinese nuclear ICBMs, the missile defence lobbyists are now downsizing the ICBM threat perception by projecting the

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GMD as a defence against a future nuclear ICBM threat from Iran and North Korea.

The recent test involving the first ever ICBM class target is seen as a point to prove the effectiveness against any limited ICBM target possibly from North Korea. This test could probably be more to prove the relevance and utility of the GMD to the congress and the government rather than to signal capability to the North Koreans. The test comes after North Korea tested a ballistic missile on May 14, 2017 that reached an altitude of about 2000 km.⁸ Normally, a 10,000 km range ICBM launch in a minimum energy trajectory would have an apogee of approximately 2000 km. But the North Korean missile is reported to have splashed down in the ocean 800km⁹ from the launch point, suggesting that the actual range is far below 10,000km. The trajectory had been highly lofted and was not an ICBM's trajectory. However, this could be the longest range missile North Korea had ever tested. What is to be noted here is the effective heat shield of the missile re-entry vehicle (RV) that was able to withstand the re-entry heat.

North Korea is clearly improving its long range ballistic missile capability that is getting more mobile on the ground as well. For instance, DPRK recently converted from liquid to solid fuel for the development of their SLBM and similar land based version. They have also managed to work out the technique of cold launching missiles from

TEL based canisters. So the DPRK might in the future manage to build an ICBM capable of targeting the US mainland.

However, the question is, will the GMD be able to defend against such a threat? What does the recent test prove? As mentioned above, there were no details on the target used for the test except for the information that it was an ICBM class target. It is not known if the target included counter-measures and decoys and there was also no mention if the test was in operational configuration, because if it was, the agency would have probably highlighted it to boost the credibility of the system among the American public and the congress. Further, as was the practice in some of the earlier tests, it is not known if the test was scripted by way of the target transmitting its position to the defence system making it easier for the kill vehicle to identify it and engage. It has become a trend the world over that the missile defence tests are seldom conducted in a realistic scenario.

A typical North Korean ICBM attack in the future, if it were to happen, could most likely have the following characteristics. The recent North Korean missile test with a 2000 km apogee is an indicator that the re-entry problem has been solved. A rudimentary DPRK ICBM with range sufficient to reach US mainland might not have very high accuracy as high precision engineering might not have been used while building it. For DPRK, the objective would be to just deliver a

nuclear warhead anywhere on the US mainland. A few kilometres miss wouldn't matter much. Moreover, any such attack would come in salvos to meet the objective.

More importantly, the challenge for DPRK would be to defeat the defences in the mid-course phase where the GMD interceptor would attempt to intercept it, beyond which there is no effective defence that could take on an ICBM warhead. Hence, the ICBM would certainly use countermeasures at least in the form of decoys to defeat and overwhelm the defence systems. The countermeasures are relatively easy to build and deploy, even for a state like North Korea and would be very effective in the mid-course phase. In such a case, the recent GMD test appears to fall short of the challenge as only a single interceptor was launched. In a real scenario, multiple interceptors would be launched to increase the probability of kill, and this would be for a unitary warhead with no decoys. The employment of decoys would necessitate even more interceptors per ICBM.

In such a scenario, there are some serious problems for the GMD. Firstly, positively identifying the actual warhead from the decoys is a difficult task. The one area where the US has shown immense advancement in missile defence technology is in the field of radar sensors. Extremely powerful radars in the S, L and X-bands have been deployed and networked to detect, track and identify actual targets.

Particularly, the latest sea based X-band radar (SBX), with the ability to track and discriminate targets at an altitude of 4000km, is a key sensor that would aid the interceptor in the crucial mid-course phase.

In the midcourse phase, decoys such as inflatable Mylar balloons with IR signatures matched with the target, would complicate the job of the optical sensor of the kill vehicle in identifying the real target. However, the long range ground based x-band radar would employ techniques like micro-Doppler and other methods to physically analyse and identify the target from the rest of the objects in its field of view. But concealing the actual warhead itself in an IR masked Mylar balloon would neutralise this advantage too. Nevertheless, there were instances during tests where the SBX itself failed to identify the target. In a test carried out on 31 January 2010, the chuffing of solid fuel material from the target booster created a more complex scene than was anticipated along with simple countermeasures which resulted in the shutting down of the SBX radar. Here there was a malfunction of EKV too resulting in a failed intercept.¹⁰

A second problem for the GMD would arise when accurate discrimination of the actual target from the decoys fails. The system ought to fire interceptors at each target. Given the low SSKP,¹¹ at least three-four have to be fired at each incoming object. It is well known that the number of interceptors deployed is limited to a

total of 36 which are deployed in Fort Greely, Alaska and Vandenberg Air Force Base, California. Assuming a limited attack consisting of four ICBMs, each with 2 inflatable Mylar decoys and a warhead, the total number of interceptors required to neutralise 12 targets would be 48 interceptors which far exceeds the available number. In a real scenario, the number of decoys could be greater. Moreover, past tests have shown that there is a clear record of the interceptors or its ground launch systems malfunctioning frequently (the ground launch release mechanism, data bus, the EKV's optical homing cooling system, etc.) resulting in a failed intercept. Keeping this in mind, it would mean more number of interceptors per target.

A successful intercept with a single interceptor of an ICBM target would certainly give rise to doubts and questions considering the past test success rate against targets of lower range and velocity. There could probably be much more about the recent test the MDA is withholding. Until there is specific information on the interception and the target characteristics no proper assessment of the test could be drawn. The MDA itself has stated that the test was reported a success based only on initial indications and that 'program officials will continue to evaluate system performance based upon telemetry and other data obtained during the test'.¹² To prove the credibility of the system, MDA should conduct more of such tests and give out more specifics on the performance. Overall,

the GMD is a system that is far from perfect and has to go a long way to be even efficient to successfully neutralise a limited ICBM attack from countries like North Korea in the future.

(Disclaimer: The views and opinions expressed in this article are those of the author and do not necessarily reflect the position of the Centre for Air Power Studies [CAPS])

Notes

¹ "Homeland missile defence system successfully intercepts ICBM target", <https://www.mda.mil/news/17news0003.html> , 30 May 2017

² "US homeland missile defence testing to get increasingly realistic", http://www.janes.com/article/71078/us-homeland-missile-defence-testing-to-get-increasingly-realistic?utm_campaign=CL_Jane%27s%20360-02-June-2017_PC5308_e-production_E-1166_KP_0602_0702&utm_medium=email&utm_source=El oqua , 02 June 2017

³ Though there are unconventional methods that could be employed like firing nuclear armed cruise missiles from trawlers and commercial shipping containers in merchant ships plying the Atlantic and Pacific, it is not discussed here as this is beyond the scope of this article and also defence against cruise missile is an altogether a different domain.

⁴ "Shielded from Oversight: The Disastrous US Approach to Strategic Missile Defence", Union of Concerned Scientists, July 2016, p.14
<http://www.ucsusa.org/sites/default/files/attach/2016/07/Shielded-from-Oversight-appendix-7.pdf>

⁵ "Technical Realities: An Analysis of the 2004 Deployment of a U.S. National Missile Defence System", Union of Concerned Scientists, May 2004, p.12
http://www.ucsusa.org/sites/default/files/legacy/assets/documents/nwgs/technicalrealities_fullreport.pdf , page 12

⁶ No.3

⁷ "Updated List of Claims of about GMD Effectiveness", <https://mostlymissiledefense.com/2017/05/12/updated-list-of-claims-about-gmd-effectiveness-may-12-2017/>, updated 12 May 2017

⁸ “North Korea fires ballistic missiles that reaches 2000km altitude”, <http://www.janes.com/article/70394/north-korea-fires-ballistic-missile-that-reaches-2-000-km-altitude> , 16 May 2017

⁹ Ibid

¹⁰ “Shielded from Oversight: The Disastrous US Approach to Strategic Missile Defence”, Union of Concerned Scientists, July 2016, p.6
<http://www.ucsusa.org/sites/default/files/attach/2016/07/Shielded-from-Oversight-appendix-7.pdf>

¹¹ Assumption based on the GMD test results

¹² No.1

