Hit to kill: the US strategic missile defence system moves on from ICBM target intercept

Daniel Wasserbly reports

"About 10 minutes." That is how long it takes between an intercontinental ballistic missile (ICBM) being launched towards the United States and when an interceptor is launched to destroy it, according to Vice Admiral Jim Syring, director of the US Missile Defense Agency (MDA).

The Ground-based Midcourse Defense (GMD) system designed to protect the US homeland, despite being declared operational in 2004, had never been tested against an ICBM-class target, but on 30 May it scored its first hit against a missile designed to simulate the speed and range of an ICBM fired from North Korea.
The ICBM target was launched from the Reagan Test Site on Kwajalein Atoll in the Marshall Islands and "multiple sensors provided target acquisition and tracking data" for a ground-based interceptor that was then launched from Vandenberg Air Force Base (AFB) in California. The interceptor's exo-atmospheric kill vehicle "intercepted and destroyed the target in a direct collision", the MDA said in a statement.

"It actually replicated, without going into classified details, an operational scenario that we are concerned about," Vice Adm Syring told reporters at the Pentagon the next day. He added that the target included decoys as countermeasures, which are meant to fool the incoming kill vehicle.

He declined to elaborate further about the target, but said it "flew at a higher altitude and a longer range and a higher velocity than any other target we have flown to date".

A source confirmed to Jane's that it was a three-stage ICBM-class target supplied by Orbital ATK. In a statement Orbital ATK said the target "was provided under the [existing] Intermediate Range Ballistic Missile contract, which continues at least until 2019 with options for additional target vehicles and launches". The type of decoy or countermeasure that was used is classified.

Soon after the target was launched a US Air Force Space-Based Infrared System (SBIRS) satellite provided a warning. It cued other sensors including an AN/TPY-2 phased-array radar and the massive Sea-Based X-band radar that displaces more than 50,000 tons atop a re-purposed oil rig in the Pacific.

The SBIRS satellite also sounded a 'quick alert' warning soldiers at the 100th Missile Defense Brigade. The loud alarm sent National Guardsmen to their work consoles at the brigade's headquarters at Schriever AFB in Colorado. Based on the sensor data, the system calculated a threat to the United States and the missile defence crew began preparing the GMD Fire Control (GFC) system to find an intercept solution.

The operators were one of five crews that staff GMD at the brigade element at Schriever; another five crews staff a battalion element Fire Direction Centre, which for live operations would be at Fort Greely in Alaska but for tests is at Vandenberg AFB.
The teams sit in a horseshoe with the director, a lieutenant colonel, at the front. To the right, the deputy director and a future operations officer are responsible for wargaming; tactics, techniques, and procedures; and engagement recommendations. To the left, a readiness officer and a current operations officer are responsible for managing sensors that support GMD. All are either officers or non-commissioned officers.

An enormous amount of sensor data streams in. For this test it included an AN/TPY-2 radar on Wake Island, the Sea-Based X-band radar, the space-based SBIRS, and others. For a real North Korean attack it would likely include SBIRS but also forward-based AN/TPY-2 radar stations in Japan and Guam, as well as US Navy Aegis destroyers in the Pacific first seeing the target. It would then be passed over to 'primary eyes' such as the Sea-Based X-band radar and the Cobra Dane: a 95 ft (29 m)-diameter phased-array radar at Eareckson Air Station on Shemya, Alaska, at the western end of the Aleutian Island chain. Other inputs would come from radars at Clear Air Force Station in Alaska or Beale AFB in California.

The GFC uses all this data to determine exactly where to send the GMD's Ground-Based Interceptors (GBIs).

"What we as operators have at our disposal is a feature of the software, referred to as MBE, or management by exception, and it is a manual key stroke by the future operations officer that directs the GFC to allocate a certain amount of GBIs against an inbound threat," Lieutenant Colonel Richard Michalski, director of the brigade's C-crew, told Jane’s.

Once the system is available to shoot, its engagement planner, "which is essentially the brains of our system, decides on the best shot", Lt Col Michalski said.

Crews man the GMD at all times and spend a considerable amount of their shifts undertaking training tasks. "We conduct roughly four to six hours of combat simulation scenarios daily," Lt Col Michalski said. These drills range from 'nominal runs' if there is a crew member in training to more complex scenarios such as medical or fire emergencies.

Before joining the 100th Missile Defense Brigade, soldiers learn doctrine and operating techniques at a US Army Space and Missile Defense Command/Army Forces Strategic Command (SMDC/ARSTRAT) training facility, Lieutenant General James Dickinson, head of SMDC/ARSTRAT, told Jane’s.

At the brigade they then go through another training regime. "At the end of that, before they're ever allowed to pull a live shift for the nation, I have a team at my level that will actually evaluate and certify them to make sure they can function as a team … in some very complex scenarios," Lt Gen Dickinson said.

He noted that most operators are full-time National Guardsmen. They may move between crews but generally remain in this career and are "experts in their field of missile defence".

Once the interceptor is launched into space, however, the crew must hope the technology functions as designed. An exo-atmospheric kill vehicle (EKV) separates from the booster after it identifies the 'threat cloud', which includes the incoming warhead but also the decoys and debris.
that fly alongside it. Among those objects, the EKV's sensors must determine which one is the warhead. The vehicle's four divert thrusters then make small course corrections to ensure it collides directly with the warhead, destroying it on impact.

On 30 May the MDA conducted the first-ever intercept of an ICBM-like target, seen here before launch from Kwajalein Atoll in the Marshall Islands. (MDA)

The success of the test on 30 May is a significant boon to the programme because it had struggled to achieve easier intercepts against slower targets - previously making 9 intercepts in 17 attempts.

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Upgrades

For the GMD system the kill vehicle has lately proven to be troublesome. Two separate programmes are now underway to upgrade or replace it with a newer weapon.

A test of the system's second-generation Capability Enhancement II (CE-II) interceptor was first attempted in January 2010 but failed due to 'quality control issues'. The next try, in December 2010, failed because of excessive vibration for the kill vehicle's inertial measurement unit, leading CE-II production to be stopped. In July 2013 an earlier-generation CE-I interceptor failed to hit its target because a problem with the EKV's battery caused it to not separate from the boost vehicle.

Vice Adm Syring told the US Congress in a testimony on 7 June that the system is now beginning to overcome some of the challenges associated with its rapid fielding "without a proper system engineering cycle or production engineering cycle". It was fielded while still being tested because
of a perceived urgent need for defences at the time. He said the GMD system is currently "addressing the threat that we know today", but that North Korea’s missile advancements "in the last six months have caused great concern to me and others".

Vice Adm Syring added, "I have reliability concerns with the system that have been systematically addressed in a large part over the last, I'll say, six years, bit by bit. It's not just the interceptor; it's the entire system. We are not there yet."

The Sea-Based X-band radar, the world's largest phased-array X-band radar, is carried aboard an oceangoing semi-submersible oil platform. (US Navy)

For upcoming homeland defence tests the MDA plans to continue making scenarios increasingly realistic and continue to test its newer design fixes.

Around August or September 2018, for example, the agency is planning a 'salvo' intercept that would test the GMD system as it would be used during a real operation: firing multiple interceptors at one incoming target to bolster its chances of success.

"We want to exercise the GMD system with more than one interceptor to gather data for what a first interceptor would do in terms of kill and what the second interceptor would see," Vice Adm Syring said. That test is slated to also address an ICBM-class target.

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The threat

Pyongyang’s intentions have long been clear - it wants to credibly threaten the United States with nuclear strikes - but it is not yet clear whether North Korea has mastered all the necessary technology. Its goals could be met with the KN-08 (Hwasong 13) or the KN-14 modification (Hwasong 14) missiles, but these have not been flight tested and are likely to still be several years away from representing a credible long-range threat.
Soldiers from the 100th Missile Defense Brigade’s C-crew train on the Ground-based Midcourse Defense system to shoot down incoming missile attacks (screens are blacked for security reasons). (USASMDC/ARSTRAT)

Still, North Korea may indeed be close to an ICBM test because it has been developing in earnest the needed heat-shields, missile guidance systems, and rocket engines, including a large liquid-fuel engine. It has conducted five nuclear tests - two in 2016 - and claims the ability to reduce the size and weight of a nuclear device to fit within an ICBM re-entry vehicle, although such 'miniaturisation' has not been verified.

Mattis noted that "the threat is growing" and has called North Korea the United States' biggest threat.

"What we have in Fort Greely now and in California, I believe, is sufficient to buy us time so that when we come to you with a [budgeting] programme, I can defend it and I won't come back and say we had it misjudged or targeted in the wrong direction," he told lawmakers, some of whom were displeased that the MDA's budget request did not increase this year.

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