US enhancing Ground-Based Midcourse Missile Defense as North Korea succeeds in developing an ICBM capable to deliver a nuclear weapon anywhere in the United States

Kim has finally succeeded in developing an ICBM operational capability through which it can deliver a nuclear weapon anywhere in the United States, according to analysis based on Images released by North Korea. North Korea released dozens of photos and a video after 29 Nov launch of the new Hwasong-15 missile, and leader Kim Jong Un declared the country had "finally realized the great historic cause of completing the state nuclear force". North Korea said the missile soared to an altitude of about 4,475 km (2,780 miles), more than 10 times the height of the International Space Station, and flew 950 km (590 miles) during its 53-minute flight before landing in the sea near Japan.

In an analysis for the Washington-based 38 North think tank, missile expert Michael Elleman of the International Institute for Strategic Studies said the North Korean photos showed a missile considerably larger than its predecessor. "Initial calculations indicate the new missile could deliver a moderately sized nuclear weapon to any city on the US mainland," Elleman said. Elleman said the missile was large and powerful enough to carry simple decoys or other countermeasures to challenge US missile defences.

But it was unclear if Pyongyang had the technology to miniaturise a nuclear warhead, however Jeffrey Lewis of the Middlebury Institute of Strategic Studies said on Twitter the Hwasong-15 was “so big that the warhead wouldn’t need to be miniaturised.” Experts and US officials also question whether it has a re-entry vehicle capable of protecting a nuclear warhead as it speeds toward its target and about the accuracy of its guidance systems. “A handful of additional flight tests are needed to validate the Hwasong-15’s performance and reliability, and likely establish the efficacy of a protection system needed to ensure the warhead survives the rigors of atmospheric re-entry,” Elleman wrote. Only two or three more tests might be needed if North Korea could accept low confidence in the missile’s reliability.

The Ground-Based Midcourse Defense (GMD) is an element of the US Ballistic Missile Defense System that provides combatant commanders the capability to engage and destroy limited intermediate- and intercontinental-ballistic missile threats in space to protect the United States. US considers GMD as essential to protect itself from nuclear missile attacks from rogue states such as North Korea and Iran. US experts and officials said the Korean missile still appeared to be powered by liquid fuel, something that made it vulnerable as it could take to up to two hours to fuel on-site before launching.

The task facing all ICBM interceptor systems is shooting down a projectile travelling at a staggering 6,000 m/s – roughly 13,500 mph – before it hits its target, it’s like hitting a bullet with a bullet . The world’s only conventional ballistic missile defence system specifically designed to intercept ICBMs, GMD passed an important milestone at the end of May

with its first ever successful intercept of an ICBM-class target.

The United States has steadily strengthened its missile defense system against North Korean missiles, deploying 30 ground-based missile interceptors (GBIs) in Alaska and California. Twenty of the interceptors carry an early version of the “kill vehicle” while the other 10 carry the new version that was tested. It plans to deploy an additional 14 GBIs by 2017.

The other ballistic missile defence (BMD) systems like the Terminal High Altitude Area Defense (THAAD) anti-ballistic missile system to South Korea, the Patriot, including the latest PAC-3, and the ship-borne Aegis is deployed aboard US and Japanese warships have been designed to provide theatre ballistic missile defence, to deal with the threat of short to intermediate-range weapons,

Lieutenant General David L. Mann, commander of U.S. Army Space and Missile Defense Command/Army Strategic Forces Command and Joint Functional Component Command for Integrated Missile Defense, recently told the Senate Armed Services Committee “the GMD system remains our Nation’s only defense against an ICBM attack.” He went on to state, “As the Secretary of Defense and various Combatant Commanders have previously testified, the Warfighter remains confident in our ability to protect the Nation against a limited intercontinental ballistic missile attack, even in the face of the changing fiscal environment

Ground-Based Midcourse Defense (GMD)

U.S. Ground-Based Midcourse Defense (GMD) is designed to defend against intercontinental ballistic missiles (ICBMs). GMD employs integrated communications networks, fire control systems, globally deployed sensors, and Ground-based Interceptors (GBIs) that are capable of detecting, tracking and destroying ballistic missile threats. The GMD communications network uses satellite communications and fiber optic cabling as means to provide secure voice and data for GMD components.

The GMD interceptor employs an exo-atmospheric kill vehicle (EKV), which would collide with and destroy incoming warheads in space during the midcourse portion of their flight. The Exo-atmospheric Kill Vehicle (EKV) is a sensor/propulsion package that uses the kinetic energy from a direct hit to destroy the incoming target vehicle. This hit-to-kill technology has been proven in a number of successful intercept flight tests, including nine using GBIs.

In 2014, system intercepted a simulated incoming missile over the Pacific Ocean for the first time. The IRBM target was launched from the Reagan Test Site, then detected and tracked by the US Navy destroyer USS Hopper [DDG 70, with AEGIS BMD 4.0.2] and the Sea-Based X-Band radar, which provided data to GMD fire control using the MDA’s C2BMC back-end system. The intercept was achieved by an EKV CE-II model.

Ground Support & Fire Control Systems consist of redundant fire control nodes, interceptor launch facilities, and a communications network. GMD Fire Control (GFC) receives data from satellites and ground based radar sources. The GFC uses

the data received to support and task and the GBIs to intercept inbound targets. The GFC data provides situational awareness to the Command & Control, Battle Management & Communications (C2BMC) element

The GMD system consists of state of the art ground detection and tracking technology, a three-stage solid rocket booster capable of flying at near-hypersonic speeds to exit the atmosphere and an exo-atmospheric kill vehicle (EKV). Once released from the interceptor missile, the EKV's on-board computer steers the vehicle using tracking data from multi-colour sensors and its own rocket motor onto an intercept trajectory, enabling the kinetic force of the collision to destroy the threat without the need for a conventional warhead.

The recent test is undoubtedly a major fillip for ballistic missile defence but, as James Dwyer, Politics and International Relations Teaching Fellow at the University of Tasmania points out, despite their enormous lead in the technology, the US still struggles to achieve consistent success. "GMD has only been tested once against an ICBM – and it did succeed – but has failed quite a few times against slower, shorter range ballistic missiles," he says.

In September 2004, U.S. Army Space and Missile Defense Command/Army Forces Strategic Command declared the 100th Missile Defense Brigade (Ground-based Midcourse Defense) operational. These Soldiers are tasked with the mission of defending the homeland from ballistic missile attacks. Since 2004, the GMD system has increased its capability with additional sensor systems that increase the fidelity and coverage of systems such as the Army operated early warning

radars; transportable X-band radars (AN-TPY2). From an original fleet of five ground-based interceptors at Fort Greely, the system has grown to 30 interceptors located at Fort Greely and Vandenberg Air Force Base, California.

Alaska's Long Range Discrimination Radar on Track for 2020

The Long Range Discrimination Radar that will be operational in Alaska in 2020 is on track despite the aggressive schedule, a Lockheed Martin official said at the Space and Missile Defense Symposium. The Missile Defense Agency (MDA) had awarded a $784 million contract to– Lockheed Martin to build new long-range discrimination radar (LRDR) a vital component to intercepting possible intercontinental ballistic missiles from North Korea and Iran. The radar is expected to become operational in the ground in Clear, Alaska, by the end of 2020.

It will also be networked to the company's Command, Control Battle Management and Communication (C2BMC) system, Brad Hicks, Lockheed Martin's vice president for Mission Systems and Training, said.

The LRDR is a Gallium Nitride (GaN)-based, solid-state Active Electronically Scanned Array (AESA) radar that will provide 24-hour coverage. The sensor will increase the effectiveness of the Ground-based Midcourse Defense System by adding the capability to discriminate debris and decoys in order to identify lethal objects "to improve the probably of kill, or engagement success," said Brad Hicks, a vice president of business development at Lockheed Martin.

According to Missile Defense Advocacy Alliance, Alaska's unique geostrategic location makes it the "only state from where one can defend all 50 states from a long range ballistic missile attack coming from the Northern Hemisphere, both east and west, from Hawaii to Florida." Two of the main land-based sensors for tracking the North Korean missile threat are located in Alaska.

There's a flaw in the homeland missile defense system

The GMD program, however, has been plagued by questions. The 2015 DOT&E Report concluded that GMD has demonstrated the capability to defend against limited threats. The Pentagon is pushing ahead with an expansion of the nation's homeland missile defense system, despite a newly recognized deficiency that affects nearly all the system's rocket interceptors, a Los Angeles Times investigation has found.

The problem threatens the performance of small thrusters attached to the interceptors. In the event of a nuclear attack, the thrusters would be relied on to steer interceptors into the paths of enemy warheads, destroying them. If a thruster malfunctioned, an interceptor could fly off-course and miss its target, with potentially disastrous consequences. The interceptors are the spine of the Ground-based Midcourse Defense system, or GMD, the nation's primary protection against a missile strike by North Korea or Iran.

The problem affecting the thrusters came to light as a result of the system's most recent flight test, on Jan. 28, 2016, when an interceptor was launched from Vandenberg Air Force Base in California. The test was designed to show whether a redesign of the thrusters had solved persistent problems with the component. It did not go as planned. One of the interceptor's four thrusters shut down during the test, causing the interceptor to veer far from its intended course.

$40 billion missile defense system proves unreliable

The LA Times wrote a feature about the GMD system in 2014, whose $40 billion price tag and 8/16 success record (including just 3/8 successes since becoming operational in 2004) don't inspire favorable treatment. That record suggests that the USA would need to volley about 4 missiles at each incoming missile, in order to have a high probability of success.

"The flight test failures that have occurred during the past three years raise questions regarding the robustness of the EKV's design…. Consider whether to re-design the EKV using a rigorous systems engineering process".

The MDA has decided on a full redesign of the missile's kill vehicle, which will involve an initial $99.5 million in FY 2015; overall interceptor improvements are budgeted to cost around $700 million from FY 2015 – 2019.

“The redesigned EKV will be built with a modular, open architecture and designed with common interfaces and standards, making upgrades easier and broadening our vendor and supplier base. The redesigned EKV will increase performance to address the evolving threat; improve reliability, availability, maintainability, testability and producibility; and increase in-flight communications to improve usage of off-board sensors information and situational awareness to combatant commanders for enabling new tactics such as shoot-assess-shoot.”

The limits of U.S. missile defense

The GMD program, however, has been plagued by questions. The interceptor has passed just nine of seventeen tests since 1999. The most recent test, in June 2014, was the system’s first success since 2008.

“Furthermore, the GMD interceptor tests have been highly scripted, with target trajectory known in advance. The interceptor has not yet been tested against a target with the velocity of an ICBM warhead (that test that it passed successfully end of May 2017), nor has it had to face sophisticated decoys and other countermeasures, which would complicate intercept of a real enemy warhead,” writes Steven Pifer in “The limits of U.S. missile defense”.

He further writes, “Defending the United States against a major Russian or Chinese ballistic missile attack is currently not feasible. A reliable and affordable defense that could protect America against a Russian ICBM and SLBM force that could launch some 1,500 ballistic missile warheads simply does not exist. While the Chinese force is much smaller, numbering

several dozen ICBMs, it probably includes countermeasures that would seriously complicate disruption by missile defense systems".

"For the foreseeable future, offense wins the offense-defense relationship. Offensive ballistic missile technology is far more mature than that of missile defense, and cost considerations favor the offense. Adding fourteen more GMD interceptors by 2017 will require the Pentagon to spend about $1 billion. The Russians and Chinese can each add fourteen more warheads to their strategic offensive forces at considerably less cost. One reason that the Russians are building a replacement for their heavy SS-18 ICBM is to have a missile that can carry ten-fifteen warheads as a means of overwhelming a future American missile defense," writes Steven Pifer

GMD: The System

GMD depends on tracking that begins in the boost phase, in order to allow true mid-course interception attempts in space, before descent or terminal phase options like THAAD and then Patriot would be tried.

In order to accomplish that task, GMD missiles must use data feeds from an assortment of long-range sensors, including satellites like SBIRS and DSP, some SPSS/BMEWS huge early-warning radars, and even the naval SBX radar.

- The COBRA DANE Upgrade Radar at Eareckson Air Station (Shemya Island), AK.
- Upgraded BMEWS Early Warning Radars at Beale AFB, CA; RAF Fylingdales, United Kingdom; and Thule AB, Greenland
- Ground-based Interceptor (GBI) missiles at Fort Greely, AK,

plus 4 silos at Vandenberg AFB, California.
• GMD ground system including GMD Fire Control (GFC) nodes at Schriever AFB, CO, and Fort Greely, AK;
• Command Launch Equipment at Vandenberg AFB, CA, and Fort Greely, AK; and In-Flight Interceptor
• Communication System Data Terminals at Vandenberg AFB, CA, Fort Greely, AK, and Shemya Island, AK.
• GMD secure data and voice communication system including long-haul communications using the Defense Satellite Communication System, commercial satellite communications, and fiber-optic cable (both terrestrial and submarine).
• External interfaces that connect to Aegis BMD; North American Aerospace Defense – U.S. Northern Command Command Center and Command and Control, Battle Management, and Communications at Peterson AFB, CO; Space Based Infrared System/Defense Support Program at Buckley AFB, CO to relay data from early warning satellites; and the AN/TPY-2 radar at Shariki AB, Japan.
• The Sea-Based X-band radar can be operationally deployed as needed.

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