



KINETIC ENERGY INTERCEPTORS WEAPON SYSTEM

Deployable Early Engagement Capability Adds Strategic Flexibility – Where It’s Needed, When It’s Needed.

Flexibility for an Uncertain Future

In today’s volatile geopolitical environment with growing numbers of ballistic missile threats facing the United States and its allies, the nation needs utmost flexibility to meet the needs of warfighters and to defend against an expanding range and complexity of threats as new adversaries continue to emerge.

The Director of National Intelligence lists the ability to develop and/or acquire dangerous weapons and delivery systems as a major and growing threat to the nation and its deployed troops, second only to terrorism. Some 30 nations have ballistic missiles and more than 100 foreign ballistic missiles were tested in 2007 alone. One can only conclude the United States must prepare to counter this inevitable threat. KEI provides unique and vital regional defense on demand to protect the homeland and strategic interests overseas.

Northrop Grumman, in partnership with the U.S. Missile Defense Agency (MDA), is developing the globally deployable Kinetic Energy Interceptors weapon system to

meet this urgent need for vital regional defense on demand to protect the homeland and strategic interests overseas.

Strategic and Operational Flexibility

The 1972 Anti-Ballistic Missile (ABM) Treaty between the U.S. and the Soviet Union restricted missile deployments to specific locations and limited the types and locations of missile warning sensors used by each country. The treaty specifically prevented deployment of systems that could protect large regions, including allies. After the U.S. withdrew from the treaty in 2002, MDA began pursuing new ways of solving the challenges of ballistic missile defense.

KEI is the only MDA interceptor system designed for a post-ABM treaty world, allowing globally deployable, mobile, expansive regional protection for homeland defense, allies and deployed forces. MDA chose Northrop Grumman’s weapon system approach, employing proven state-of-the-art technologies, to engineer and design a unique capability without ABM Treaty constraints.

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Artist's concept of land-mobile KEI system

One of the KEI weapon system's strength is its flexibility. As a deployable system, KEI can avoid many of the drawbacks associated with expensive, permanent silo fixed sites. The KEI system requires little or no facilities investment for deployment. This precludes the loss of facilities investments that can occur with fixed sites due to host nation political changes, denial of access in time of crisis or natural disasters. There is also no need for permanent deployments of U.S. personnel and no obsolescence of facilities investments when the threat or engagement kinematics change. KEI can be easily removed and moved to a new location when it is no longer wanted or when dictated by operational necessity.

A System That Performs

The KEI system is comprised of cutting-edge components: a highly maneuverable kill vehicle that's carried on an ultra fast acceleration and continuously maneuverable missile. The missile is cold gas-launched from a mobile platform and guided by a unique new sensor fusing fire control system with near-real-time update capability.



Artist's concept of deployable KEI system

The KEI interceptor is also designed to be compatible with multiple payloads, offering flexibility to address the most advanced threat-enhancing countermeasures.

This integrated weapon system provides a persistent (24/7), all weather capability to destroy intermediate and intercontinental ballistic missiles in their boost to early midcourse phases of flight.

Unique Sensor Fusing Capability

Unlike other missile defense systems, KEI does not rely on radar sensors alone. The KEI system will use all sensor data available including satellite data. That means quicker cueing, near-real-time, high-fidelity track updates, and higher probability of kill.

Continuous In-Flight Control

Once the interceptor is launched in the right direction and as sensors refine the track, Northrop Grumman's fire control communicates changes in near-real-time to constantly redirect the interceptor to the target most efficiently. MDA is seeking to adopt elements of this approach for its other missile defense systems through the spiral development process.

Value of Layered Defense

KEI adds flexibility and military utility by enabling a vital part of a multi-layered Ballistic Missile Defense System (BMDS). By strengthening the early engagement layer, KEI opens a window for "shoot-look-shoot." That new capability, coupled with the interceptor sensor downlink, improves the probability of engagement success by weapon systems in the subsequent layers (For example, GMD and SM-3 for midcourse, THAAD for terminal).

Importance of Early Engagement

Early engagement can substantially reduce the number of defensive assets required to destroy threats by engaging targets during the "few on few" phase before the threat deploys warheads and decoys. KEI substantially improves the economics of engagement by minimizing the number of "many on many" engagements and reliance on salvos to improve probability of kill in later engagement phases.

KEI's ability to conduct early engagements increases the ability of the missile defense battle captain to effectively manage his battle assets. By giving him the chance to shoot early, the warfighter has time to assess the shot and shoot again if necessary — with another KEI or

alternative system if in range. This gives the warfighter the opportunity to conserve these limited assets and ultimately leads to a higher probability of kill.

Sea-Mobile KEI

MDA and Northrop Grumman have conducted analysis to facilitate placing the KEI weapons system on sea-based platforms. For example, the KEI interceptor comes in a canister as an “all-up-round” (AUR), and can be handled and stored like the U.S. Navy manages the logistics of other munitions. When it needs refurbishment, the canister would be sent back to its primary depot, as the military does with other weapons and platforms.

Safety is enhanced by a cold-gas launch system, which pitches the rocket up more than 100 feet in the air before the motor ignites and the rocket accelerates away. Several Navy platforms have been evaluated for accommodating KEI including surface warships and submarines.

Expanding KEI mobility with sea-basing adds another dimension for combatant commanders to address threats across broad regions of responsibility. The current contract directs the KEI program to identify requirements and preserve the ability to spiral to a sea-mobile solution.



“... accelerated development of sea-based terminal and kinetic boost phase interceptor capabilities would effectively build on the initial missile defense capability already deployed in the USPACOM AOR.”

**— Admiral Timothy J. Keating,
Commander - U.S. Pacific Command
3/11/08 Senate Testimony**



“We can’t afford to believe that we will never be threatened. There have been two world wars in my lifetime. We didn’t start them and, indeed, did everything we could to avoid being drawn into them. But we were ill-prepared for both. Had we been better prepared, peace might have been preserved.”

**— President Ronald Reagan
Speech calling for the creation
of SDIO in 1983.**

Strategically Deployable Deterrence and Regional Protection

KEI supports U.S. power projection and deterrence in times of crisis. Deployable to virtually any location in the world in 24 hours by C-17 aircraft, KEI provides a defensive alternative to offensive pre-emptive strikes to deny an enemy its launch capability. The weapon system’s intercept capability allows it to not only defend the U.S. mainland from overseas operating areas, but in many cases to extend that protection to regional allies and friends and forces in theater. For example, a KEI battery deployed within a large area of mid- to Eastern Europe can protect much of the continental U.S., all of Western Europe and Israel against long-range threats emanating from menacing areas in the Middle East.

Program Achievements

Technical progress has been significant over the years since program award. The fire control system has had four successful demonstrations and achieved its Key Knowledge Point ahead of schedule. It has proven KEI can meet the short target acquisition, fire control and launch timelines required to hit a missile in the earliest minutes after launch.

Northrop Grumman and the government have also completed hypersonic wind tunnel testing and several increasingly demanding tests of the first and second stage

rocket motors in preparation for the next round of static fire tests. Currently the program is focused on delivering the first booster flight test as an MDA Director's Key Knowledge Point to demonstrate readiness to proceed with the overall weapon system development and test program.

A robust test program continues to verify engineering design and analysis predictions. Overall performance remains consistent with expectations as the high performance booster components continue to be run through their paces. Mission assurance is a critical element underlying every design component and test. This approach will offer greater confidence in the full weapon system's reliability and performance once it is deployed to users in the field.

Congressional Support

KEI was slowed by budget challenges following contract award. Recently, recognition of the importance of KEI's game-changing capabilities and excellent technical progress have brought strong support from Congress, which added \$115 million to the President's budget request in FY08. MDA was also directed by Congress to accelerate availability of the total weapon system. The additional funding enabled the program to leverage prior-year accomplishments in fire control and launcher development to begin the weapon system engineering requirements work. FY08 funding was also used to reinforce the booster flight knowledge point preparation.

KEI Team and the Path Forward

The Northrop Grumman-led KEI team draws on nationwide missile defense expertise. Major Northrop Grumman operations contributing to KEI are located in



KEI first stage rocket motor static fire test, Nov. 2008

Huntsville, Ala. (program management office), Fairfax, Va., San Bernardino, Calif., and Clearfield, Utah. Principal teammates include the Raytheon Company, Tucson, Ariz.; ATK, Promontory, Utah, and Elkton, Md.; Orbital Sciences, Phoenix and Chandler, Ariz.; Honeywell, Tempe, Ariz.; Aerojet, Sacramento, Calif.; Ball Aerospace, Colorado Springs, Colo.; and Kuchera, Johnstown, Pa.

Over the next 10 months, the KEI program will complete four more motor static fire tests in preparation for the initial booster flight that will achieve the MDA Knowledge Point. This flight will be followed by canister eject tests and a second booster flight in 2010. ■

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