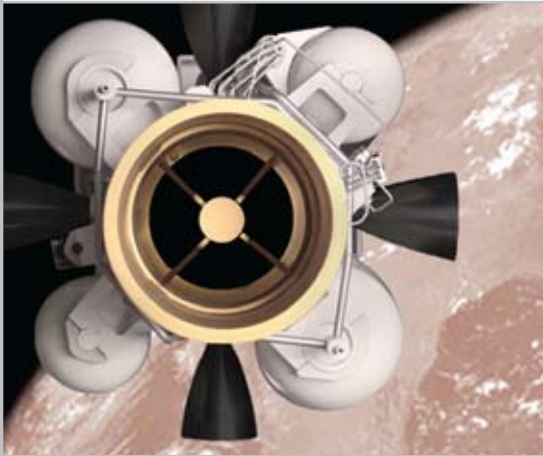


EKV/GMD

Exoatmospheric Kill Vehicle/Ground-based Midcourse Defense System



EKV/GMD

Raytheon's hit-to-kill successes with the GMD program occurred on:

October 9, 1999

July 14, 2001

December 3, 2001

March 15, 2002

October 14, 2002

Benefits

- Adds synergy to a multi-layered defense
- Counters the threat in the midcourse phase of flight
- Target selection made in presence of multiple decoys
- "Hit-to-kill" technology allows complete destruction of weapons of mass destruction
- Payload consists of EKV and adapter for booster mounting

Within the Department of Defense, the Missile Defense Agency is responsible for developing and testing the Ballistic Missile Defense System. Three segments are currently under development to support a "layered" defense: Boost Phase Defense, Midcourse Defense, and Terminal Defense. An element of the Midcourse Defense segment is Ground-based Midcourse Defense (GMD).

The GMD is being designed and developed to protect all 50 U.S. states against limited ballistic missile attack by intercepting long-range ballistic missiles during the midcourse or ballistic phase of their flight, before their reentry into the earth's atmosphere.

In December 2002, the president directed the Department of Defense to proceed with fielding an initial set of missile defense capabilities to begin operating in 2004 and 2005. These initial capabilities will include ground-based interceptors, sea-based

interceptors, additional Patriot (PAC-3) units, and sensors based on land, at sea, and in space.

Extensive testing efforts are scheduled to take place under operationally realistic conditions with establishment of a testbed complex at Ft. Greely, Alaska. Additionally, the president has directed an initial deployment of ground-based interceptors at Fort Greely and Vandenberg Air Force Base, California. These interceptors will be placed in silos in late 2004 and used as part of a potential system to defend the homeland against a possible missile attack.

The Raytheon kill vehicle represents a critical piece of the GMD program. The kill vehicle is the intercept component of the Ground-Based Interceptor (GBI) that includes a government choice of a booster. Its mission is to provide protection against small-scale missile attacks. Specifically, its niche in defense of the nation is to engage high-speed ballistic

missile warheads, otherwise known as reentry vehicles, in the midcourse or exoatmospheric phase of their trajectories and destroy them using only force of impact.

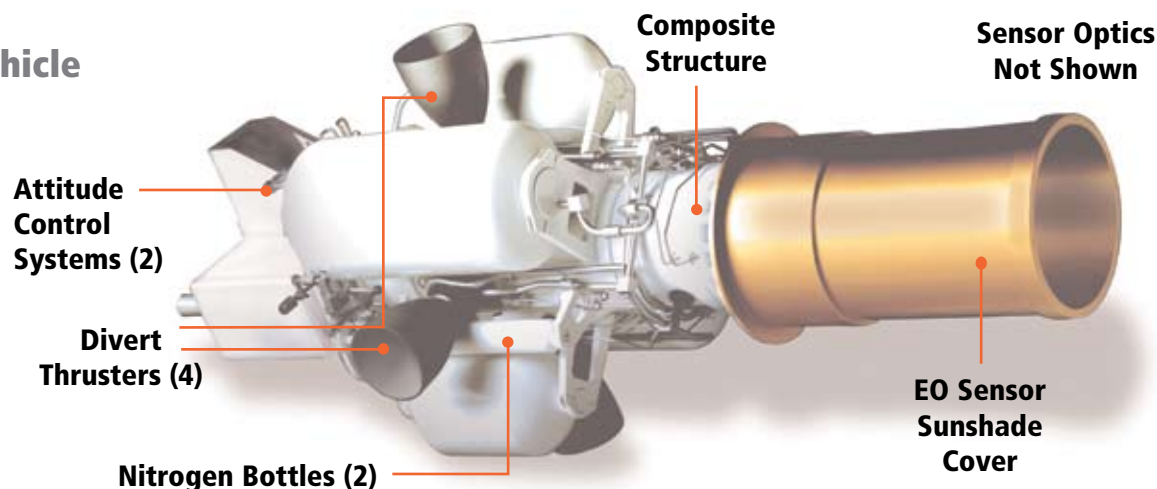
The Exoatmospheric Kill Vehicle (EKV) consists of an infrared seeker in a flight package used to detect and discriminate the reentry vehicle from other objects. The "hit-to-kill" concept involves colliding with the incoming warhead, completely pulverizing it.

This collision ensures complete destruction of a warhead carrying weapons of mass destruction — nuclear, biological or chemical — and the means of delivery, such as mid-range and long-range ballistic missiles. Accidental or unauthorized attacks by nuclear-capable nations, or attacks by rogue nations or a terrorist group represent significant concerns.

In addition to having an infrared seeker, the EKV has its



Kill Vehicle



own propulsion, communication link, discrimination algorithms, guidance and control system, and computers to support target selection and intercept decisions in the final seconds, or end game, of its flight.

The EKV weighs approximately 140 pounds, is 55 inches in length and approximately 24 inches in diameter.

Successful EKV sensor tests conducted in 1997 and 1998 demonstrated the onboard sensor's performance in discriminating the surrogate reentry vehicle from among decoys. These tests consisted of EKV sensor "fly-bys" of simulated missile warheads and decoys. Data was collected, transmitted to a ground station, and used to exercise and refine target discrimination algorithms for future intercept tests.

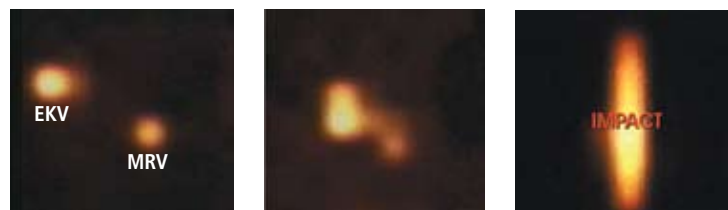
At the time, the sensor tests represented key milestones as elements of risk mitigation prior to flying the kill vehicle with its

Divert and Attitude Control System (DACS), which steers the EKV, and its onboard discriminating sensor. The sensor includes a multiple-waveband infrared seeker which it uses to acquire and track targets. This seeker is comprised of focal plane arrays and a cryogenic cooling assembly attached to an optical telescope, supported by hardware and software processing.

The EKV is designed to withstand the rigors of the in-flight environment en route to performing its mission of locating and destroying its target using kinetic energy, or "hit-to-kill" technology.

In April 1998, BMDO (now MDA) awarded the Boeing Company a long-term contract to coordinate the entire missile defense effort. As prime contractor, Boeing is responsible for design, development, testing, and integration of the six GMD elements into a viable system capable of defending against a limited ballistic missile attack.

The continued development and testing of a potential "layered" system will result in an extensive review of terminal, midcourse, and boost-intercept systems to determine the practicality of deploying the total system. The review will consider the capability, as well as the current and future ballistic missile threat.



Pictured above is the sequence that depicts the "hit-to-kill" intercept, which occurs 8 minutes into flight. The impact photo depicts the EKV collision with the MRV.

The base requirement currently is land-based development. This system will consist of a Ground-Based Radar (GBR) along with a small number of GBIs, comprised of kill vehicles integrated with booster rocket motors. Additionally, space-based early warning satellites, both in high-elliptical and low-elliptical orbit, and ground-based Upgraded Early Warning Radars (UEWRs) will detect hostile missile launches and provide guidance to ground stations. A battle management, command, control, and communication system will provide operational control and man-in-the-loop interface.

The Army's GBI Project Management Office and GMD Joint Program Office in Huntsville, Ala., are the cognizant military authorities for the Raytheon EKV as it is integrated with the government's choice of booster.

"Layered" missile defense is needed to protect U.S. and allied forces, as well as the U.S. homeland,

from long-range, medium-range, and short-range air and missile attack. Raytheon's technologies and capabilities contribute to this total missile defense system via its outstanding discrimination processes, as well as lethality in the end game.

The significance of the initial firing campaign in which five successful intercepts were realized cannot be overstated. These intercepts place the GMD system on track to meet the nation's most essential objectives.

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