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**PRESIDENT, GEORGE C. MARSHALL INSTITUTE**

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**BEFORE THE SUBCOMMITTEE ON NATIONAL SECURITY AND FOREIGN AFFAIRS**

**COMMITTEE ON OVERSIGHT AND GOVERNMENT REFORM**

**U.S. HOUSE OF REPRESENTATIVES**

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Mr. Chairman, Mr. Shays, and Members of the Subcommittee, I appreciate the opportunity to appear before you today to discuss the importance of ballistic missile defense to the security of the United States. I am Jeff Kueter, President of the George C. Marshall Institute. The George Marshall Institute is a 501(c)(3) non-profit organization founded in 1984, focused on how science is used in making public policy. The Institute's analyses are designed to improve the comprehension of the public, the media, and policy makers of important scientific and technical issues. We publish reports and host roundtables and workshops. Our activities focus on the environment and national security topics, with a particular emphasis on ballistic missile defense and space security.[1]

## The Importance of Missile Defense

Missile defense provides the United States with options for addressing a growing threat in an uncertain world. During the Cold War, the ballistic missile was an instrument of strategic power, employed by both the U.S. and the Soviet Union as a means to check each other's global power. Through the recognition that use of these capabilities would result in wholesale destruction, a certain macabre stability emerged. Today's security environment is much different and so are the roles that growing ballistic missile arsenals play.

Today, states view the ballistic missile as a relatively cheap way to gain considerable leverage. Through its ability to reliably deliver significant firepower at precise locations, the ballistic missile is assuming strategic roles previously held by fighter and bomber aircraft. The ability to deliver ballistic missiles at long ranges is increasing among nations hostile to the United States. Perhaps because of the ballistic missile's ability to act as an instrument of terror, the pursuit of missiles with ranges in the

[1] More information on the Marshall Institute's work on ballistic missile defense is available http://www.marshall.org/subcategory.php?id=12.

thousands of kilometers strongly suggests that motives outside of regional concerns are driving the decisions to invest in missiles of longer and longer ranges.

The National Air & Space Intelligence Center concludes its 2006 assessment stating: "Ballistic missiles are already in widespread use and will continue to increase in number and variety. The availability of weapons of mass destruction for use on ballistic missiles vastly increases the significance of this threat."[2]

North Korea already has an arsenal of more than 100 short- and medium-range missiles capable of striking points throughout American allies, South Korea and Japan. Yet, it continues to pursue the longer range Taepodong which is intended to have striking capabilities in the thousands of kilometers. Further, North Korea is working to develop solid fueled intermediate- and short-range missiles, which would provide them with a more accurate and mobile force.

Similarly, Iran is investing in longer range missiles even though it already possess a sizeable short- and medium-range arsenal. The extended-range version of the Shahab-3 would give Iran the ability to strike targets in southern and eastern Europe. Like the North Koreans (with whom they share critical technologies, designs, and plans), the Iranians are seeking solid-propellant technology as well as new missile designs.

The emergence of long-range missiles in the arsenals of countries hostile to the United States, our friends, and allies, and the widespread availability of the knowledge and technical capacity to build such arsenals, are cause for concern. Writing in 2001, Michael O'Hanlon and James Lindsay of the Brookings Institution note the consequences:

> "The death toll in a biological or nuclear attack from a single missile could easily exceed the total number of U.S. soldiers who died fighting in the Korean War and would probably be comparable to the casualties in Hiroshima and Nagasaki … a missile armed with a nuclear warhead that landed on downtown [Los Angeles] at mid-day could kill 250,000 people instantly and tens of thousands more in the days and weeks to follow. The prospect of wholesale slaughter is what gives long-range missiles their coercive power."[3]

A missile defense reduces the coercive power, discourages the acquisition of missiles, deters aggressors from action by reducing the probability of success, and, most importantly, offers the possibility of saving the lives of thousands of people in the event a missile is launched.

Without a defense, the choices available to deter missile proliferators are unpalatable. For instance, Ashton Carter and former Secretary of Defense William Perry, writing in June 2006 as concerns about a North Korean ballistic missile test were at their peak, advocated a pre-emptive strike to prevent the launch of the test missile. They said: "But intervening before mortal threats to U.S. security can develop is surely a prudent policy. Therefore, if North Korea persists in its launch preparations, the United States

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[2] National Air & Space Intelligence Center. *Ballistic and Cruise Missile Threat*, (March 2006).

[3] Michael O'Hanlon and James Lindsay. *Defending America* (Brookings Institution: Washington, D.C., 2001):. 80-81.

should immediately make clear its intention to strike and destroy the North Korean Taepodong missile before it can be launched."[4]

Should the same policy be applied to Iran? What should the United States do when Iran is ready to test its space launch rocket as it has expressed the intention to do? The risks of such a strategy are obvious and the consequences of the war it would start are grim. Even in the case of North Korea, such a provocative use of U.S. offensive military power risks the start of offensive operations against South Korea or Japan as well as widespread international condemnation.

As the aforementioned has illustrated, the end of the Cold War strategic competition has seen important changes in the nature of the ballistic missile threat. The drawdown in the U.S. and former Soviet strategic arsenals may have produced a decline in the aggregate number of ballistic missiles, but the number of states seeking these capabilities is rising, as is the sharing of technical expertise and capabilities. Strengthened enforcement of missile technology control regimes is essential, but not sufficient to deter the existing threat, much less that expected to emerge.

Earlier this month, the Bucharest Summit Communiqué issued by NATO acknowledged the significance of the ballistic missile threat and agreement with the path forward outlined by the United States. They said:

> "Ballistic missile proliferation poses an increasing threat to Allies' forces, territory and populations. Missile defence forms part of a broader response to counter this threat. We therefore recognise the substantial contribution to the protection of Allies from long-range ballistic missiles to be provided by the planned deployment of European-based United States missile defence assets. We are exploring ways to link this capability with current NATO missile defence efforts as a way to ensure that it would be an integral part of any future NATO-wide missile defence architecture."[5]

**Effectiveness of U.S. Missile Defense Systems**

In December 2002, President Bush called for the deployment of missile defense assets capable of providing an initial defense against the rogue state ballistic missile threat. The initial deployment as outlined by the President was expected to be "modest" but available for limited defensive missions beginning in 2004.[6] These efforts were clearly considered just "a starting point" for development and deployment of improved and expanded capabilities in the years that followed.[7]

Today, the United States has twenty-four ground-based midcourse interceptors in missile fields at Fort Greely, Alaska, and Vandenberg Air Force Base, California, with a

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[4] Ashton Carter and William Perry. "If Necessary, Strike and Destroy: North Korea Cannot Be Allowed to Test This Missile" *Washington Post* (June 22, 2006). (http://www.washingtonpost.com/wp-dyn/content/article/2006/06/21/AR2006062101518.html)

[5] Bucharest Summit Declaration Issued by the Heads of State and Government participating in the meeting of the North Atlantic Council in Bucharest on 3 April 2008 (http://www.nato.int/docu/pr/2008/p08-049e.html).

[6] Department of Defense, Missile Defense Deployment Announcement Briefing (December 17, 2002) – http://www.defenselink.mil/news/Dec2002/t12172002_t1217missiledef.html

[7] George W. Bush (December 17, 2002) – http://www.whitehouse.gov/news/releases/2002/12/20021217.html

total of thirty planned for by the end of 2008. Twelve Aegis ships are equipped with the long-range surveillance and track capabilities needed to perform ballistic missile defense missions. Conversion of six more is planned by the end of 2008. These vessels are outfitted with Standard Missile Three (SM-3) interceptors. Further expansion of the Navy's capabilities will come with the upgrading of the SM-2 Block IV missile, the goal being to deploy up to 100 interceptors to provide a near-term terminal engagement capability on eighteen Aegis BMD ships beginning in 2009. The Patriot PAC-3 terminal defensive system was completed and transitioned to the U.S. Army. Work on the Fylingdales Radar in the United Kingdom, the Cobra Dane Radar, the Sea-Based X-Band Radar, and the forward-based transportable X-Band radar in addition to the development and construction of the communications and battle management systems and software linking the whole system together was completed. The integration of these multiple radars enlarge the battlespace, provide overlapping fields of vision to increase the accuracy of tracking data and prevent the creation of blindspots, and ease the transition or "hand-off" of information to the kill vehicle.

The hit-to-kill approach was successfully demonstrated thirty-four times in various systems since 2001. The purpose of tests is to evaluate progress and reveal areas in need of improvement. The "unsuccessful" intercept tests of the ground-based midcourse defense revealed problems with the booster rockets. Those problems were corrected, as illustrated by the successful functioning of the system in its September 2007 flight test. The Aegis program has had thirteen successful intercept tests, with its two "failures" linked to assembly issues with the divert attitude control (FM-5, June 2003) and an incorrect system setting, a human error (FTM-11, December 2006). The Terminal High Altitude Area Defense (THAAD) is four for four in its intercept tests, with one target malfunction resulting in a canceled test. The failures therefore revealed hardware and engineering issues associated with the boosters and highlighted the importance of investing in a reliable target set. For each of the systems, the test experiences show that, once deployed, the kill vehicle reliably finds and destroys its target.

The realism of the testing program, particularly for the GMD system, is sometimes questioned. The Patriot PAC-3 system was operationally deployed and used during Operation Iraqi Freedom, where it destroyed nine Iraqi missiles in nine attempts. The Aegis BMD, which has successfully destroyed separating and unitary targets and has had a simultaneous interception of two targets, led Dr. Charles McQueary, Director of Operational Test and Evaluation at the Department of Defense, to state before the Senate Armed Services Committee on April 1st that Aegis BMD has "demonstrated the capability to detect, track, and engage short- and medium-range ballistic missile targets in the midcourse phase with Standard Missile-3 missiles."[8]

The GMD program suffers from the perception that its testing program is lacking in "operational realism." It is important to remember that progress in the test program was delayed by failed launches of the booster rocket in 2004-05 and a target failure in 2007. Nevertheless, the September 2007 flight test involved many operational elements, including servicemen and women crewing the interceptors, the radars, and the fire control system and target intercept geometries based on a North Korean launch against the

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[8] Dr. Charles McQueary, Statement before the Senate Armed Services Committee, Strategic Forces Subcommittee, April 1, 2008. http://armed-services.senate.gov/statemnt/2008/April/McQueary%2004-01-08.pdf

continental United States. Approximating conditions reminiscent of the summer of 2006, when intelligence reports provided rough estimates of the times when North Korea might test launch its Taepodongs, the September test provided the warfighter with notice that a window for the test was opening and to be on alert, forcing them to react immediately when the target was launched. Similar approaches are taken for the flight tests of the other systems.

General Obering, the Director of the Missile Defense Agency, further described the "operational" aspects of the test for the Senate in early April:

> "To demonstrate the long-range BMDS capability, for example, we conducted an integrated flight test last September involving a realistic target launched from Alaska and tracked by the operational upgraded early warning radar in northern California. An Aegis ship and the sea-based X-band radar in the North Pacific tracked the target as well. The target was successfully destroyed by a Ground-Based Interceptor (GBI) launched from an operationally configured silo in central California. The data needed to calculate a fire control solution for the interceptor was provided by the operational system and the operational command and control, battle management and communications system was employed by the warfighting commanders. Overall, this single test included numerous components separated by thousands of miles and managed by four executing organizations within the Missile Defense Agency."[9]

The absence of sufficient flight test data is cited by the Government Accountability Office as well as Dr. McQueary as an impediment to their assessment of the Missile Defense Agency's modeling and simulation efforts. The MDA is presently working to anchor the models with the flight test data to validate the models, which should address these concerns. Dr. McQueary's office is working directly MDA personnel in the test planning and execution process.

All agree the challenge is continued demonstration of the GMD and other systems against more complex scenarios and in more stressing conditions. We are all anxious to see further demonstrations of the system's abilities, but the pace of the testing schedule is influenced by the costs of the tests ($80-100 million per test for the GMD) and, more importantly, the time it takes to analyze, interpret, and incorporate the results of the terabytes worth of data generated from each past test into a new test processes.

Dr. McQueary's concluding comments offer important perspective on how far the program overall has come, however. He stated:

> "Hit-to-kill is no longer a technological uncertainty; it is a reality, being successfully demonstrated many times over the past few years. The challenge now is to demonstrate hit-to-kill in more complex target scenes that include not only target deployment artifacts but countermeasures as well. General Obering has this in his future test plans. Individual element successes indicate their growing capabilities. Integrated ground testing of the BMDS continues to demonstrate that

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[9] Lt. General Henry "Trey" Obering, Statement before the Senate Armed Services Committee, Strategic Forces Subcommittee, April 1, 2008. http://armed-services.senate.gov/statemnt/2008/April/Obering%2004-01-08.pdf

> the warfighters understand and can operate the system confidently and effectively. There is still a long way to go, but the MDA's disciplined and principled approach to flight and ground tests is continuing to pay real dividends."

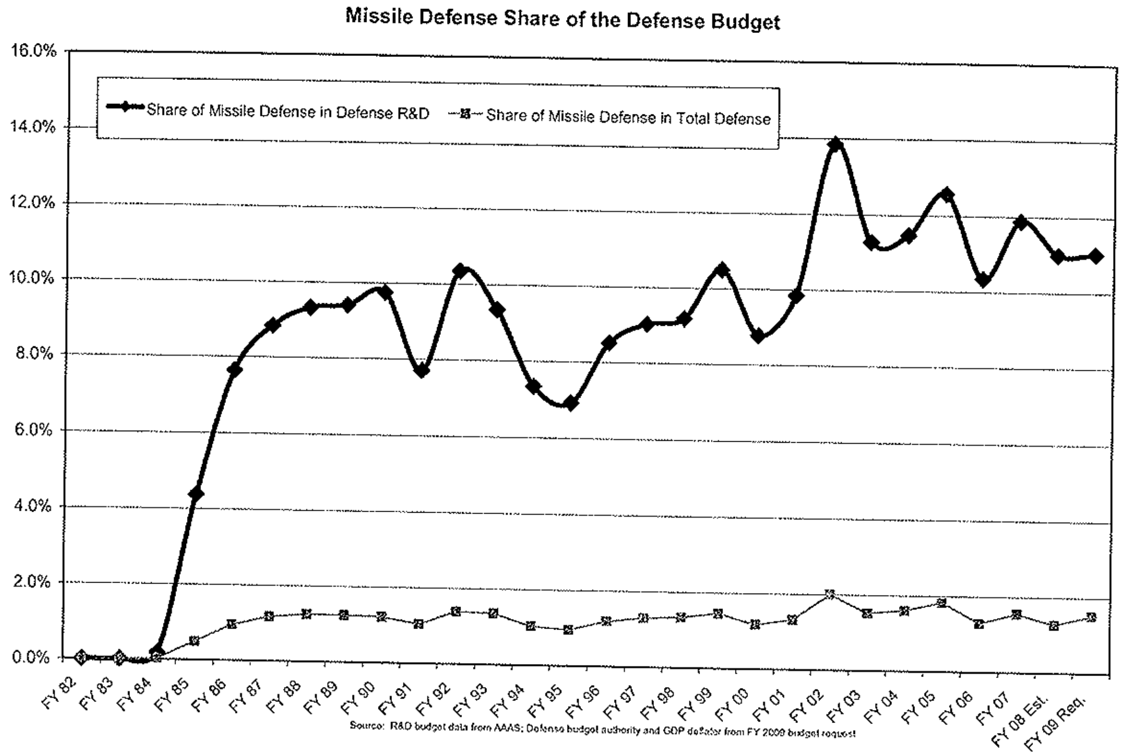
It is asserted that the midcourse defense challenge is insurmountable because adversaries can defeat the defense through the use of countermeasures. Successfully developing and using countermeasures requires detailed knowledge of the defensive system they are designed to overcome, exemplary systems engineering so the offensive system and the countermeasure function properly, and flight testing to ensure proper operation. Knowledge of the operational characteristics of the U.S. system are not widely available. Flight tests of countermeasures would allow study of their performance and modification of our own responses accordingly. Should flight tests be foregone so as to avoid such detection, the prospective attacker has introduced significant risk into their missile arsenal. The U.S. GMD system was tested against known countermeasures in seven ground and flight tests between 1997-2002. Since that time, the target acquisition, discrimination, and terminal homing abilities of the kill vehicle are tested on a regular basis with 2008 flight test plans calling for the resumption of active flight testing against countermeasures. Future plans entail the use of ever more advanced sensors and algorithms as well as a volume kill capability.

In summary, the ballistic missile defense today represents significant progress since 2002. The construction and fielding of the initial defensive capability called for by the President is well underway. Future efforts will build on this foundation by engaging missiles in their boost phase of flight, enabling multiple intercept opportunities from the same interceptor, and improving the sensor, tracking, and battle management abilities of the entire system.

**Evaluating the Investment in Missile Defense**

An examination of expenditures on missile defense efforts since the 1980s reveals short bursts of growth or reductions followed by periods of stability. As Figure 1 illustrates, missile defense has seen rising shares of total defense research and development (R&D) since the inception of a dedicated effort in the early 1980s. After averaging between 8-10% of the defense R&D budget for most of the FY 1987-2001 period, the share of defense R&D funds allocated to missile defense has fluctuated around 11% since FY 2001. In FY 2008, missile defense accounted for 11% of the defense R&D budget. The FY 2009 budget request maintains that allocation.

**Figure 1**

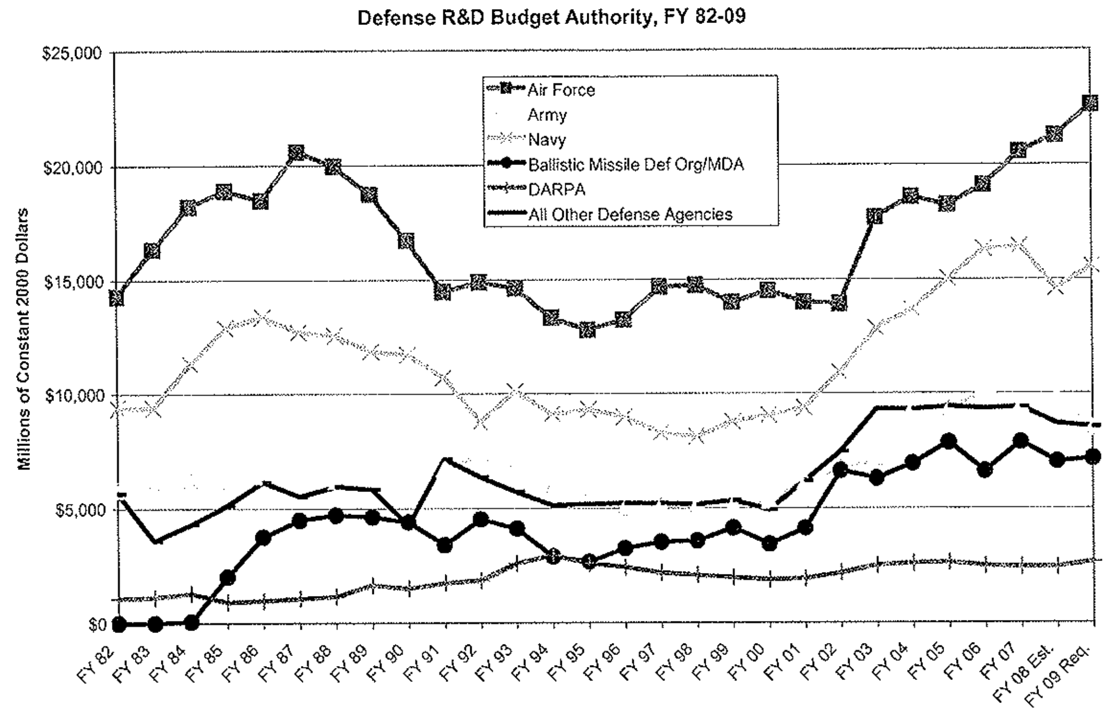



While the R&D share has grown, missile defense remains a small element of the overall defense portfolio. Only once in more than 25 years has missile defense's share of total defense budget authority exceeded 2% of the annual budget. That occurred in FY 2002 when it reached exactly 2%. In FY 2008, missile defense activities represented 1.3% of the total defense budget, down from 1.6% in FY 2007. The FY 2009 request would allocate 1.5% of defense budget authority for missile defense R&D.

The growing of share of missile defense in the R&D portfolio is indicative of increased effort and priority, but it is also a function of changes to other elements of the defense R&D portfolio. The Air Force and Navy show generally rising R&D budgets in the most recent fiscal years whereas the Army, the Defense Advanced Research Projects Agency (DARPA) and others all present flat or declining budgets, in inflation-adjusted terms.

Looking over the FY 1982-2009 period, support for missile defense activities show three distinct phases. In the 1980s, support for missile defense increased rapidly between FY 1984-1987 and then leveled off at approximately $4.5 billion annually before beginning to decline noticeably after FY 1992. Through the 1990s (FY 1990-99), the missile defense R&D budget averaged $3.6 billion with large annual fluctuations, ranging between a low of $2.6 billion in FY 1995 and a high of $4.5 billion in FY 1992. A sharp increase occurred in FY 2002, when the budget jumped from $4.1 to $6.6 billion. From FY 2002-2008, the missile defense R&D budget averaged $7 billion and shows a pattern of slow growth since FY 2002, rising $394 million in inflation-adjusted dollars between FY 2002-2008.

**Figure 2**




Source: R&D budget data from AAAS; GDP deflator from FY 2009 budget

Examining the top-line financial picture reveals how the prioritization of the missile defense mission has changed over time. Much like the top-line Air Force R&D budget, which covers activities as disparate as airframe development, engines, satellites, and rockets and shows changing emphases over time, the total missile defense budget encompasses sensor platforms, communications, software development, kill-vehicles, boosters and lasers.

Over time, the mix of these priorities has changed substantially. Like any development program, changing priorities and requirements add delays. In the case of missile defense, these changes are substantial. The missile defense envisioned by Presidents Reagan and George H.W. Bush is not the defense we are building today. They saw global defense utilizing small hit-to-kill interceptors deployed in space to intercept missiles in the boost phase of flight, supplemented by ground- and sea-based assets to provide interception options in the midcourse and terminal phases of flight.

The Clinton Administration substantially altered the focus of the nation's missile defense effort. Eliminating the space-based efforts, the Clinton program initially emphasized theater defenses. But, by 1997, the Clinton Administration had committed to developing a longer-range limited midcourse defense, along with the theater defenses. That decision laid the groundwork for the base of capabilities being deployed today. Issues arising from the Anti-Ballistic Missile (ABM) Treaty's limitations on the construction of missile defense assets prompted President Clinton in September 2000 to defer decisions about deployment, leaving them for President George W. Bush.

The Bush Administration chose first to withdraw from the ABM Treaty and then commit to the deployment of missile defense assets as they developed. The significance of the June 2002 withdrawal from the ABM Treaty can not be overlooked when evaluating the recent performance of the missile defense system. The Treaty placed limits on the development and testing of missile defense assets. For example, the Treaty limited the speed and range of target missiles and prevented the use of sea-based radars to support interceptor tests. The Treaty limited construction and deployment activities, including the construction of battle management radars in the Aleutians, deployment of land-based interceptors outside of Grand Forks, ND, and sea-based radars. Finally, the Treaty prohibited the transfer of missile defense components to our allies. As outlined above, our program has taken advantage of being freed from each of these limitations.

In summary, much like the ebb-and-flow of the top-line of the budget, the areas of emphasis within that budget have changed over time. Between 1984-1993, the principal emphasis was the development of space-based systems to provide global defensive capabilities. From 1993-1996, the defense of deployed U.S. forces and allies rose in prominence, leading to the rise in emphasis on terminal phase interceptors. From 1997 to the present, the focus shifted to providing a defense against the emerging long-range ballistic missile threat from North Korea and other so-called "rogue" states. This focus placed prominence on defenses in the midcourse phase of flight as well as continued development of terminal phase defensive systems.

The evaluation of the nation's investments in missile defense must recognize that the change in emphases over time (from global to theater to national) raise very different technical challenges and require weapon systems designed to confront those unique conditions. Much as the Air Force deploys different airplanes for different missions, the missile defense mission is met through distinct systems tailored for specific purposes.

Finally, the timelines for developing technically complex weapons systems has increased dramatically. Longer and longer development timelines are the norm, with the many weapon systems averaging more than a decade between system definition and the fielding of initial operational capabilities. For example, between 1950-1970, fighter aircraft and bombers required 4-5 years to complete the development cycle. From the 1980s forward it now takes fourteen years or more to complete the cycle. The reasons for this state of affairs are many. The decline in the technical competence of the government's acquisition system, changing requirements through the design process, uncertainty about acquisition plans, the expense of the planned systems, and the sheer technical complexity are all cited to explain the delays endemic to virtually all major defense systems.

**Summary Remarks**

The decision to deploy missile defense assets as they mature is driven by the desire to provide the building blocks of a defense against emerging threats. The simple fact is that not all threats are known or will be known and, in the current security climate, many are not deterrable. Even in their current form, the elements of the U.S. missile defense system offer options heretofore unavailable. With further research, development, and testing, the accuracies and capabilities of these systems will only improve. Further improvement of the defense is essential, but the progress is positive.

NATO's recognition of the threat posed to Europe from ballistic missiles is an important recent indicator of the seriousness of the situation. That Japan, the United Kingdom, Australia, Israel, Germany, the Netherlands, Denmark, Italy, France, India and many others are working with the U.S. on missile defense is further evidence that ballistic missiles are recognized as a global security challenge and that the approaches outlined by the United States are valid.

Thank you for the opportunity to appear here today and to present these views for your consideration.