OVERSIGHT OF MISSILE DEFENSE (PART 3): QUESTIONS FOR THE MISSILE DEFENSE AGENCY

HEARING

BEFORE THE

SUBCOMMITTEE ON NATIONAL SECURITY AND FOREIGN AFFAIRS

OF THE

COMMITTEE ON OVERSIGHT AND GOVERNMENT REFORM

HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

SECOND SESSION

APRIL 30, 2008

Serial No. 110–150

Printed for the use of the Committee on Oversight and Government Reform

Available via the World Wide Web: http://www.gpoaccess.gov/congress/index.html
http://www.oversight.house.gov

U.S. GOVERNMENT PRINTING OFFICE

48–813 PDF WASHINGTON : 2009

For sale by the Superintendent of Documents, U.S. Government Printing Office
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OVERSIGHT OF MISSILE DEFENSE (PART 3): QUESTIONS FOR THE MISSILE DEFENSE AGENCY

WEDNESDAY, APRIL 30, 2008

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON NATIONAL SECURITY AND FOREIGN AFFAIRS,
COMMITTEE ON OVERSIGHT AND GOVERNMENT REFORM,
Washington, DC.

The subcommittee met, pursuant to notice, at 10:08 a.m., in room 2154, Rayburn House Office Building, Hon. John F. Tierney (chairman of the subcommittee) presiding.

Present: Representatives Tierney, McCollum, Van Hollen, Hodes, Welch, and Shays.

Staff present: Dave Turk, staff director; Dan Himilton, fellow; Davis Hake, clerk; Hank Smith, graduate intern; Christopher Bright, Benjamin Chance, and Todd Greenwood, minority professional staff members; and Nick Palarino, minority senior investigator and policy advisor.

Mr. TIERNEY. A quorum being present, the Subcommittee on National Security and Foreign Affairs hearing entitled, "Oversight of Missile Defense (Part 3): Questions for the Missile Defense Agency," will come to order.

I ask unanimous consent that only the chairman and ranking member of the subcommittee be allowed to make opening statements. Without objection, so ordered.

I ask unanimous consent that the hearing record be kept open for 5 business days so that all of the members of the subcommittee be allowed to submit a written statement for the record. Without objection, so ordered.

Good morning, and welcome to everybody that is here, particularly our witnesses. Today's oversight hearing is the third in our series on the Nation's missile defense program. As I have noted before, the National Security Oversight Committee is undertaking this extensive and sustained oversight of missile defense for three primary reasons.

First, the Missile Defense Agency operates the largest research development program in the Department of Defense, consisting currently of about $10 billion or more a year. Since the 1980's taxpayers have already spent $120 to $150 billion, more time and more money than we spent on the Manhattan Project or Apollo Program, with no end in sight.

Second, the broader history of missile defense efforts teaches us important lessons. The nonpartisan Congressional Research Service put it this way, "efforts to counter ballistic missiles have been underway since the dawn of the missile age at the close of World War II. Numerous programs were begun, and only a very few saw completion to deployment. Technical obstacles have proven to be tenacious, and systems integration challenges have been more the norm, rather than the exception."

Third, the excellent analysis and work of those who testified at our previous two hearings and others like them have raised very serious concerns about the effectiveness, efficiency and even the need for our country's current missile defense efforts.

Today we will continue those conversations with the head of the Missile Defense Agency, General Obering. I want to thank you, General, for your service to the country and for your testimony here today.

For your benefit and for others who weren't able to attend the other hearings, I wanted to provide a short recap of what we have learned and what serious questions have been raised.

Our first hearing focused on the threats facing our country from intercontinental ballistic missiles versus other vulnerabilities we face, a discussion which should form the foundation for any wise policymaking, but which too often gets ignored, distorted or manipulated.

Joseph Cirincione testified, "the threat the United States faces from ballistic missiles has steadily declined over the past 20 years. There are fewer missiles in the world today than there were 20 years ago, fewer states with missile programs, and fewer hostile missiles aimed at the United States. Countries still pursuing long-range missile programs are fewer in number and less technologically advanced than 20 years ago. Mr. Cirincione also dissected the threat our troops and allies face from short and medium-range missiles versus the threat or lack thereof the U.S. homeland faces from long-range missiles.

Dr. Stephen Flynn, currently a fellow at the Council on Foreign Relations and formerly the director and principal author of the Hart-Rudman Commission report, testified that the "non-missile risk . . . is far greater than the ballistic missile threat" because "it is the only realistic option for a non-state actor like al Qaeda to pursue;" it provides anonymity, something a ballistic missile simply cannot; and there are a rich menu of non-missile options to exploit for getting a nuclear weapon into the United States," options which could have the additional bonus from the al Qaeda perspective of generating "cascading economic consequences by disrupting global supply chains."

This comparative threat assessment is nothing new. In fact, in 2000 the CIA itself came to the same conclusion, "U.S. territory is probably more likely to be attacked with weapons of mass destruction from non-missile delivery means (most likely from non-state entities) than by missiles."

Dr. Flynn concluded the hearing by basically begging us to use any crumbs that could be taken from the billions of dollars we lavish on our ICBM missile defense efforts to plug existing and dangerously urgent homeland security vulnerabilities.

Our second hearing tackled head-on the question of what are the prospects of our current missile defense efforts and what are the costs. One of the most eminent physicists our country has ever produced, Dr. Richard Garwin, the 2003 recipient of the National Medal of Science from President Bush, testified, "Should a state be so misguided as to attempt to deliver nuclear weapons by ICBM, they could be guaranteed against intercept in mid course by the use of appropriate countermeasures."

Philip Coyle, the longest-serving director ever of the Defense Department's testing and evaluation office testified, "Decoys and countermeasures are the Achilles Heel of missile defense. . . . From a target discrimination point of view, during the past 5 years the flight intercept tests have been simpler and less realistic than the tests in the first 5 years. None of the GMD flight intercept tests have included decoys or countermeasures during the past 5 years.—In the past 5 years, there have been just two successful GMD flight intercept tests. At this rate it would take the Missile Defense Agency 50 years before they could be ready for realistic operational testing."

Other witnesses referred to a recent report by the Government Accountability Office that concluded, "GAO was unable to assess whether MDA met its overall performance goal because there have not been enough flight tests to provide a high confidence that the models and simulations accurately predict ballistic missile defense system performance. Moreover, the tests that have been done do not provide enough information for Department of Defense's independent test organization to fully assess the BMDS's suitability and effectiveness."

The Congressional Budget Office has estimated that assuming the Missile Defense Agency continues on its present course, the taxpayers will spend an additional $213 to $277 billion between now and 2025. I need to stress that this is in addition to the $150 billion that have already been spent.

In a time of economic hardship, budget deficits and many pressing and expensive challenges, both foreign and domestic, we need to all ask ourselves, whether you are a conservative Republican or a liberal Democrat, are we wisely spending the taxpayers' money here, is there a real threat we are trying to guard against, and are we actually going to have something useful at the end of the day?

That is why we are here today. Mr. Shays, I recognize you for 5 minutes.

[The prepared statement of Hon. John F. Tierney follows:]

Opening Statement of Chairman John F. Tierney
at the
Subcommittee on National Security and Foreign Affairs hearing entitled,
"Oversight of Missile Defense (Part 3): Questions for the Missile Defense Agency."

April 30, 2008

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Other witnesses referred to a recent report by the Government Accountability Office that concluded, and I quote:

GAO was unable to assess whether MDA met its overall performance goal because there have not been enough flight tests to provide a high confidence that the models and simulations accurately predict BMDS [Ballistic Missile Defense System] performance. Moreover, the tests that have been done do not provide enough information for DOD's independent test organization to fully assess the BMDS's suitability and effectiveness.

The Congressional Budget Office has estimated that assuming the Missile Defense Agency continues on its present course, the taxpayers will spend an additional $213 to $277 billion dollars between now and 2025.

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In a time of economic hardship, budget deficits, and many pressing and expensive challenges – both foreign and domestic – we need to all ask ourselves – whether you're a conservative Republican or a liberal Democrat – are we wisely spending the taxpayers' money here; is there a real threat we are trying to guard against; and are we actually going to have something useful at the end of the day?

That is why we are here today.

Mr. SHAYS. Thank you, Mr. Tierney, for scheduling this hearing today and continuing the subcommittee's oversight of efforts to defend our Nation. I am pleased that today we will hear from the key person at the Defense Department who is responsible for designing, developing, testing and deploying our country's missile defenses. Obviously General Obering's perspective is critical for this subcommittee to properly discharge its oversight function. I look forward to hearing General Obering's explanation of the threat this Nation faces.

Earlier this year, another senior military leader testified before a House committee that, quote, the spread of nuclear, chemical and biologic weapons and the ballistic missiles to deliver them is one of the central security challenges confronting the United States and its allies. This echoed the assessment given a few weeks before by Thomas Fingar, the Deputy Director of National Intelligence. Dr. Fingar informed the House Armed Services Committee that, "Iran continues to deploy ballistic missiles inherently capable of delivering nuclear weapons and to develop longer-range missiles." He acknowledged that North Korea possesses nuclear weapons and has, "already sold ballistic missiles to several Middle East countries and to Iran." Dr. Fingar also observed that one type of North Korean missile, "probably has the potential capability to deliver a nuclear weapon sized payload to the continental United States."

This then is the situation that intelligence and military experts believe the United States confronts now and in the future. It was in light of these dangers that the Congress approved the National Missile Defense Act of 1999 which established, "the policy of the United States to deploy as soon as is technologically possible an effective national missile defense system capable of defending the United States against limited ballistic missile attacks." This is the law of the land.

Last year the chairman of HASC, House subcommittee with responsibility for missile defenses, declared that there was always, there has always been partisan, bipartisan support for developing and deploying an effective missile defense system. Mrs. Tauscher made it clear that Members from both sides of the aisle, "believed that effective missile defenses are an essential component of our country's overarching defense and national security strategy." Mrs. Tauscher's points were endorsed by the U.S. Congress and signed into law again recently.

The National Defense Authorization Act for fiscal year 2008, which was overwhelmingly approved by this House, clearly recognizes the threat of ballistic missile attacks and codifies support for an effective missile defense system. Thus, it is not surprising that 2 months ago the Secretary of Defense declared that past doubts about missile defenses have been resolved. "The question of whether this capability exists has been settled." Secretary Gates said, but he also noted that, "the question is against what kind of threat, how large a threat, and how sophisticated a threat."

I am concerned that if this subcommittee overlooks the consensus for missile defenses and succeeds in delaying or curbing the program, we may regret this action. There was a time when missile defense critics said the system, "could never hit a bullet with a bul-

let. The Missile Defense Agency has proved the skeptics wrong on this point. I suspect they will do so again on other aspects."

This notwithstanding, I believe our subcommittee has a vital, important role to play in overseeing the missile defense program. However, I believe we need to frame the debate differently. We should post queries such as, what is the proper mix of technologies available to us? Which systems perform better and are more cost effective than others? Are our international partners sufficiently engaged? Can factors which inhibit testing, such as target price and availability, be addressed in order to offer more meaningful exercises? Is there a way to better encourage sales of component systems to allies, thus bringing our production costs down while offering a measure of protection abroad?

Over the past weeks in this hearing series, we have heard wildly varying assessments of the threat this Nation faces, the capability of our current missile defense system, and the testing regime to which it has been subjected. I am eager to hear from General Obering to learn the facts, and I am interested in hearing contrary views from our second panel.

Mr. Chairman, again, I sincerely thank you again for holding these hearings.

[The prepared statement of Hon. Christopher Shays follows:]

HENRY A. WAXMAN, CALIFORNIA
CHAIRMAN

TOM DAVIS, VIRGINIA
RANKING MINORITY MEMBER

ONE HUNDRED TENTH CONGRESS

Congress of the United States

House of Representatives

COMMITTEE ON OVERSIGHT AND GOVERNMENT REFORM

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"Oversight of Missile Defense (Part 3): Questions for the Missile Defense Agency"
Subcommittee on National Security & Foreign Affairs
Wednesday, April 30, 2008

Ranking Member Christopher Shays
Opening Statement

Thank you, Mr. Tierney for scheduling this hearing today and continuing the Subcommittee's oversight of efforts to defend our nation.

I am pleased that today we will hear from the key person at the Defense Department who is responsible for designing, developing, testing and deploying our country's missile defenses. Obviously, General Obering's perspective is critical for this Subcommittee to properly discharge its oversight functions.

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This not withstanding: I believe our Subcommittee has a vitally important role to play in overseeing the missile defense program. However, I believe we need to frame the debate differently. We should pose queries such as:

What is the proper mix of technologies available to us?

Which systems perform better and are more cost effective than others?

Are our international partners sufficiently engaged?

Can factors which may inhibit testing, such as target price and availability, be addressed in order to offer more meaningful exercises?

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I am eager today to hear from General Obering to learn the facts. And, I am interested in hearing contrary views from our second panel.

Mr. Chairman, thank you again for holding this hearing.

Mr. TIERNEY. Thank you, Mr. Shays. The subcommittee will now receive testimony from our first panel before us today, Lieutenant General Henry A. "Trey" Obering III. General Obering is the Director of the Missile Defense Agency in the Office of the Secretary of Defense and has held this position since July 2004. He entered the Air Force in 1973, receiving his pilot wings in 1975, flying F–4 Phantoms. Among other assignments, General Obering participated in 15 space shuttle launches as the NASA orbiter project engineer. He was responsible for integrating firing room launch operations. Prior to his assignment at MDA, General Obering served as the Mission Area Director for Information Dominance on the Air Staff.

General, again, thank you for being with us today. We look forward to a frank and robust discussion. We do have a policy of the subcommittee to swear everybody in before they testify. So I ask you to please stand and raise your right hand.

[Witness sworn.]

Mr. TIERNEY. Thank you. Let the record reflect that the witness has answered in the affirmative.

Mr. Shays.

Mr. SHAYS. Thank you, Mr. Chairman. If I could just insert into the record two letters endorsing the current system from General Kevin Chilton and General Kevin Campbell, an MDA response to recent criticisms regarding the U.S. missile defense program; and finally, an independent report refuting the criticism lodged by Professor Ted Postal.

Mr. TIERNEY. Without objection, so ordered.

[The information referred to follows:]

DEPARTMENT OF DEFENSE
UNITED STATES STRATEGIC COMMAND

Reply To:
USSTRATCOM/J0CC
901 SAC BLVD STE 2A1
OFFUTT AFB NE 68113-6000

The Honorable Christopher Shays, Ranking Member
House Oversight & Government Reform, Subcommittee on National Security & Foreign Relations
B-350A Rayburn House Office Building
Washington, DC 20515

Dear Representative Shays,

I understand that as part of your oversight responsibilities, your Subcommittee seeks a greater understanding of our nation's missile defense efforts. United States Strategic Command (USSTRATCOM) is a global, warfighting combatant command responsible for a wide variety of global missions, including strategic deterrence, space operations, and defense of the global information grid. As the joint warfighter also charged with advocating for regional Combatant Command missile defense capabilities, I wish to offer my unqualified endorsement on behalf of the men and women in uniform, of the Missile Defense Agency's (MDA) present and future research and acquisition efforts. The actions of Lt Gen Obering and all those working at MDA have greatly facilitated the rapid development and fielding of integrated ballistic missile defense capabilities alleviating theater, regional, and global friendly force defense needs.

The proliferation of ballistic missile technologies and weapons represents a real and ever-increasing 21st Century challenge. Numerous nations possess theater ballistic missiles, and some are also pursuing long range capabilities which may ultimately hold our Homeland at risk. The United States cannot afford to wait for forces hostile to our nation to combine ballistic missile and WMD technology.

The Missile Defense Agency has set out on a block approach to meeting near-term Combatant Commander threats while planning for our future defense—across the boost, midcourse, and terminal phases. MDA has worked diligently to include and involved warfighters in their efforts and as the end-users, we have benefited substantially from this inclusive approach. I endorse their approach and have the utmost confidence in our collective ability to adequately represent warfighter priorities. Over the past four years, MDA has worked with the other Combatant Commands to test and field a limited capability to defend the homeland against the North Korean threat. A test record of 34 of 42 terminal and mid-course intercepts in the atmosphere and space since 2001 demonstrates the efficacy of our collective efforts. Missile Defense is an integral part of the spectrum of deterrence designed to defend the United States and our allies against ballistic missile attacks. I strongly support the mission and goals of the Missile Defense Agency and endorse the requirement for an integrated BMDS to defend our people and the nation.

KEVIN P. CHILTON
General, USAF
Commander

Copy To: The Honorable John F. Tierney

DEPARTMENT OF THE ARMY
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND/
ARMY FORCES STRATEGIC COMMAND
POST OFFICE BOX 1500
HUNTSVILLE AL 35807-3801

REPLY TO
ATTENTION OF

Office of the Commander

29 APR 2008

Chairman John F. Tierney
House Committee on Oversight and Government Reform
Subcommittee on National Security and Foreign Affairs
2157 Rayburn House Office Building
Washington, DC 20515-6143

Dear Chairman Tierney:

I would like to thank you and the members of the Subcommittee for holding oversight hearings on the nation's missile defense program. I am hopeful that the hearings afford stakeholders the opportunity to consider all aspects of the missile defense program and collectively reach a consensus on its importance to our nation. Toward that end, I would like to offer a Warfighter's perspective on missile defense capabilities.

The Warfighter consensus is that there is a unified need for an expedient and robust deployment of missile defense capabilities. Warfighters require a layered defense capability to defeat all ranges of ballistic missile threats in all phases of flight to protect our deployed forces and homeland against current and emerging threats. This is a complex mission and the Warfighters have partnered with the Missile Defense Agency, Services and industry to expedite development and delivery of the required capabilities.

The current missile defense development process has produced real capability in an unprecedented time in support of our Combatant Commanders. We have engaged in all aspects of the missile defense program to increase operational realism in testing the delivered systems. The Warfighters have also conducted operational trials and exercises to ensure effectiveness and suitability of these capabilities in operational environments. The recent operation using missile defense capabilities to intercept a non-operational satellite further demonstrates the technological maturity and operational readiness of our missile defense capabilities.

Missile defense is a reality today and we must aggressively expand our capability to keep pace with the emerging threat. The men and woman in uniform are ready to defend this nation and our missile defense capabilities are key enablers to support this mission.

Sincerely,

KEVIN T. CAMPBELL
Lieutenant General, USA
Commanding

cc: Representative Christopher H. Shays
Ranking Member
House Committee on Oversight and Government Reform
Subcommittee on National Security and Foreign Affairs

Investigation of Alleged Research Misconduct by Lincoln Laboratory Members of the 1998-5 POET Study Team

Dr. Brendan B. Godfrey, Investigator
Air Force Office of Scientific Research

Foreword by
Mr. Norman R Augustine, Advisor and Consultant

Prepared for
The Honorable Kenneth J. Krieg, USD(AT&L)

29 January 2007

Foreword
Norman R. Augustine

The accompanying report summarizes an investigation into alleged research misconduct relating to the Phase One Engineering Team (POET) evaluation of aspects of the IFT-1A ballistic missile defense flight test. The investigation itself was conducted by Dr. Brendan B. Godfrey. My role, in response to a request by the Under Secretary of Defense for Acquisition, Technology and Logistics, was to opine on the thoroughness and impartiality of the investigation and to serve as advisor and consultant to the investigator. In this capacity, and as a Special Government Employee, I was granted full access to all available information, including classified information, pertaining to the subject investigation. I actively participated in interviews of all but one of the 49 individuals questioned in connection with the allegations and reviewed over 100 documents. In addition, Dr. Godfrey and I conducted frequent informal discussions and communications related to our respective responsibilities.

It is important to note what the subject investigation was *not*. It was *not* an assessment of the overall feasibility of ballistic missile defense, nor was it an examination into the overall efficacy of exoatmospheric discrimination. It *was* an investigation into six specific items identified during an inquiry conducted by Professor Edward Crawley as part of the MIT internal review of the allegations which had been levied.

The present investigation was complicated by the substantial passage of time since the events of interest occurred, with eight years having transpired since the subject POET analysis was conducted and four years since the Inquiry Report was completed. In several instances it was difficult to locate relevant documents (although all documents sought eventually were obtained); in others the firms involved in the events ceased to exist as independent entities; and in still others, individuals retired and their security clearances lapsed,[1] people changed jobs, memories – not unexpectedly – faded; and one individual died. In addition, there continues to be ongoing litigation which impinges on the matter. It also should be observed that the Office of Science and Technology Policy (OSTP) document which officially defines "research misconduct" was not promulgated until 2000, two years after the POET Study was completed. The MIT policy addressing research misconduct does predate the events of concern and is similar in most regards to that ultimately provided by OSTP.

The above considerations notwithstanding, the definitions and procedures prescribed in the OSTP document formed the basis for the conduct of this investigation. According to OSTP, research misconduct is characterized as "fabrication, falsification or plagiarism..." It is further prescribed that to constitute research misconduct the subject transgression must have been committed "intentionally, or knowingly, or recklessly..." – with the above to be substantiated by "the preponderance of evidence." Moreover, "Research misconduct does not include error or differences of opinion." It is thus possible that an investigator could find fault with the scope and/or substance of a technical analysis and yet not produce a finding of scientific fraud – if it were deemed that a plausible explanation existed for the course pursued by the researcher(s) and there were no evidence of malicious intent. On the other hand, if the preponderance of evidence

[1] In the case of interviews deemed particularly important, arrangements were made to have clearances temporarily reinstated.

indicated improprieties as described in the OSTP regulation, a finding of research misconduct would be required.

In the case of POET Study 1998-5, several individuals, each with significant credentials, including a Defense Criminal Investigative Service employee, a GAO employee, an MIT professor, and two former TRW employees, asserted the existence of research misconduct or other serious shortcomings in the POET analyses. By the same token, the two investigators identified as principally responsible for the portion of the POET report at issue have had long and notable careers, each holds a PhD, and their views are supported by numerous other individuals and organizations that assert no significant shortcomings are contained in the work in contention.

A number of investigations previously have been conducted into various aspects of these and related allegations, including assessments by Lincoln Laboratory, MIT, the GAO, the FBI, the Defense Criminal Investigative Service, Nichols Research Corporation, and the Utah State University Space Dynamics Laboratory. Of those focusing on the specific issue of research misconduct, none found the parties involved to have been guilty of such activities. However, the inquiry conducted by MIT that formed the impetus for the present examination did specify six issues which raised, in the mind of the individual conducting the inquiry, sufficient questions as to warrant further assessment – hence the conduct of the present investigation.

In the pursuit of this investigation, authority was not provided to compel witnesses to participate in interviews or to produce requested documentation. Nonetheless, only one individual[2] declined to be interviewed and, in fact, all seemed eager to express their views. None were accompanied by legal counsel and, in the opinions of both the investigator and the advisor, all the individuals interviewed appeared to be forthcoming and sincere in their beliefs – notwithstanding that those beliefs were not infrequently in conflict with those held by others.

In my opinion, the investigator, Dr. Godfrey, carried out his responsibilities very competently, with extraordinary diligence and a sincere effort to ferret out the truth. In recognition of the potential impact of this investigation, he devoted a substantial amount of time and effort to the undertaking, particularly in view of the demands of his regular responsibilities as Director of the Air Force Office of Scientific Research. With the exception of the single reluctant witness mentioned above, I am unaware of any instance where the investigation was intentionally impeded by anyone or any organization. Full access to all requested available documentation was in every case cooperatively provided.[3] In my judgment, the accompanying report accurately portrays the circumstances which were investigated and the resolution of the issues identified. I therefore endorse the findings and recommendations contained therein.

[2] Considered to be somewhat peripheral to the primary thrust of the investigation.

[3] As but one example, at the first of our meetings at Lincoln Laboratory, without prior notification I requested access to the secret document files relating to the IFT-1A matter contained in the desk of one of the POET authors. A similar unannounced request was made for first-hand access to the IFT-1A section of the classified document storage vault located in the basement of Lincoln Laboratory. In each case, unimpeded access was immediately provided.

A final brief observation is perhaps in order with regard to my own participation in the investigation. As is presumably the case for any individual possessing knowledge of a topic as narrow as ballistic missile defense and for which there is but one customer, that individual likely will have or have had at least some first-hand participation in the field. Such is my case – with my having been involved at one time or another throughout my career with a number of the organizations related to this investigation. These potential conflicts have been disclosed to the Department of Defense and subjected to its standard conflict of interest review, following which it was determined by the Department's Office of the General Counsel that my involvements are not of such a nature as to interfere with my ability to perform the duties assigned. This is a view which I share. Nonetheless, I note the above in the spirit of full disclosure.

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Executive Summary

This report summarizes the results of an investigation of alleged research misconduct in connection with Phase One Engineering Team (POET) Study 1998-5 [Tsai 1999a]. Research misconduct is defined [OSTP 2000] as "fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results." "Research misconduct does not include honest error or differences of opinion." "A finding of research misconduct requires that: there be a significant departure from accepted practices of the relevant research community; and the misconduct be committed intentionally, or knowingly, or recklessly; and the allegation be proven by a preponderance of evidence."

The federal policy goes on to say that "a response to an allegation of research misconduct will usually consist of several phases, including: (1) an inquiry – the assessment of whether the allegation has substance and if an investigation is warranted; (2) an investigation – the formal development of the factual record, and the examination of that record leading to the dismissal of the case or to a recommendation for a finding of research misconduct or other appropriate remedies; (3) adjudication – during which recommendations are reviewed and appropriate corrective actions determined." Federal policy further provides that there should be safeguards for both informants and subjects of investigation.

An inquiry completed four years ago found that an investigation to address several remaining open issues was warranted [Crawley 2002f]. The present investigation thus is focused on the six specific issues identified by the inquiry and is not intended to assess broader matters, such as the feasibility of ballistic missile defense, the efficacy of exoatmospheric discrimination, the performance of any particular missile defense system, or alleged misconduct by the IFT-1A prime and subcontractors. Of course, any apparent illegalities uncovered, whether or not within the scope of the investigation, were to be reported to appropriate authorities.

POET Study 1998-5 relates to Integrated Flight Test (IFT) 1A of the Ground-Based Interceptor missile defense program, which occurred on 24 June 1997. IFT-1A employed a Payload Launch Vehicle carrying a Sensor Payload (SPL), a Target Launch Vehicle carrying a mock reentry vehicle (MRV) and nine decoys, and assorted range assets. Boeing was the prime contractor, and TRW was the subcontractor responsible for Tracking, Fusion, and Discrimination.

Establishing whether IFT-1A was an experiment or system verification is important in setting the context of this investigation, because experiments and system verifications are held to different contractual and community standards. (For example, subjecting flight data to a variety of possible discrimination algorithms might be considered appropriate in the former case but generally would not be in the latter.) According to the contractor 60-Day Report, the principal objective of IFT-1A was "to reduce risk for subsequent Exoatmospheric Kill Vehicle [EKV] flight tests" [Boeing 1997a, p. 8]. The SPL primary objectives were "to demonstrate exoatmospheric sensor operations, provide sensor sensitivity measurement and calibration data, provide signature data collection, and provide discrimination data collection." The Ballistic Missile Defense Organization (BMDO) director described the contractor discrimination program at that time as "research and development" [Kadish 2001]. Similarly, according to the General Accountability Office (GAO), program officials described IFT-1A as an "early research and

development test" [GAO 2002a, p. 1]. Demonstrating actual discrimination was not among the stated SPL objectives. Nonetheless, the subcontractor analyzed signature data for this purpose and indicated that the Baseline Algorithm (BLA) correctly performed its discrimination function on the IFT-1A flight data [Boeing 1998a, p. 134].

Also in 1997 a former TRW employee filed a False Claims Act lawsuit against TRW, alleging that the company had misrepresented the capabilities of its discrimination algorithm. The Department of Justice and the Defense Criminal Investigative Service (DCIS) began an investigation into the allegations in order to determine whether the US Government should participate in the lawsuit. To provide an independent assessment of the BLA and its discrimination capability, the BMDO chartered POET Study 1998-5 to conduct (1) a "review of discrimination algorithms, software implementation, and associated data developed by TRW for use in the Boeing EKV for consistency and correctness in its scientific, mathematical and engineering principles"; (2) a "review of [the BLA's] performance against IFT-1A data"; and (3) an assessment of "potential performance [of the BLA] for IFT-3" [Englander, 1998]. The study was completed near the end of 1998, although discussions with DCIS continued into early 1999. The False Claims Act lawsuit eventually was dismissed, in part because the Department of Defense (DOD) declined, under the "military and state secrets privilege", to provide classified documents pertaining to the litigation [J. Brown 2003].

In 2000 an MIT professor claimed that the IFT-1A data analysis [Postol 2000] and, subsequently, POET Study 1998-5 [Postol 2001] were fraudulent. He also has stated that he had "made no accusations of misconduct against the MIT Lincoln Laboratory authors of the POET report" [Postol 2002b]. Nevertheless, because two of the study authors were employees of MIT Lincoln Laboratory (LL), the MIT Provost initiated an inquiry [R. Brown 2002b] to determine whether a formal investigation of "research misconduct" was warranted. After several months' consideration, the professor performing the inquiry recommended that an investigation be conducted, because "sufficient inconsistencies, open issues, and needs for detailed rectifications of facts" remained [Crawley 2002f, p 2].

In brief, the six open issues identified in the Inquiry Report were [Crawley 2002f, pp. 3 - 4].

1. "The POET report is silent on the issue of the calibration and functional status of the IR [infrared] sensor", despite its elevated temperature and uncertain calibration.
2. "Why was only a subset of the [sensor] data examined by the POET team?"
3. "There are discrepancies between the POET report and the DCIS investigation on the subject of the [BLA] 'reinitialization' and [feature] ellipse 'movement'. The POET report seems internally self-contradictory on the question of the effectiveness and robustness of the algorithms."
4. "The Report concludes that the EKF [Extended Kalman Filter] appears to track the signals reasonably well. This would suggest that a dominant harmonic is present in the signal, which independent analysis ... suggests is not the case."
5. "Did the authors, and potentially others within Lincoln Laboratory, [selectively] interpret the scope of effort and responsibility implied by the Statement of Work, and [if so] what impact did it have on the resolution of the four issues outlined above?"
6. "The GAO report and the POET report are at variance on several issues, including the functional status of the sensor and the time window analyzed. Yet the GAO report also

> claims that 'the Department of Defense concurred with our findings' [GAO 2002a, p. 9]. Where in the interactions of the Lincoln Laboratory, the DOD and the GAO were the discrepancies resolved?"

Upon receipt of the Inquiry Report, the MIT Provost attempted to charter an investigation [R. Brown 2004]. However, the BMDO declined, "due to the national security interests at stake" [Kadish 2003], to authorize access to classified documents deemed necessary to conduct a credible investigation. Then, in early 2006 the Office of the Secretary of Defense (OSD) directed the author of this report to conduct the investigation, granting full access to all relevant information. OSD also appointed a retired industry executive who previously had served as a DOD official to be an advisor and consultant, also with full access to all relevant information. The two spent nine months interviewing nearly 50 individuals and reviewing over 160 documents, many of which were classified. The investigation's principal findings and supporting rationale in summary form are as follows.

1. The infrared sensor did not reach its nominal operating temperature due to an equipment malfunction, and the actual temperature varied significantly during the measurements. Electrical noise in a power supply also was a problem [Huppi 2001]. The POET study made no mention of these facts. Omitting discussion of such critical information in a scientific journal article might constitute research misconduct. However, this was not a scientific journal article, and the two LL members of the POET team responded that the classified POET study was meant only for about 10 people, that the sensor problems were known to those involved in IFT-1A, and that the sensor produced adequate data anyway [Meins 2002, pp. 2, 4 - 6], all of which were true. Indeed, the contractor had reported the sensor cooling problems [Boeing 1998a] prior to the publication of the POET report. It also might be argued that assessing the experimental performance of the IFT-1A sensor was beyond the scope of the POET study. Nonetheless, this investigation concludes that sensor performance was so important that it should have been discussed in the POET report. This omission does not, however, rise to the level of research misconduct, due to the extenuating circumstances just described.
2. The POET study analyzed 17 seconds of a much longer period of collected data. There seems to be general agreement that the data obtained prior to this 17-second window was of too low a quality to be of much use due to the low signal-to-noise ratio. On the other hand, some critics of the TRW IFT-1A data analysis believe that as much as 11 seconds of usable data beyond the 17-second window should have been analyzed as well and would have caused the BLA ultimately to identify a decoy as the MRV. The two LL authors responded that analyzing the additional data was unnecessary, because the targeting algorithm would have selected the MRV for targeting prior to the beginning of the 11 seconds in question [Meins 2002, p. 6 - 7]. An analysis conducted in support of the present investigation identified about 7 additional seconds of useful data before images began streaking and multiple objects began permanently leaving the field of view [Kraemer 2006]. The present investigation concludes that the POET study could have analyzed the additional 7 seconds of data together with the 17 seconds in order to gain further insight into the effectiveness of the discrimination algorithm. However, the amount of time to be analyzed was to some degree a matter of professional judgment, and analyzing just the 17 seconds does not constitute research misconduct. During the additional 7 seconds, the BLA continued to properly identify the MRV, although the

probability assigned to one particular decoy increased significantly during the final seconds [Boeing, 1998a]. A retired scientist involved in the TRW discrimination analysis suggested in an interview that the increasing probability assigned to the decoy during the final seconds was an anomaly due to rapid motion of objects across the field of view.

3. The third open issue has three components. Contractor plots of the "Object Ranking Metric", which was the BLA-based probability that an object was the MRV, displayed an abrupt change part way through the 17-second data window [Boeing 1997b and 1998a, Sec. 4.4.2.5.4.3]. The DCIS investigator alleged that the abrupt change was due to reinitializing the calculation, and the POET study, which repeated the contractor computation, concluded that the abrupt change was due to the inclusion of an additional data feature when it became available [Tsai 1999a, p. 25 - 29]. Examination of the contractor and POET reports, including data used in determining the Object Ranking Metric, indicates that the POET report is correct. Consequently, the investigation concludes that no research misconduct occurred in this regard. Next, the DCIS investigator questioned why feature ellipses changed from the 45-Day analysis (as described in [Boeing 1998b, pp. 154 – 185]) to the 60-Day Report [Boeing 1997b, Sec. 4.4.2.5.4.3] to the revised 60-Day Report [Boeing 1998a, Sec. 4.4.2.5.4.3], while the POET report accepted the contractor explanations for these two changes. The first change, involving both the locations and orientations of several ellipses, was attributed by the contractor to an error in the Gap-Filling Algorithm (GFA) as employed by Monte Carlo simulations of the target signatures and sensor performance in the 45-day analysis. Discussions with the POET authors and with contractor personnel as part of the investigation suggested that this was, for the most part, a plausible explanation. (Why the GFA would cause some ellipses to tilt in the particular direction predicted in the 45-day analysis is not obvious to the investigator.) However, only by reproducing the simulations could the contractor explanation have been validated. Doing so was beyond the scope of the POET study, and this investigation concludes that not conducting such an analysis does not constitute research misconduct. The second change was a decrease by a factor of about 2.5 in the sizes of all the ellipses, which the contractor explained as a scaling error in the original 60-Day Report. This explanation is demonstrably true, because the Monte Carlo results on which the ellipses were based were identical in both versions of the 60-Day Report and consistent with the sizes of the ellipses in the revised report. Finally, the POET report can only be considered generous in stating that "overall, the BLA are well designed and work properly, with only some refinements or redesign required to increase the robustness of the overall discrimination function", especially in light of concerns expressed elsewhere in the report itself. Nonetheless, the several BLA deficiencies are articulated clearly in the immediately subsequent paragraphs of the POET report [Tsai 1999a, p. iii]. In view of these disclosures, the investigation concludes that the choice of wording in a single sentence, taken by itself, does not rise to the level of research misconduct.
4. On multiple occasions, the MIT professor alleging research misconduct has stated that the POET EKF analysis must be wrong in claiming to identify an oscillation in the flight data, because no dominant frequency was visible in its power spectrum. As part of this investigation, a review of the sensor data used in the POET study to examine the EKF indicated that a dominant frequency was, in fact, present, although it was not obvious in the power spectrum figures apparently available to the professor. Additionally, as part of

the present investigation, an individual highly experienced in the use of Kalman Filters first reviewed the description of the EKF analysis in the POET report and found it to be credible, with the limitations of the EKF properly documented in that report, and then verified the software used by the POET team and reproduced some of the EKF computations themselves. (In particular, Figure 15 of the POET Report was reproduced.) It should be noted that the EKF had been deleted from the BLA prior to IFT-1A and thus had no operational impact. The investigation concludes that this issue involves no research misconduct.

5. The BMDO director stated at the time of the POET study that "the scope of the POET review has been narrowly defined to provide confidence to the NMD [National Missile Defense] Program Manager that the Boeing EKV, utilizing TRW-supplied algorithms, will indeed technically perform as required" [Lyles, 1998]. Interviews with MDA officials conducted during the investigation indicate that BMDO management was satisfied that the POET study met the requirements of the Statement of Work, including the additional task of analyzing the EKF. This investigation agrees. Additionally, although the Statement of Work (SOW) itself may, in retrospect, have been too narrow, its content was a management decision. For these reasons the investigation concludes that no research misconduct exists for this issue either.
6. The GAO reports and the POET report are not at variance on the functional status of the sensor and the time window analyzed. Rather, the GAO reports, written three years after the POET report, discussed these two matters, and the POET report did not. Interviews conducted as part of the investigation indicated that the GAO report authors did not fault the POET study (with the exception of one author, who also faulted the GAO study). The OSD official who formally concurred with the GAO reports stated in an interview that he did so, because the reports were not critical of BMDO's conduct and contained no recommendations for substantive action. Concurrence by OSD with the GAO reports was, in any case, an OSD management decision. The investigation concludes that this issue does not involve research misconduct.

The investigator also was alert for possible instances of research misconduct in connection with POET Study 1998-5 yet not directly related to the issues identified in the Inquiry Report but did not encounter any.

Ballistic missile defense is an exceedingly complex undertaking. Competent people could, and did, disagree on many technical issues, such as whether reentry vehicles and decoys could be distinguished reliably. The manner in which the POET team presented its results should have more prominently emphasized caveats and limitations. However, when the available facts are considered, the team's actions do not rise to the level of research misconduct. There are plausible explanations for their actions, and no evidence was found of intentional efforts to deceive. The investigation concludes, therefore, that neither the POET team nor the management of Lincoln Laboratory is guilty of research misconduct with respect to POET Study 1998-5.

The investigation made several findings of a procedural nature. The most important are these:

1. BMDO and contractor statements that IFT-1A demonstrated the discrimination capabilities of the BLA seem overly broad and were not fully substantiated by the IFT-1A data. Moreover, as noted above, IFT-1A was an experiment, not a system verification.

2. The DCIS investigator relied primarily on a scientist with a strong interest in the outcome of his investigation for technical advice.
3. MIT initiated its inquiry without clear, written allegations [Canizares 2006, p. 17]. As noted above, the MIT professor who first claimed "scientific fraud" has stated that his charges were not aimed specifically at the POET study authors. Also, MIT did not protect adequately the confidentiality of the inquiry process. Copies of a draft version of the report were not controlled, and some information found its way into newspapers; e. g., [Broad 2003]. MIT did not follow its policy that "after considering the responses of the alleged offender, the fact finder should" include "an accurate summary of the information offered by the alleged offender" in the inquiry final report [MIT 1997b].
4. Access to relevant classified information indeed was necessary to conduct this investigation.
5. Excessive delay occurred in addressing the allegations of research misconduct, especially between the end of the inquiry and the beginning of the investigation. In particular, the DOD did not follow the federal requirement to initiate an investigation responding to the Inquiry Report in a reasonable period of time, despite MIT's repeated requests. Over the past five years, many participants changed positions or retired, and one key participant died. Participants' recollections of events, of course, also faded.
6. Complex inquiries and investigations of research misconduct should be performed by more than one person.

In conclusion, the investigation recommends:

1. Charges of research misconduct in connection with POET Study 1998-5 be dismissed.
2. Reasonable efforts be made to publicly exonerate the two Lincoln Laboratory authors, in accordance with their wishes.
3. Confidentiality requirements be strengthened in the OSTP, DOD, and MIT research misconduct policies, and then enforced.
4. A requirement for a complete set of written allegations, along with the basis for making them, be added to the OSTP, DOD, and MIT research misconduct policies.
5. DCIS investigators be provided with knowledgeable, disinterested technical assistance when conducting technically complex investigations.
6. A lessons-learned report be prepared by OSD several months from the date of the present report. (It is possible that not all lessons will have been learned until some months after this report has been released.)

Finally, the investigator affirms that, to the best of his ability, he conducted this investigation in a thorough and unbiased manner and that no one attempted to improperly influence the outcome.

1. Background

The 2002 General Accountability Office (GAO) reports [GAO 2002a and 2002b, pp. 1-4] provided a thorough summary of relevant events until that time, and the current report quotes extensively from them:

History through 2000. "For a number of years, the Department of Defense has been researching and developing defenses against ballistic missile attacks on the United States, its deployed forces, friends, and allies. In 1990, the Department awarded research and development contracts to three contractors to develop and test exoatmospheric kill vehicles. The Department planned to use the best of the three vehicles in a follow-on missile defense program. One of the contractors, Rockwell International, subcontracted a portion of its kill vehicle design work to TRW. TRW was tasked with developing software that could operate on a computer onboard the kill vehicle. The software was to analyze data collected in flight by the kill vehicle's sensor (which collects real-time information about threat objects), enabling the kill vehicle to distinguish an enemy reentry vehicle from accompanying decoys.

"The three contractors proceeded with development of the kill vehicle designs and built and tested key subsystems (such as the sensor) until 1994. In 1994, the Department of Defense eliminated Martin Marietta from the competition. Both Rockwell — portions of which in December 1996 became Boeing North American — and Hughes — now Raytheon — continued designing and testing their kill vehicles. In 1997 and 1998, the National Missile Defense Joint Program Office conducted tests, in space, of the sensors being developed by the contractors for their competing kill vehicles. Boeing's sensor was tested in June 1997 (Integrated Flight Test 1A) and Raytheon's sensor was tested in January 1998 (Integrated Flight Test 2). Program officials said these tests were not meant to demonstrate that the sensor met performance requirements, nor were they intended to be the basis for any contract award decisions. Rather, they were early research and development tests that the program office considered experiments to primarily reduce risk in future flight tests. Specifically, the tests were designed to determine if the sensor could operate in space; to examine the extent to which the sensor could detect small differences in infrared emissions; to determine if the sensor was accurately calibrated; and to collect target signature data for post-mission discrimination analysis.

"After the two sensor tests, the program office planned another 19 flight tests from 1999 through 2005 in which the kill vehicle would attempt to intercept a mock warhead. Initially, Boeing's kill vehicle was scheduled for testing in Integrated Flight Test 3 and Raytheon's in Integrated Flight Test 4. However, Boeing became the Lead System Integrator for the National Missile Defense Program in April 1998 and, before the third flight test was conducted, selected Raytheon as the primary kill vehicle developer.

"Meanwhile, in September 1995, TRW had hired a senior staff engineer, Dr. Nira Schwartz, to work on various projects, including the company's effort to develop the exoatmospheric kill vehicle's discrimination software. The engineer helped evaluate some facets of a technology known as the Extended Kalman Filter Feature Extractor, which TRW planned to add as an enhancement to its discrimination software. The engineer reported to TRW in February 1996 that tests revealed that the Filter could not extract the key characteristics, or features, from

various target objects that an enemy missile might deploy and demanded that the company inform Rockwell and the Department of Defense. TRW fired the engineer in March 1996. In April 1996, the engineer filed a lawsuit under the False Claims Act alleging that TRW falsely reported or hid information to make the National Missile Defense Joint Program Office believe that the Extended Kalman Filter Feature Extractor met the Department's technical requirements. The engineer has amended the lawsuit several times, including adding allegations that TRW misled the Department of Defense about the ability of its discrimination software to distinguish a warhead from decoys and that TRW's test reports on Integrated Flight Test 1A falsely represented the discrimination software's performance.

"The False Claims Act allows a person to bring a lawsuit on behalf of the U.S. government if he or she has knowledge that a person or company has made a false or fraudulent claim against the government. If the suit is successful, the person bringing the lawsuit may share in any money recovered. The Department of Justice reviews all lawsuits filed under the act before deciding whether to join them. If it does, it becomes primarily responsible for prosecuting the case.

"To determine whether it should join the engineer's lawsuit against TRW, Justice asked the Defense Criminal Investigative Service, a unit within the Department of Defense Inspector General's office, to examine the allegations. The engineer cooperated with the Investigative Service for more than 2 years. During the course of the Department of Defense's investigation into the allegations of contractor fraud, two groups examined the former employee's specific allegations regarding the performance of TRW's basic discrimination software and performed limited evaluations of the Extended Kalman Filter Feature Extractor. The first was Nichols Research Corporation, a contractor providing technical assistance to the Ground Based Interceptor Project Management Office for its oversight of the exoatmospheric kill vehicle contracts. (This office within the National Missile Defense Joint Program Office is responsible for the exoatmospheric kill vehicle contracts.) Because an investigator for the Defense Criminal Investigative Service was concerned about the ability of Nichols to provide a truly objective assessment, the National Missile Defense Joint Program Office asked an existing advisory group, known as the Phase One Engineering Team, to undertake another review of the specific allegations of fraud with respect to the software. This group is comprised of scientists from Federally Funded Research and Development Centers who were selected for the review team because of their knowledge of the National Missile Defense system. In addition, both Nichols and the Phase One Engineering Team assessed the feasibility of using the Extended Kalman Filter Feature Extractor to extract additional features from target objects that an enemy missile might deploy.

"The Department of Justice and the Defense Criminal Investigative Service investigated the engineer's allegations until March 1999. At that time, the Department of Justice decided not to intervene in the lawsuit. The engineer has continued to pursue her lawsuit without Justice's intervention. [Additional information on the Defense Criminal Investigative Service (DCIS) investigation is contained in Chapter 2, "Previous Relevant Investigations".]

"When a Massachusetts Institute of Technology professor, Dr. Theodore Postol, learned of the engineer's claims, he conducted his own analysis of Integrated Flight Test 1A. In May 2000, the

professor wrote to the White House [Chief of Staff] alleging that Boeing North American and TRW misrepresented the results of the test.

"The professor claimed that his analysis of Integrated Flight Test 1A showed that the system can be defeated by the simplest of decoys and that the National Missile Defense Joint Program Office and its contractors attempted to hide this fact by tampering with the flight test data and altering their analysis of the sensor's discrimination capabilities. The professor also alleged that objects deployed as part of Integrated Flight Test 1A displayed no distinguishable differences that Boeing's infrared sensor could use to identify the mock warhead from decoys and that the program office hid the sensor's weaknesses by reducing the number of decoys planned for future tests. Further, the professor claimed that the Phase One Engineering Team's analysis was faulty."

Allegations by Prof. Postol to the White House Chief of Staff. Allegations in the letter directed at the Phase One Engineering Team (POET) study and apparently at the Ballistic Missile Defense Organization (BMDO) included [Postol 2000, Attachment B]:

- "The BMDO-POET Team used an erroneous example of simulated data to show that they could detect an oscillating component in a signal." "However, the BMDO-POET Team did not show that they could find oscillating components in the signals from the IFT-1A experiment. This is because there is no oscillating component in the IFT-1A data."
- "The BMDO-POET Team ... arbitrarily stopped the analysis of the data, and ... began a second fit to the data. Not surprisingly, the warhead was quickly selected as the target during this time interval." "This result was simply fortuitous, as they obviously chose the time period where the warhead was bright relative to other targets..."
- "Data from the tenth object, a partially inflated medium balloon, is not shown in the figure, as this data was inexplicably removed from the IFT-1A telemetry, apparently because its signal appeared more like that expected for the warhead than the warhead itself."

(IFT means Integrated Flight Test.) Included with the letter as its Attachment D was a redacted version of a draft [Tsai 1998b] of the POET study. Apparently, the DCIS investigator had unmasked portions of the draft to remove presumed classified information, copied it, and provided it to Dr Schwartz to aid his investigation. A copy then found its way to Prof. Postol.

A number of classified rebuttals were written in response to Prof. Postol's letter, including [Handler 2000] and [Keane 2002]. In general, they disputed all of the allegations. Based on these rebuttals, the White House Chief of Staff personally acknowledged Prof. Postol's letter [Podesta 2000] but apparently took no further action.

GAO and FBI Responses to Congress. Prof. Postol subsequently shared his concerns with Members of Congress, who in turn requested both the Federal Bureau of Investigation (FBI) and the GAO to investigate. As explained in Chapter 2, "Previous Relevant Investigations", the issues forwarded to the two investigative organizations included allegations not only of fraudulent misrepresentation of IFT-1A data and analysis but also of improper efforts by the Department of Defense (DOD) to classify portions of his earlier letter and attachments to the White House Chief of Staff.

Both the FBI and GAO found that DOD had acted properly in attempting to classify parts of Prof. Postol's letter and attachments [FBI 2001], [Hast 2001]. In addition, the FBI found no evidence of criminal misconduct, instead stating "that Postol's claim that data had been altered was unfounded. As to Postol's claim that the system is incapable of distinguishing between warheads and decoys, there is a dispute among scientists about the ability of the system to discriminate based on scientific grounds. This is a scientific dispute and Postol's attempt to raise it to the level of criminal conduct has no basis in fact" [FBI 2001].

After an extensive review, the GAO in two reports released concurrently [GAO 2002a and 2002b] responded in detail to seven specific questions posed by Members of Congress. In sections of the two reports, the GAO summarized, but did not express an opinion on the adequacy of, the POET report. It did, however, observe that the POET team did not verify the accuracy of the data reduction performed by the contractor or develop its own reference data and, consequently, could not verify all aspects of the contractor claims of having successfully discriminated the mock reentry vehicle (MRV) in IFT-1A. Overall, the two reports identified no criminal misconduct. It should be noted, however, that one of the GAO investigators recently alleged that the GAO investigation did uncover evidence of misconduct but suppressed it [Ghoshroy 2005]. GAO management has denied these charges [Walker 2006]. More detail is provided in Chapter 2, "Previous Relevant Investigations".

MIT Inquiry into Alleged POET Team Research Misconduct. Also in 2001, Prof. Postol requested in conversations and an exchange of emails with Massachusetts Institute of Technology (MIT) President Charles Vest that "scientific fraud" associated with the POET Report be investigated [Postol 2002a and attachments]. MIT Provost Robert Brown selected Prof. Edward Crawley in early 2002 to conduct an inquiry [R. Brown 2002b]. (By federal and MIT policies, an inquiry first is conducted into allegations of research misconduct in order to determine whether an investigation is warranted [OSTP 2000], [MIT 1997b]. Procedures for addressing charges of research misconduct are described in Chapter 3, "Investigation Process".)

Prof. Postol's concerns at that time were spelled out in his first letter to Prof. Crawley [Postol 2002e]. He began by stating that he had "made no accusations of misconduct against the MIT Lincoln Laboratory authors of the POET Report... The matter at issue is the accuracy of the scientific findings..." These scientific issues included the quality of the IFT-1A data (in light of a higher than desired IFT-1A sensor temperature), performance of the Extended Kalman Filter (EKF), and purported errors in the "confusion matrix" (a measure of the overlap among the computed feature ellipses of the MRV and decoys). Prof. Postol concluded by emphasizing his view of the seriousness of the situation, stating that "Lincoln Laboratory [LL] managers, and the MIT Administrators who manage Lincoln, need to explain how they could know that this report contained fraudulent scientific conclusions and yet no effort was made to inform the Defense Criminal Investigative Service or the Department of Justice. If Lincoln Laboratory knowingly provided false information under these conditions, the Laboratory was in effect impeding an investigation of fraud." He went on to say that "there can be no investigation of misconduct where the management of Lincoln Laboratory can be excluded, including the Director..."

Prof. Crawley conducted his inquiry during the Spring and early Summer of 2002, interviewing Prof. Postol; Dr. Ming-Jer Tsai and Dr. Charles Meins, the two POET Report authors from LL;

Dr. David Briggs, LL Director; and others. He also reviewed a substantial amount of printed material provided by Provost Brown, Prof. Postol, and the POET authors. During this time, Prof. Postol made additional allegations, most of which eventually were included in the Inquiry Report. In the first draft, Prof. Crawley concluded that an investigation was not warranted [Crawley 2002c]. He then shared the draft with the two POET Report authors and with Prof. Postol, as required by MIT policy, and with a few other individuals. Drs. Tsai and Meins reportedly expressed few concerns regarding the draft report.

Prof. Postol, on the other hand, expressed serious concerns in three additional letters to Prof. Crawley and in two additional interviews. For instance, he stated that "there are very serious inconsistencies between the facts reported in the MIT First Draft Report and those reported by two separate federal investigations. MIT's knowledge of these inconsistencies and failure to resolve them has the potential to implicate the MIT Administration, and you [Prof. Crawley], as partners to an effort to cover up possible fraud and obstruction of justice" [Postol 2002h]. Near the end of the final interview, Prof. Postol suggested that "if you were to take the position that [']there's enough uncertainty from what I can gather given the resources that I have available to me and the time that I have available to me that this will require an external investigation to determine whether or not something improper had occurred[']', that's fine with me" [Crawley 2002e]. Subsequently, Prof. Crawley revised his draft report to recommend a formal investigation, stating that "I find there are still sufficient inconsistencies, open issues, and needs for detailed rectification of facts that the allegations cannot be closed by this inquiry" [Crawley 2002f]. Appendix C reproduces the first four pages of the Inquiry Report (except for a short paragraph outlining the structure of the report), which summarize the overall findings of the inquiry. The remainder of the Inquiry Report contains some sensitive information and may not be reproduced here. The two POET Report authors and Prof. Postol were given the opportunity to review the Inquiry Report, and Drs. Meins and Tsai prepared an extensive rebuttal [Meins 2002]. Prof. Crawley stated during the current investigation that he had not seen the rebuttal.

Provost Brown advised the Missile Defense Agency (MDA), the successor organization to the BMDO, in February 2003 that MIT intended "to initiate an investigation into the issues identified in the Inquiry Report" [R. Brown 2003a]. However, doing so required that MDA grant access to relevant classified documents, which MDA declined to do, stating that Prof. Postol's allegations appeared "to be an attempt to misuse the academic research process by repackaging and resurrecting challenges that have been found to be without basis" [Kadish 2004].

Prof. Postol also charged in early 2002 that the MIT administration had failed to investigate his POET study allegations in a timely manner and also had attempted to intimidate him and improperly influence his research [Postol 2002a]. Findings of the subsequent investigation into these matters by Dr. Frank Press [Press 2002] are described in Chapter 2, "Previous Relevant Investigations".

False Claims Act Lawsuit Dismissed. Dr. Schwartz' False Claims Act lawsuit was dismissed in 2003, in part because the Department of Defense (DOD) declined, under the "military and state secrets privilege", to provide classified documents pertaining to the litigation [J. Brown 2003].

2. Previous Relevant Investigations

Several formal investigations related in one way or another to the present investigation have been conducted. In considering the relevance of those investigations, it is important to be precise in stating what they concluded, and the present investigation attempts to do so here.

DCIS Investigation of Allegations by Dr. Nira Schwartz. The first, and longest running, investigation was performed by DCIS from June 1996 to August 1999 on behalf of the Department of Justice (DOJ), which sought to determine whether it should join the False Claims Act lawsuit filed by Dr. Nira Schwartz against TRW. The DCIS and DOJ principal investigators were lawyers and relied heavily on Dr. Schwartz, the "relator", for technical advice. Another TRW scientist and an Army scientist also provided advice. Issues included whether the contractor falsely claimed that it could discriminate between the IFT-1A MRV and decoys, whether it modified algorithm predictions to match the experimental data, whether it used data selectively to match predictions, and whether it falsely claimed that its EKF could extract information useful to discrimination from the data. At the request of that investigation team, BMDO commissioned Nichols Research Corporation (NRC), already under contract to provide technical advice to BMDO, to conduct an assessment of the TRW Base Line Algorithm (BLA) and the EKF. To assess the BLA, NRC compiled and ran the TRW test bed software for 50 representative scenarios and found that "performance results for the vast majority of independent cases exceeded the discrimination requirements" of the Technical Requirements Document (TRD) [MD-PEO 1993] near-term threat. They attributed the poor results of three scenarios to problems with the Gap-Filling Algorithm (GFA), as well as to software errors [Barton 1997]. To assess the EKF, NRC coded the TRW algorithm and ran it for various synthetic but realistic data sets, finding that the "algorithm provides good [feature] extraction capability over a wide range of signature variations consistent with scenario and engagement dynamics for the near-term threat." NRC did, however, note that "unless the threat and its deployment kinematics are well-defined ..., the performance of the EKFFE [EKF Feature Extractor] (or any estimative/predictive filter) will most likely be suboptimal" [Barton 1998]. However, because the DCIS investigation team felt that NRC was not sufficiently independent, it requested another study. POET Study 1998-5 was the outcome.

Like NRC, POET concluded that the BLA and EKF worked but were fragile. Throughout the DCIS investigation, the investigation team exchanged numerous letters with BMDO and others. Many of the questions posed were addressed by the POET team in Appendix B of its report, although not always to the satisfaction of the DCIS investigator or Dr. Schwartz. Areas of specific disagreement included choice of IFT-1A data to be analyzed, explanations for changes in feature ellipses as published by the contractor, and alternative approaches for computing the probability that a detected object was the MRV. In addition, the DCIS investigator requested that the scope of the POET study Statement of Work (SOW) be expanded to include assessing "the concept and performance of the Threat Typing Sensitivity Study Report" and verifying that the contractor's BLA and IFT-1A data analysis "comply without exception to the TRD" [Reed 1998e]. This was not done, because compliance with the TRD, including the role of threat typing, was considered a systems-level issue, well beyond the scope of the assessing the BLA [Handler, 1998]. (Threat typing refers to knowledge of the threat reentry vehicles(s) and decoys obtained prior to launch, typically by intelligence assessments.) Based on the NRC and POET

studies, and at the recommendation of the Army Legal Services Agency [Hoffman 1999], DOJ decided in March 1999 not to join Dr. Schwartz' lawsuit. The investigation itself was closed five months later without criminal charges [Reed 1999h]. Nonetheless, the principal DCIS investigator believed that the contractor had misrepresented the capabilities of its BLA [Reed 1999g].

The DCIS investigation did result in a Management Control Deficiency Report (MCDR), recommending "that a second independent POET be assembled, by an upper level management authority, to verify and ensure compliance with contract requirements by: 1.) Evaluating the eleven (11)-detailed reports, generated by Dr. Nira Schwartz and two other engineers, that specifically identified problem areas in TRW discrimination algorithms and 2.) Validating the initial POET report, which contains apparent inconsistent and contradictory conclusions, so as to adequately address the issues raised in the aforementioned eleven- (11) reports" [Reed 2000]. The MCDR was advisory in nature, and the BMDO director declined to act on its recommendations, responding that the matter had been studied enough. He also stated, "given the nature of research and development programs, it would have been unreasonable to expect that the preliminary version of TRW's software developed in advance of the availability of real-world flight data would be the final solution to the challenges of discrimination. Both the GBI Office and the POET review team verified that TRW's discrimination approach, while it could be improved, was sound. Both recognized it as a work in progress, as expected given the state of [Exoatmospheric Kill Vehicle] EKV development effort in the 1995-1998 time frame" [Kadish 2001].

FBI Investigation of Allegations by Prof. Postol. On 15 June 2000, fifty-three Members of Congress requested that the FBI investigate charges by Prof. Theodore Postol that BMDO flight experiments were unable to discriminate between MRVs and decoys and that the experimental data was altered to hide this fact. The Members of Congress also requested that the FBI investigate whether DOD violated Executive Order 12958 by retroactively classifying Prof. Postol's letter containing those charges [Kucinich 2000b]. (Prof. Postol's letter was addressed to Mr. John Podesta, then White House Chief of Staff [Postol 2000].) Rep. Kucinich in a separate letter requested that the DOD Inspector General (IG) also investigate the second of these issues [Kucinich 2000a]. The FBI and the DCIS, a component of the DOD/IG office, jointly conducted the requested investigations with the FBI as lead. The FBI concluded in early 2001 "that Postol's claim that data had been altered was unfounded. As to Postol's claim that the system is incapable of distinguishing between warheads and decoys, there is a dispute among scientists about the ability of the system to discriminate based on scientific grounds. This is a scientific dispute and Postol's attempt to raise it to the level of criminal conduct has no basis in fact." With respect to the alleged violation of Executive Order 12958 by DOD, the FBI found that Prof. Postol's letter did, in fact, contain classified material, although he "used this information believing it to be unclassified" [FBI 2001]. In its formal response to the Members of Congress, the FBI stated that its investigation "did not identify any criminal fraud or cover-up by Pentagon officials or contractors involved with the National Missile Defense System" [Kubic 2001].

GAO Investigation of Allegation that DOD Misused the Classification Process. Rep. Markey requested that the GAO also investigate whether (as paraphrased by GAO) the DOD "misused the classification process to stifle public discussion of possible problems with the

National Missile Defense System." The GAO replied that "DOD's actions were performed in accordance with Executive Order 12958. Similarly, BMDO's subsequent request that the Defense Security Service [DSS] contact Dr. Postol to discuss concerns that his letter contained classified information was made in accordance with DOD's regulations" [Hast 2001].

GAO Investigations of Allegations Relating to IFT-1A. On 28 February 2002, GAO released two similar reports on IFT-1A in response to requests by Rep. Markey [GAO 2002a] and by Sen. Grassley and Rep. Berman [GAO 2002b]. The reports first provided a thorough historical summary and then, taken together, answered seven specific questions. First, GAO found that the contractors "disclosed the key results and limitations of Integrated Flight Test 1A in written reports" [GAO 2002a, p. 5]. However, GAO expressed concern that the contractor reports sometimes characterized the test in subjective terms, such as "success" and "excellent", which "increased the likelihood that test results would be interpreted in different ways and might even be misinterpreted" [GAO 2002a, p. 6]. Second, GAO did not express an opinion on whether discrimination using the BLA was possible but instead reported that "the Phase One Engineering Team and Nichols Research Corporation have noted that TRW's software used prior knowledge of warhead and decoy differences, to the maximum extent available, to discriminate one object from the other and cautioned such knowledge may not always be available in the real world" [GAO 2002a, p. 7]. Third, GAO summarized, but did not express an opinion on, the adequacy of the POET report. It did, however, point out that, "because the Phase One Engineering Team did not process the raw data from Integrated Flight Test 1A or develop its own reference data, the team cannot be said to have definitely proved or disproved TRW's claim that its software successfully discriminated the mock warhead from decoys using data collected from Integrated Flight Test 1A" [GAO 2002a, p. 9]. It made a similar observation about the NRC evaluation of the BLA [GAO 2002b, p. 7]. Fourth, GAO explained that BMDO relied on, for instance, "the sponsoring agreement between the Air Force and Lincoln Laboratory" to "avoid any action that would put its personnel in perceived or actual conflicts of interest regarding either unfair competition or objectivity." However, GAO noted that the POET team members might be viewed as "insiders" [GAO 2002b, p. 38-39]. GAO also commented on how BMDO and the Army exercised contractor oversight, why they reduced the number of decoys in later flight tests, and how DOJ decided not to join Dr. Schwartz' lawsuit. In all, the two GAO reports provided a comprehensive factual account of IFT-1A, the POET study, and related activities but drew few conclusions. In particular, the GAO reported no misconduct.

In late 2005, one of the authors of the two GAO reports accused GAO of suppressing "evidence that the contractor made false statements about success and skewed test results by manipulating data". Key concerns relating to the contractor included discrepancies between the contractor 45- and 60-Day Reports, claims for the target acquisition range, and claims for discrimination. The GAO author also stated that "the contractor discrimination software ... was actually based on concepts developed through many years of government-funded research by MIT Lincoln Laboratory", thereby creating a conflict of interest for members of the POET team [Ghoshroy 2005]. GAO has strongly denied the accusations against it and offered alternative explanations for the concerns [Walker 2006].

Press Investigation of Alleged Misconduct by MIT Administration. At the request of MIT, Dr. Frank Press, former Science Advisor to the U. S. President, in 2002 investigated two

complaints by Prof. Postol, "that [MIT] President Vest and 'his inner circle of administrators' failed to investigate in a timely manner Professor Postol's allegations of scientific fraud related to POET Study 1998-5" and "that President Vest attempted to intimidate or otherwise improperly influence Professor Postol's research". (The latter complaint involved, in part, an alleged attempt by DSS agents to "entrap and intimidate Professor Postol." The FBI and 2001 GAO investigations, discussed previously, concluded that DSS actions did not violate Executive Order 12958 but did not address any alleged entrapment or intimidation.) In the conclusion of his letter report, Dr. Press stated "that the initiation of an inquiry into Professor Postol's allegation of scientific fraud, though prolonged, did not violate the standard set by MIT's Policies and Procedures. However, we also believe that Professor Postol could have been better informed about the progress of the fraud inquiry, although this is not required by MIT's Policies. We found no evidence of attempted intimidation by either President Vest [or] Provost Brown" [Press 2002].

3. Investigation Process

As described in Chapter 1, "Background", the MIT Administration attempted to conduct a classified investigation of the open issues listed in Prof. Crawley's Inquiry Report, but the MDA declined to grant access to the necessary classified documents. There the matter stood until late 2005, when MIT President Susan Hockfield and Deputy Undersecretary of Defense Kenneth Krieg agreed that DOD would conduct the investigation.

Investigation Charter. On 3 January 2006, Mr Krieg verbally requested Dr. Brendan Godfrey to conduct the investigation, which he agreed to do. The text of the formal appointment letter [Krieg 2006a], dated 8 February 2006, appears in Appendix A. The investigator has been a practicing physicist and research manager for some 37 years, presently as the Director of the Air Force Office of Scientific Research. His work on ballistic missile defense focused on laser and particle beam concepts and concluded 12 years ago. Appendix I contains a brief biography of Dr. Godfrey.

At about the same time, Mr. Norman Augustine, was asked to participate in the investigation as an advisor and consultant. Upon his agreement, he was appointed an unpaid Special Government Employee. His responsibilities were defined in an email from Mr. Douglas Larsen, legal advisor to the investigation. The thrust of that email is contained in Appendix B. Now retired, Mr. Augustine has held senior positions in both industry and government. He has been involved in ballistic missile defense in a variety of capacities in the past. He also has served on the MIT Board of Trustees. Appendix I likewise contains a brief biography of Mr. Augustine.

Federal Policy. As stipulated in the appointment letter, the investigation was to cover "the six issues identified in the MIT inquiry officer's report using the standards in the *Federal Policy on Research Misconduct* as implemented in DOD Instruction 3210.7, *Research Integrity and Misconduct.*" Thus, the investigation was not to encompass such broader issues as the feasibility of ballistic missile defense, the efficacy of exoatmospheric discrimination, the performance of any particular missile defense system, or alleged misconduct by the IFT-1A prime and subcontractors. Of course, any apparent illegalities uncovered, whether or not within the scope of the investigation, were to be reported to appropriate authorities.

The *Federal Policy on Research Misconduct* [OSTP 2000] defines research misconduct as "fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results." "Research misconduct does not include honest error or differences of opinion." "A finding of research misconduct requires that: there be a significant departure from accepted practices of the relevant research community; and the misconduct be committed intentionally, or knowingly, or recklessly; and the allegation be proven by a preponderance of evidence."

The federal policy goes on to say that "a response to an allegation of research misconduct will usually consist of several phases, including: (1) an inquiry – the assessment of whether the allegation has substance and if an investigation is warranted; (2) an investigation – the formal development of the factual record, and the examination of that record leading to the dismissal of the case or to a recommendation for a finding of research misconduct or other appropriate

remedies; (3) adjudication – during which recommendations are reviewed and appropriate corrective actions determined." Federal policy further provides that there should be safeguards for both informants and subjects of investigation. The investigators are to conduct the investigation in a fair and unbiased manner, make a good faith effort to protect the confidentiality of any sensitive information provided to them, and complete the investigation in a timely manner.

Mr Krieg has designated himself the adjudicator for item (3) of the process just described [Krieg 2006a].

The *Federal Policy on Research Misconduct* is similar to the *MIT Policy on Academic Misconduct and Dishonesty* [MIT 1997b], under which the inquiry was conducted.

DOD Instruction 3210.7 [DOD 2004] supplements the OSTP policy by specifying that those accused of research misconduct are entitled to "a description of substantial allegations made against them; ... reasonable access to the data and other supporting evidence related to the allegation; and ... the opportunity to respond to the allegation, the evidence, and the findings."

The investigator met with Dr. Kenneth Roth and Mr. Roger Sudbury, representing LL management, and Dr. Tsai and Dr. Meins on 15 December 2006. The four read pages 1 – 35 of the report and had the opportunity, if they wished, to read the appendices as well. They then verbally accepted the report as written, suggesting only a few minor corrections that did not change the substance of the report. With respect to Recommendation 2, appearing on page 34, the two POET authors requested that LL employees be informed of the outcome of the investigation and subsequent adjudication. The management representatives agreed that this would be appropriate. The written response by the LL POET authors to the present investigation report, received on 20 December 2006, is contained in Appendix D. Their two recommended changes have been incorporated. LL management did not submit a written response.

DOD Instruction 3210.7 also provides that the accused have the right to appeal the adjudication decision to an authority not "directly involved in the inquiry, investigation, or adjudication ..."

Documents reviewed. The findings of the investigation are based largely on the review of over 160 documents, listed in Appendix F. The documents were obtained as follows:

- At the beginning of the investigation, MDA provided six large binders of documents, the majority of which were classified.
- The investigation advisor skimmed the POET classified holdings at LL and identified several dozen mostly classified documents, copies of which were provided promptly.
- Upon request, the DCIS provided copies of its correspondence associated with its two investigations described in Chapter 2, "Previous Relevant Investigations".
- Upon request, the GAO provided several background documents.
- Prof. Postol provided several documents and letters.
- Several individuals provided information by email.
- By cross-referencing the available documents, the investigator identified a few more documents that appeared to be useful, and they were provided promptly by MDA or LL.

Thus, it seems likely that the investigation had access to all relevant, important documents, although this of course cannot be guaranteed.

Among the most useful of the documents reviewed were POET Study 1998-5 and its redacted earlier draft, the separate LL analysis of IFT-1A data quality, the interim and final draft Inquiry Reports, the Response to the Inquiry Report by Drs. Meins and Tsai, the three GAO reports, the DCIS investigation close-out report and MCDR, the FBI investigation summary reports, the Boeing-TRW 60-Day Report Addendum, the July 1998 contractor briefing to the POET Team, the BLA and EKF assessments by NRC, and certain letters by Prof. Postol.

Interviews. This review of written documentation was complemented by interviews, typically in person but sometimes by telephone, with 49 individuals who had been involved in IFT-1A, the POET study, or the related investigations. (Dr. Schwartz was not interviewed due to her involvement in continuing legal matters.) Although many of the interviewees had strong feelings on these matters, each seemed forthright and anxious to share their insights. Appendix E lists the individuals interviewed.

The investigator and the advisor met four times with Mr. Krieg and members of his staff:

- Discussion of investigation background, scope, and timeline (17 March 2006)
- Presentation of investigation progress (31 July 2006)
- Informal discussion of investigation progress (5 October 2006)
- Presentation of investigation findings and recommendations (4 December 2006)

In addition, the advisor met earlier on one occasion with Mr. Krieg to discuss the advisor's potential participation in the investigation.

Electronic data analyzed. The IFT-1A sensor data analyzed by the POET team and subsequently by an LL staff member for sensor performance [Schulz, 2004] had been preserved electronically on several computer disks, listed in Appendix G. The data files include simulated signatures from the 45-Day and 60-Day analyses, corresponding simulated features, simulated feature ellipses, flight data amplitudes, flight data signal-to-noise ratios, corresponding flight data tracks and features, and the raw focal plane array (FPA) data. Track files from the original 60-Day Report [Boeing 1997b] did not include one small, faint decoy. The POET team reportedly did not have the raw FPA data.

At the request of the investigator, three colleagues at the Air Force Research Laboratory (AFRL) reviewed this collection of data, and particularly the raw focal plane array data, to assess the data quality as a function of time and to observe when objects left the view of the focal plane [Kraemer 2006]. Another AFRL colleague obtained the software employed by the POET team to analyze the EKF, then examined the software, ran it on simulated and actual flight data, and reviewed the POET study EKF results.

4. Discussion

In recommending that an investigation be conducted, the Inquiry Report made two fundamental points: "there are still sufficient inconsistencies, open issues, and needs for detailed rectification of facts that the allegations cannot be closed by this inquiry", and "there was enough involvement by MIT Lincoln Laboratory employees and management in the preparation and subsequent discussion of the POET Report that it would be appropriate to continue to consider it the subject of an investigation commissioned by MIT" [Crawley 2002f, p. 2].

Role of Lincoln Laboratory. Investigation interviews with several individuals included discussions of the second point. From those interviews it appears that LL management neither specified the overall content of the POET report nor approved its release. On the other hand, LL management did select the LL members of the POET team, and reviewed and may have suggested changes to the report. Moreover, Dr. Tsai, an LL senior scientist, was the technical leader of the study and principal author of the report. Consequently, this investigation agrees with the inquiry that there was sufficient connection between LL and the POET study to justify MIT conducting an inquiry and investigation. Of course, even without this connection the DOD has authority to conduct the investigation, because the POET study was funded by a DOD agency. All LL interviewees, including the two authors, stated firmly to the investigator and advisor that no pressure was put on the authors to reach particular conclusions in their report.

Inquiry Issues. The six issues identified by the Inquiry Report [Crawley 2002b, pp. 3 - 4] can be summarized as:

1. "The POET report is silent on the issue of the calibration and functional status of the IR [infrared] sensor", despite its elevated temperature and uncertain calibration.
2. "Why was only a subset of the [sensor] data examined by the POET team?"
3. "There are discrepancies between the POET report and the DCIS investigation on the subject of the [BLA] 'reinitialization' and [feature] ellipse 'movement'. The POET report seems internally self-contradictory on the question of the effectiveness and robustness of the algorithms."
4. "The Report concludes that the EKF appears to track the signals reasonably well. This would suggest that a dominant harmonic is present in the signal, which independent analysis ... suggests is not the case."
5. "Did the authors, and potentially others within Lincoln Laboratory, [selectively] interpret the scope of effort and responsibility implied by the Statement of Work, and [if so] what impact did it have on the resolution of the four issues outlined above?"
6. "The GAO report and the POET report are at variance on several issues, including the functional status of the sensor and the time window analyzed. Yet the GAO report also claims that 'the Department of Defense concurred with our findings' [GAO 2002a, p. 9]. Where in the interactions of the Lincoln Laboratory, the DOD and the GAO were the discrepancies resolved?"

The literal wording of these six issues is contained in the Inquiry Report "Recommendations and Rationale", reproduced as Appendix C of this investigation report.

Status of IFT-1A. Establishing whether IFT-1A was an experiment or a system verification is important in setting the context for examining these issues, because experiments and system

verifications are held to different contractual and community standards. (For example, subjecting flight data to a variety of possible discrimination algorithms might be considered appropriate in the former case but generally would not be in the latter.) According to the contractor 60-Day Report, the principal objective of IFT-1A was "to reduce risk for subsequent Exoatmospheric Kill Vehicle flight tests" [Boeing 1997a, p. 8]. The sensor payload (SPL) primary objectives were "to demonstrate exoatmospheric sensor operations, provide sensor sensitivity measurement and calibration data, provide signature data collection, and provide discrimination data collection." The BMDO director described the contractor discrimination program at that time as "research and development" [Kadish 2001]. Similarly, according to the GAO, program officials described IFT-1A as an "early research and development test" [GAO 2002a, p. 1].

Although demonstrating actual discrimination was not among the stated SPL objectives, the subcontractor analyzed sensor output for this purpose and indicated that the performance of the Baseline Algorithm (BLA) correctly performed its discrimination function on the IFT-1A flight data [Boeing 1998a, p. 134]. BMDO directors also described IFT-1A (and the subsequent IFT-2, which had similar objectives but a competing sensor package and discrimination algorithm) as having demonstrated the ability to discriminate between warheads and decoys [Lyles 1998]. Likewise, "IFT-1A and 2 demonstrated a robustness in discrimination capability that went beyond the baseline threat..." [Kadish 2000].

The investigation concludes, on balance, that data acquisition and subsequent analysis conducted as part of IFT-1A are to be viewed as an experiment, and the POET report should be considered in that light. This is true not withstanding the broad statements made by BMDO officials and by the contractor about what IFT-1A demonstrated.

The six Inquiry Report issues are now considered in turn. Two closely related allegations by Prof. Postol, improper manipulation of simulation predictions and flight data, and deletion of the data for one of the decoys, also are addressed.

Sensor Performance and Calibration. The IFT-1A infrared sensor FPA was intended to operate at a constant nominal temperature for an extended period. In fact, the sensor only reached 1.2 -1.5° K above the nominal temperature, and then only for the last 25 – 30 seconds of target data collection, due to a partial blockage of coolant gas. Ground-based calibration data indicated a variation in sensor sensitivity of almost 10% over that temperature range in one of the measurement bands [Huppi 2001]. An on-board calibration also was undertaken by observing a star, but a low signal-to noise ratio reduced its effectiveness. There was some ambiguity about whether star calibration results were used to adjust sensor data before analysis [Boeing 1998a, Sec 4.4.2.3 vs. 4.4.2.4.9]. The GAO reported that star calibration results were inconsistent [GAO 2002a], and one of the POET authors stated in an investigation interview that the IFT-1A flight data received by the POET team had been calibrated by the contractor using ground-based calibration information. The low pointing agility of the payload launch vehicle on which the FPA was mounted for the IFT-1A flight also enhanced sensor noise [Schultz 2004], as did rapid variation in the sensor temperature early in the data collection period. Electrical noise from a power supply was present as well [Huppi 2001].

The POET study made no mention of these facts but instead accepted data provided by the contractor as a given. Omitting a discussion of such critical information in a scientific journal article might have constituted research misconduct. However, this was not a scientific journal article, and the two LL members of the POET team responded that the classified POET report was meant only for about 10 people, that the sensor problems were known to those involved in IFT-1A, and that the sensor produced adequate data anyway for at least 17 seconds [Meins 2002, pp. 2, 4 - 6], all of which were true. Based on DCIS correspondence [Reed 2000], members of the DCIS investigation team were among those familiar with the contents of the 60-Day Report. It also might be argued that assessing the experimental performance of the IFT-1A sensor was beyond the scope of the POET study. Nonetheless, this investigation concludes that sensor performance was so important that it should have been discussed in the report. This omission does not, however, rise to the level of research misconduct, due to the extenuating circumstances just described.

For completeness, it should be noted that the 60-Day Report was inconsistent in discussing sensor performance. Although, as just mentioned, the report addendum discussed sensor issues in some detail [Boeing 1998a], the main report, published earlier, stated in its summary section, "Sensor operation and data acquisition were nominal, as monitored during flight and by detailed reviews and analysis of the recorded telemetry data." It went on to say, "The sensor cooled to operating range with a hold time significantly greater than the required" period [Boeing 1997b, p.12].

Choice of Data Analyzed. The POET study analyzed 17 seconds of a much longer period of available data. There seems to be general agreement that the data obtained prior to this 17-second window was of too low a quality to be of much use, due to the low signal-to-noise ratio, which was a consequence of the sensor cooling problem described above. A subsequent LL review of IFT-1A sensor performance supported this view [Schultz 2004]. On the other hand, some critics of the TRW IFT-1A data analysis believe that as much as 11 seconds of usable data beyond the 17-second window should also have been analyzed and would have caused the BLA ultimately to identify a decoy as the MRV. The two LL POET authors responded that analyzing the additional data was unnecessary, because the targeting algorithm was programmed to select the MRV prior to the beginning of the 11 seconds in question [Meins 2002, p. 6 - 7]. They subsequently added in response to the investigation report draft, "the POET report concentrated on the analysis reported by TRW. [The POET team] therefore used the same span of data that TRW did" [Tsai 2006]. An analysis conducted in support of the present investigation identified only 7 additional seconds of useful data before images began streaking and multiple objects began permanently leaving the field of view [Kramer 2006]. The investigation concludes that the POET study could have analyzed the additional 7 seconds of data together with the 17 seconds in order to gain further insight into the effectiveness of the discrimination algorithm. However, the amount of time to be analyzed is to some degree a matter of professional judgment, and analyzing just the 17 seconds does not constitute research misconduct. During the additional 7 seconds, the BLA continued properly to identify the MRV, although the probability assigned to one decoy increased significantly during the final seconds [Boeing, 1998a]. A retired TRW scientist involved in the 60-Day discrimination analysis suggested in an interview that the increasing probability assigned to the decoy during the final few seconds was due to rapid relative motion of objects across the field of view.

Again for completeness, it should be noted that Prof. Postol has asserted that "highly anomalous behavior of the sensor ... rendered the IFT-1A data useless when applied to the Baseline Algorithm" [Postol 2006], presumably due to allegedly inadequate calibration data [Postol 2002e]. This assertion apparently is meant to apply even to the time when the sensor temperature had stabilized. However, as discussed above, ground-based calibration data permitted sensor output to be calibrated to within about 10%, sufficient for meaningful comparison of IFT-1A data with BLA predictions.

BLA 'Reinitialization'. The third open issue has three components, the first of which is alleged reinitialization of the BLA software by the contractor in order obtain better discrimination results. Contractor plots of the "Object Ranking Metric", which was the BLA-based probability that an object was the MRV, displayed an abrupt change part way through the 17-second data window [Boeing 1997b and 1998a, Sec. 4.4.2.5.4.3]. The DCIS investigator alleged that the abrupt change was due to reinitializing the calculation [Reed 2000], and the POET study, which repeated the contractor computation, concluded that the abrupt change was due to the inclusion of an additional data feature when it became available [Tsai 1999a, p. 25 - 29]. Examination of the contractor and POET reports, including data used in determining the Object Ranking Metric, indicates that the POET report is correct. For instance, several figures overlaying actual and predicted signature features in section Sec. 4.4.2.5.4.3 of the 60-Day report show first one-dimensional (i.e., one feature only) and then two-dimensional distributions of flight data features. Examining these figures also shows that a single feature is insufficient to achieve good discrimination, which explains the inconclusive discrimination results in plots of the "Object Ranking Metric" for the first several seconds. During the investigation interviews, the POET authors provided cogent explanations of the computational transition from one to two features. Consequently, the investigation concludes that no research misconduct occurred in this regard.

Ellipse 'Movement'. To assess this second component of the third issue from the Inquiry Report, it is necessary to understand what feature ellipses are and how they are calculated. The MRV and decoys appeared as time- and frequency-dependent point sources to the IFT-1A FPA. They were discriminated by comparison with expected signatures, the latter computed using prior knowledge of the characteristics of the objects and an understanding of the underlying physics. Because many of these characteristics were uncertain or known only statistically, the computations were performed 1000 times in a Monte Carlo fashion. Then, a number of numerical characteristics of the solutions, called "features", were derived from the numerical predictions, and their multivariate mean and covariance calculated. If two features were considered, then the two-dimensional mean and covariance could be represented graphically as an ellipse within which most (e.g., one-sigma) of the simulated feature points lay. If the corresponding features from the flight data lay close to the predicted means of the respective ellipses and the ellipses did not overlap excessively, the objects could be discriminated accurately. (Note that these ellipses were plotted in various reports for illustrative purposes only. The actual Object Ranking Metric was calculated directly from the means and covariance matrices.)

The DCIS investigator noted that the ellipses from the 45-day analysis as described in the revised 60-Day Report [Boeing 1998b, pp. 154 – 185], from the 60-day analysis as described in the

original 60-Day Report, [Boeing 1997b, Sec. 4.4.2.5.4.3], and from the 60-day analysis as described in the revised 60-Day Report [Boeing 1998a, Sec. 4.4.2.5.4.3] were significantly different in many instances, and alleged that they were changed by the contractor after the flight in order to create the appearance of successful discrimination [Reed 2000]. In contrast, the POET report accepted the contractor explanations for these changes. The change between the ellipses in the 60-Day Report and the revised 60-Day Report is easy to explain. The various ellipses differed only in size (by a factor of about 2.5) between the two versions of the 60-Day Report, and the contractor explanation that the ellipses in the original 60-Day Report were incorrectly scaled is demonstrably true [Boeing 1998b]. The Monte Carlo results upon which the ellipses were based were identical in both versions of the report and consistent with the sizes of the ellipses in the revised report. Moreover, a retired contractor scientist confirmed this interpretation to the investigator, stating that he himself made the coding error.

The second change was between the 45-day analysis and the 60-day analysis, both described in the revised 60-Day Report. (The so-called 45-Day Report actually was a set of briefing slides, which contained no ellipses [Crowder 1997a].) The locations, sizes, and orientations of several ellipses changed, in some cases significantly. The contractor attributed this to an error in the GFA. The GFA was a portion of the BLA software that estimated brief segments of object tracks that were missing from the flight data, typically due to low signal-to-noise ratios early in the one-minute observation period, when the targets were far from the sensor, hence faint, and the FPA temperature was much too high. Consistent with the Monte Carlo simulation process described previously, the poorly designed GFA also was employed in the feature predictions, leading to errors in the ellipses, according to the contractor. In the 45-day analysis, the simulations spanned 47 seconds of the observation period, and the GFA greatly impacted the simulation results. In the 60-day analysis, the simulations spanned only 23 seconds [Boeing 1998b, p 156]. Consequently, the GFA had minimal impact on the 60-day analysis ellipses and flight data. Contractor researchers stated in a briefing to the POET team [Boeing 1998b] that they also ran simulations of the shorter time period with the GFA disabled and obtained ellipses essentially identical to those for the same shorter time period with the GFA not disabled. Interviews with the POET authors and with contractor personnel as part of the investigation suggest that this explanation is, for the most part, plausible. (Why the GFA would cause some ellipses to tilt in the particular direction predicted in the 45-day analysis is not obvious to the investigator.) However, only by reproducing the simulations could the contractor explanation have been validated. Doing so was beyond the scope of the POET study and far beyond the scope of the present investigation. The investigator believes that it was not unreasonable for the POET team to have accepted the contractor's explanation instead of reproducing the contractor's results. The preponderance of the limited evidence on this matter does not indicate research misconduct.

The larger question of whether the contractor was justified in selecting only the time period of the simulations that gave favorable results will be addressed later in this Chapter.

POET Report Internal Inconsistencies. In its Executive Summary the POET report stated that "overall, the BLA are well designed and work properly, with only some refinements or redesign required to increase the robustness of the overall discrimination function" [Tsai 1999a, p. iii]. In the Inquiry Report and in an interview as part of this investigation, Prof. Crawley expressed

concern that this statement did not adequately capture the shortcomings of the BLA and its use to analyze the IFT-1A data that were identified in the body of the POET report. This investigation agrees that the quoted sentence was overly generous. Nonetheless, several BLA deficiencies were articulated clearly in the immediately subsequent paragraphs of the POET report Executive Summary. Identified deficiencies included the GFA, lack of independence among some target features, use of a so-called "confidence" factor in the final targeting decision, the need for fairly detailed prior knowledge of the objects to be discriminated, and a classified issue. In view of these disclosures, the investigation concludes that the choice of wording in a single sentence, viewed in isolation, does not rise to the level of research misconduct.

Extended Kalman Filter. Prof. Postol has stated repeatedly that the POET team "did not show that they could find oscillating components in the signals from the IFT-1A experiment [using the EKF]. This is because there is no oscillating component in the IFT-1A data." The basis for his statement presumably is the absence of a clear spike in the power spectral density of the MRV data, as plotted in the redacted form of the POET report [Postol 2000]. However, the figures in question had no scales because of the redaction. Hence, there was no way for Prof Postol to know that the spike from the oscillatory signal was buried in the broad zero-frequency spike. (The POET report included these figures as part of its discussion of a low-pass filter to reduce high-frequency noise, and the figures were scaled to show just that – the noise.) In fact, a cursory examination of the MRV data plotted in the POET report reveals a low-frequency oscillation, although with much noise superimposed.

To further clarify the situation, an individual highly experienced in the use of Kalman Filters reviewed the description of the EKF analysis in the POET report as part of the current investigation. He found it to be credible, with the limitations of the EKF properly documented in the POET report. For instance, the POET report correctly emphasized that convergence of the EKF for IFT-1A data was quite sensitive to the choice of initialization parameters and, therefore, probably was not suitable for BLA purposes. He then verified the correctness of the software used by the POET team and reproduced some of the POET EKF computations themselves. (In particular, Figure 15 of the POET report was reproduced.) The investigator also examined the software and found it to embody a standard EKF formulation. The investigation concludes that this issue involves no research misconduct. For completeness, it should be noted that the EKF had been deleted from the BLA prior to IFT-1A.

Interpretation of the Statement of Work. The BMDO director stated at the time of the POET study that "the scope of the POET review has been narrowly defined to provide confidence to the {National Missile Defense] NMD Program Manager that the Boeing EKV, utilizing TRW-supplied algorithms, will indeed technically perform as required" [Lyles, 1998]. The SOW, reproduced in Appendix A of the POET report [Tsai 1999a], contained three tasks,

- "Review of discrimination algorithms, software implementation, and associated [simulation] data developed by TRW for use in the BOEING EKV for consistency and correctness in its scientific, mathematical, and engineering principles"
- "Review of performance [of the BLA] against IFT-1A data"
- "[If] possible within the 2-month study ... estimate the performance the algorithms, implementation and associated data would provide given the expected data from IFT 3."

(IFT 3 was to have been the second flight of the Boeing EKV.) In addition, the EKF initially proposed but not employed by TRW was analyzed. This additional task was performed by verbal agreement between BMDO and the POET team, reportedly because allegations about the EKF were central to Dr. Schwartz' lawsuit. The POET report also provided responses in its Appendix B to numerous questions posed by the DCIS investigation team. All tasks were accomplished, although over six months rather than two.

Interviews with MDA officials conducted during the investigation indicate that BMDO management was satisfied that the POET study met the requirements of the SOW, including the additional task of analyzing the EKF. This investigation agrees. Additionally, although the SOW itself may have been narrow, its content was a BMDO management decision. For these reasons the investigation concludes that no research misconduct exists with respect to this issue.

Reconciliation of GAO and POET Reports. Contrary to the assertion in issue 6 of the Inquiry Report, the GAO reports [GAO 2002a, 2002b] and the POET report are not at variance on the functional status of the sensor and the time window analyzed. Rather, the GAO reports, written three years after the POET report, discussed these two matters, and the POET report did not. In interviews conducted as part of the present investigation, the GAO report authors did not fault the POET study (with the exception of Mr. Ghoshroy, who also faulted the GAO study). The Office of the Secretary of Defense (OSD) official who concurred formally on the GAO reports stated in an interview conducted as part of the present investigation that he did so, because the reports were not critical of BMDO's conduct and contained no recommendations for substantive action. Concurrence by OSD with the GAO reports was, in any case, an OSD management decision. The investigation concludes that this issue does not involve research misconduct.

Alleged Improper Manipulation of Simulation Predictions and IFT-1A Flight Data. Underlying the allegation that the contractor improperly changed the feature ellipses, discussed previously, is a larger allegation raised by the DCIS investigation team [Reed 2000] and subsequently by Prof. Postol [Postol 2000]:

- The contractor fraudulently used knowledge obtained from the IFT-1A flight to modify the simulation predications to improve discrimination results.
- The contractor selected only the most favorable portion of the flight data for comparison with the predictions, again to improve discrimination results.

Certainly, the contractor did incorporate into its predictions the actual cloud cover at the time of the flight, and a sensor noise model based on the actual time history of the FPA temperature. In addition, the contractor used only the low noise segments of the simulated data and the flight data for comparison [Boeing 1998a]. Whether these actions were improper depends principally on the purpose of IFT-1A. As explained at the beginning of this chapter, IFT-1A was an experiment, not a system verification. So, using information from the experiment to improve the computational model and thereby enhance its ability to discriminate was reasonable, provided that the actions were disclosed and that the model remained internally consistent. In addition, utilizing only the data that was not corrupted by noise was reasonable, provided that enough data was left to make meaningful comparisons and that the criteria for discarding the other data were disclosed. The investigation observed that these requirements were met, although the revised 60-Day Report could have been clearer in this regard [Boeing 1998a, Sec. 4.4.2.5.4.2].

Alleged Suppression of Misdeployed Decoy. As quoted in Chapter 1, "Background", Prof. Postol claimed in a letter to the White House Chief of Staff [Postol 2000] that "Data from the tenth object, a partially inflated medium balloon, is not shown in the figure, as this data was inexplicably removed from the IFT-1A telemetry, apparently because its signal appeared more like that expected for the warhead than the warhead itself." Actually, all medium balloons, partially inflated or otherwise, were represented in the reduced IFT-1A data analyzed by the POET team and depicted in several figures of their report. Instead, a small decoy was missing from this data, because it was too faint to follow easily in the FPA output when analyzed for the original 60-Day Report [Boeing 1997b]. Even this decoy was present in the reduced IFT-1A data prepared for the revised 60-Day Report [Boeing 1998a, Sec. 4.4.2.4.8.3]. Confusing this faint decoy with the MRV was highly unlikely, because their feature sets were well separated.

The investigation also developed several observations of a non-technical nature.

Claims that IFT-1A Verified Discrimination Capability. As noted above, both BMDO officials and the contractor made broad claims about the ability of the contractor EKV and BLA software to discriminate the MRV. To be sure, IFT-1A represented a useful step toward assessing discrimination capability. However, in light of the BLA shortcomings and IFT-1A experimental difficulties identified in the POET and GAO reports, those claims seem overly broad, if based on IFT-1A results. (Whether such claims were warranted based on the results of IFT-2 is beyond the scope of this investigation.) As noted by the GAO, the contractor made laudatory comments about IFT-1A, such as characterizing the test as a "success" and the sensor's performance as "excellent", that "increased the likelihood that test results would be interpreted in different ways and might even be misunderstood" [GAO 2002a, p. 6].

Technical Assistance for DCIS Investigation. The DCIS investigator was a lawyer with considerable investigative experience but little scientific background. He relied primarily on Dr. Schwartz, the "relator", who had a strong financial and personal interest in the outcome of the DCIS investigation, for technical advice.

Written List of Allegations and the Basis for Them. MIT initiated its inquiry without clear, written allegations [Canizares 2006, p. 17], although it reportedly did request them from Prof. Postol [R. Brown 2002b]. Instead, allegations were accumulated during the early part of the inquiry from letters and interviews with Prof. Postol. As noted previously, Prof. Postol stated that his charges were not aimed specifically at the POET study authors.

Confidentiality of the Inquiry. The importance of confidentiality was stressed in several inquiry interviews; e.g., [Crawley 2002d]. Nonetheless, according to investigation interviews with MIT employees, copies of a draft version of the Inquiry Report were not controlled adequately. Some information found its way into newspapers; e. g., [Broad 2003]. Apparently, this violation of federal and MIT policy was not investigated.

Comments by Meins and Tsai not Reflected in Inquiry Report. According to MIT policy [MIT 1997b], "After considering the responses of the alleged offender, the fact finder should prepare a final report, including an accurate summary of the information offered by the alleged offender..." Although the two LL authors prepared an extensive rebuttal to the Inquiry Report

[Meins 2002] and submitted it to MIT management, Prof. Crawley reported in an investigation interview that he was not aware of the rebuttal and, therefore, did not summarize it in his final report. Incidentally, that final report is labeled "draft" [Crawley 2002f].

Need for Classified Access in order to Perform Investigation. The investigation recommended by the Inquiry Report was delayed for three years, because MDA did not authorize access to relevant classified documents. Prof. Postol has made statements suggesting that the investigation could have been performed using only publicly available information [Postol 2006b]. This investigation does not agree. Several of the key documents already identified in Chapter 3, "Investigation Process", are classified. Access to classified information surrounding the majority of the technical issues discussed above was necessary to resolve them. A number of investigation interviews were conducted at a classified level. Most importantly, conducting an investigation into alleged research misconduct associated with the POET report without actually reading that classified report would have been inherently unreasonable and unjust.

Delays in Initiating the Investigation. On the other hand, Prof. Postol is correct that the investigation should have been conducted sooner. DOD did not follow the federal requirement to initiate an investigation responding to the Inquiry Report in a reasonable period of time. Delays made the investigation more difficult, left charges against the POET authors unresolved and tended to discredit DOD. The inquiry also might have been initiated sooner, although an external advisor concluded that the inquiry delay was not unreasonable [Press 2002]. Over the past several years, many participants changed positions or retired, and one key participant died. Participants' recollections of events, of course, also faded.

Value of an Advisor. The investigator found it extremely valuable to have a knowledgeable advisor with whom to discuss issues. This was especially the case, because the present investigation of alleged research misconduct apparently was the first conducted by DOD under the OSTP 2000 guidelines.

Prof. Crawley remarked during the interview for the current investigation that an "Inquiry Handbook" would have been useful to him. The investigator also might have benefited from an "Investigation Handbook".

Allegation of Financial and Other Irregularities. During the course of this investigation, Prof. Postol raised issues of financial irregularities at MIT and was referred by the investigator to the office of the DOD General Counsel. He also has suggested in various materials that MIT and LL management may be guilty of misleading Congress and federal investigators. Evidence of such actions should be submitted by him to the DOD/IG, FBI or other appropriate authority.

5. Findings

The findings resulting from the assessments in Chapter 4, "Discussion", are summarized here.

- There was sufficient connection between LL and the POET study to justify MIT conducting an inquiry.
- IFT-1A primarily was an experiment, not a system verification.
- Allegations of possible research misconduct against the POET team and LL management, as articulated in the Inquiry Report, were not substantiated by a preponderance of evidence.
- Related allegations of improper manipulation of simulation predictions and IFT-1A flight data, and of suppressing data on a misdeployed balloon were not substantiated by a preponderance of evidence.
- BMDO and contractor statements that IFT-1A demonstrated the discrimination capabilities of the BLA seem overly broad in light of the limitations of IFT-1A, including the BLA.
- The DCIS investigator relied for technical advice primarily on a scientist with a strong interest in the outcome of his investigation.
- MIT initiated its inquiry without clearly written allegations, did not protect the confidentiality of the inquiry process adequately, and did not follow its policy that the fact finder consider the responses of the alleged offenders and include in the inquiry final report an accurate summary of the information offered.
- Access to relevant classified information was essential to the conduct of this investigation.
- Excessive delay occurred in addressing the allegations of research misconduct, especially between the end of the inquiry and the beginning of this investigation.
- Complex inquiries and investigations of research misconduct should be performed by more than one person.

6. Recommendations

In conclusion, the investigation recommends:

1. Charges of research misconduct in connection with POET Study 1998-5 be dismissed.
2. Reasonable efforts be made to publicly exonerate the two POET authors at LL, in accordance with their wishes.
3. Confidentiality requirements be strengthened in the OSTP, DOD, and MIT research misconduct policies, and then enforced.
4. A requirement for a complete set of written allegations, along with the basis for making them, be added to the OSTP, DOD, and MIT research misconduct policies.
5. DCIS investigators be provided with knowledgeable, disinterested technical assistance when conducting technically complex investigations.
6. A lessons-learned report be prepared by OSD several months from the date of the present report. (It is likely that not all lessons will have been learned until some months after this report has been released.)

7. Acknowledgements

This investigation could not have been completed without the dedication and hard work of Mr. Norman Augustine, who joined the investigator in conducting nearly every interview, reviewed dozens of documents, repeatedly reviewed drafts of this report, and shared his excellent judgment on many difficult issues.

The investigator wishes also to express his appreciation to each of the 49 individuals who voluntarily shared with Mr. Augustine and him their recollections and assessments of the issues addressed in this report. Their insights went well beyond the information available in written reports. Although many of the interviewees had strong feelings on these matters, each of them seemed forthright, and in our view not one attempted to improperly influence the investigation.

The investigator thanks Mr. Roger Sudbury of Lincoln Laboratory, Mr. Thomas Duffy of the Missile Defense Agency, and Mr. Keith Dixon of the Defense Criminal Investigative Service for tirelessly tracking down and providing copies of over 160 documents, many of which were classified.

Finally, the investigator thanks his colleagues Drs. Kathleen Kraemer, Stephen Price, and Robert Morris for independently assessing the quality of the IFT-1A sensor data and Dr. Eric Blasch for evaluating the POET EKF analysis.

Appendix A

Charge to the Investigator

MEMORANDUM FOR DR. BRENDAN B. GODFREY, DIRECTOR, AIR FORCE OFFICE OF SCIENTIFICRESEARCH

THROUGH: SECRETARY OF THE AIR FORCE

SUBJECT: Designation as Investigator into Allegations of Research Misconduct at Lincoln Laboratory

In 2001, a faculty member lodged research misconduct allegations with the Massachusetts Institute of Technology (MIT) against two Lincoln Laboratory scientists who contributed to a Phase One Engineering Team (POET) review of some portions of a 1997 missile defense-related flight test. Under Federal policy, responses to allegations of research misconduct include three phases: inquiry, investigation, and adjudication. Consistent with that policy, MIT conducted an inquiry that concluded there were six open issues that warranted investigation. In February 2003, the MIT Provost advised the Missile Defense Agency that MIT intended to proceed to an investigation of the unresolved issues and requested that outside investigators for MIT be allowed access to classified information. The Department, for national security reasons, declined to authorize the requested access to classified information. Thus, the inquiry phase has been completed, but the investigation and adjudication phases have not.

I have determined that the allegations relate to a major acquisition program of the Department, and that it is in the public interest for the Department to complete the investigation of these allegations. Accordingly, with the approval of the Secretary of the Air Force, I designate you as the investigator. I will perform the function of adjudicator.

You will investigate the six issues identified in the MIT inquiry officer's report using the standards in the *Federal Policy on Research Misconduct* as implemented in DOD Instruction 3210.7, *Research Integrity and Misconduct.* You may consider prior investigations of related allegations that were conducted by other Government entities, e.g., the Government Accountability Office, the Federal Bureau of Investigation, and the Defense Criminal Investigative Service. At the conclusion of your investigation, you are to prepare a report of your findings and recommendations and submit it directly to me. Mr. Douglas Larsen, Deputy General Counsel (Acquisition & Logistics), Office of the General Counsel of the Department of Defense, is available to provide legal advice in regard to this matter. You may contact him at 703-614-4398 or larsend@dodgc.osd.mil.

/s/ Kenneth Krieg, 8 Feb 06

Appendix B

Advisor's Statement of Responsibility

The actual investigation of alleged research misconduct is to be conducted by Dr. Brendan Godfrey. The role of the advisor and consultant to the investigator is to assist in ensuring that the investigation has been thorough and impartial. This will include advising whether or not the investigator has been provided full access to all relevant information, whether or not the review has been conducted in a balanced fashion, and whether or not the investigator has been impeded in any way in carrying out his efforts. The advisor's comments on the investigation will be available to the USD(AT&L) and unclassified comments will be available to MIT. It is specifically not the advisor's role to opine on the merits of the allegation of academic misconduct, or to certify the technical accuracy of any analyses performed in conjunction with the review process.

[Larsen 2006]

Appendix C
Inquiry Report Summary Section

Report to the Provost
On the Inquiry into the
Allegations of Research Misconduct
In Connection with POET Study 1998-5

Submitted by Prof. Ed Crawley
October 29, 2002

Background

This *Inquiry* report was commissioned by Provost Brown, by his letter of March 1, 2002 to Professor Ed Crawley. The allegations of academic misconduct were with regard to the work of Dr. Ming-Jer Tsai and Dr. Charles K. Meins, senior staff members at Lincoln Laboratory, in their work on the POET Study 1998-5, "Independent Review of TRW Discrimination Techniques, Final Report", issued Jan 25, 1999 (the Report). Academic misconduct is defined in Section 10.1 of MIT Policies and Procedures.

Principle Recommendation of the Inquiry

An investigation into the preparation and subsequent presentation of the POET Report is recommended.

Recommendations and Rationale

Background

The inquiry that I have concluded is at the extreme end of the complexity scale for those imagined by MIT's processes. The issues that compound the inquiry include:

- The respondents are not members of the campus community, but are members of the technical staff at the Lincoln Laboratory, a place with a different organizational culture and special charter. The nature of the management structure of the Lincoln Laboratory involves their management in supervision and review of work products in ways not common on campus.
- The actual POET Report 1998-5 that is the direct subject of this inquiry is classified. The complainant has only had access to the redacted unclassified version, and various third party commentaries on the report. Because of the classification issue, the respondents are somewhat limited in their ability to respond. As part of the inquiry, I have had access to the classified report.
- The issue at the heart of the POET Report has been the subject of at least three other investigations, conducted by or on behalf of the federal government. Not only does this

create a substantial amount of information in review, but it introduces the possibility of reaching conclusions that may be at variance with those reached by the other reports on the topic, and the burden of reconciling those variances.

Recommendation, Findings and Rationale

At this time, I find that an investigation is warranted, and recommend that one be carried out. This recommendation is based on two aspects of rationale: the inability to close the issue at the level of an inquiry; and the standing of the effort to write and present the POET Report as, in part, a product of MIT employees.

To date, I have conducted an inquiry at least as comprehensive as envisioned by Policies and Procedures. I have conducted several rounds of meetings with the complainant and respondents, and have read volumes of materials supplied by both (including the classified version of the POET Report, and other federal government agency reports written on the issue). I have written an interim draft of my report, and have received input on the interim draft from all parties. A more detailed description of the inquiry process is given at the end of this document.

At the conclusion of the process, I find there are still sufficient inconsistencies, open issues, and needs for detailed rectification of facts that the allegations cannot be closed by this inquiry. Under the criteria stated in MIT Policies and Procedures, I am therefore recommending that an investigation be carried out.

Furthermore, I find that there was enough involvement of MIT Lincoln Laboratory employees and management in the preparation and subsequent discussions of the POET Report that it would be appropriate to continue to consider it the subject of an investigation commissioned by MIT.

Additionally, I find that issues under discussion are of critical importance for reasons of both process and product. The process issues associated with the preparation of the POET Report go to the fundamental basis of the relationship between the government and the Lincoln Laboratory as an FFRDC managed by MIT in the public interest. The product, the POET Report, had material impact on a legal action, and potentially on the national debate on ballistic missile defense.

What is most at issue is not the detailed technical merit of the work the Lincoln Laboratory staff did. Rather it is the scope and completeness of the work – what they did and didn't do, how the results were portrayed and reported, and the interpretation of their technical results in contrast with those of other investigations.

Specifically, at the conclusion of the inquiry, the principal open issues are:

1. The functional status of the IR sensors onboard the emulated EKV during IFT-1A. The POET Report is silent on the issue of the calibration and functional status of the IR sensors. By this silence, the authors imply that the sensors were functioning sufficiently well that their functional status did not impact the question "What performance do the algorithms, software implementation, and associated data provided using the data provided by IFT1A" (extracted

from the POET Statement of Work, paragraph A.1.2 Objectives, p. 37). In contrast, the GAO report raises serious issues about the functionality of the sensor.

2. The time span of data analyzed as part of the POET Study. The POET Report analyzes about 17 seconds of the total of about 60 seconds of data taken. According to the GAO Report, all the data was available to TRW. Therefore in analyzing the performance of the TRW algorithm, why was only a subset of the data examined by the POET team?
3. The target identification algorithm, particularly with regard to "re-initialization" of the algorithm which calculates the *a posteriori* probability of a target being classified as a true reentry vehicle (P_{AT}), the "movement" of the feature ellipses between two of TRW's reports, and the robustness of the algorithm. There are discrepancies between the POET Report and a DCIS investigation on the subject of the "re-initialization" and ellipse "movement". The POET Report seems internally self-contradictory on the question of the effectiveness and robustness of the algorithms.
4. The applicability of the extended Kalman filter (EKF). The Report concludes that the EKF appears to track the signals reasonably well. This would suggest that a dominant harmonic is present in the signal, which independent analysis by Prof. Postol suggests is not the case.

Two additional issues are related to the process used in the POET study, and its subsequent reporting. Of course, these issues are not explicitly addressed in the POET Report, but rather emerge from an examination of the overall record.

5. The process of setting and interpreting the scope of the POET study. The POET study was commissioned by MDA (then BMDO) in response to a DCIS request. There was a written Statement of Work, which is included in the Report. However, in some cases, the authors appear to have interpreted this SOW quite narrowly, and in other aspects expanded upon it. How did the authors, and potentially others within the Lincoln Laboratory, interpret the scope of effort and responsibility implied by the Statement of Work, and what impact did it have on the resolution of the four issues outlined above?
6. The process of responding to the GAO report. The GAO report and the POET report are at variance on several issues, including the functional status of the sensor and time window analyzed. Yet the GAO report also claims that "the Department of Defense concurred with our findings" (GAO -02-124, p. 9). Where in the interactions of the Lincoln Laboratory, the DOD and the GAO were the discrepancies resolved?

A suggested set of initial steps in the investigation is listed below. These are intended as neither prescriptive nor inclusive, but merely a guide as how to begin an investigation of this matter.

1. Read the unclassified version of the POET Report, GAO reports and other general background materials.
2. Meet with the complainant and respondents, in a first round to gain an understanding of the issues. Read the classified POET Report. Then meet with all parties again in a second round to identify with some precision the discrepancies and open issues.
3. Read the history of DCIS correspondence with MDA, the history of Lincoln Laboratory correspondence with MDA and the GAO, and other applicable primary source documents as available.
4. Meet with appropriate DCIS, MDA and GAO officials as available.

Appendix D
Response by Lincoln Laboratory POET Authors

We feel that Dr. Godfrey and Mr. Augustine have conducted a thorough and credible study. We were given a fair hearing, our case was clearly understood, and we were given the opportunity to address and rebut the various charges. Dr. Godfrey involved a team of scientists to analyze the data used in the POET report and we appreciate their efforts in replicating the results contained in POET Study 1998-5.

With the exception of two minor technical points, we accept all the findings and conclusions as described in the investigation report. The first point is on page 26 ("Choice of Data Analyzed") where the question of the appropriate span of data is discussed. The POET report concentrated on the analysis reported by TRW. We therefore used the same span of data that TRW did. The second point is on page 27 ("Ellipse Movement") where the data gaps are discussed. The investigation report noted the change of sensor noise over time which, while true, was a secondary concern. The primary issue was the decreasing range between the sensor and the targets over time. Target detections first occur when the target intensity is comparable to the detection threshold: some of the measurements are above the threshold and the rest below. This leads to gaps in the data. Since the threshold decreases as range decreases, starting the analysis at a shorter range (later time) yields fewer gaps to fill.

We particularly appreciate the recommendation that MIT issue a public statement exonerating us of the allegations. On this point, a simple statement saying that we were cleared of the charges of academic misconduct is preferred.

Dr. Ming-Jer Tsai
Dr. Charles K. Meins Jr
MIT Lincoln Laboratory

[Tsai 2006]

Appendix E
Individuals Interviewed

Alan, Douglas, Director, Missile Defense Technologies, Computer Science Corporation (4 August 2006)
Barcikowski, Henry, Missile Defense Agency (25 September 2006)
Barkakati, Naba, GAO (9 June 2006)
Barton, Phillip, Principal Lead Scientist, Computer Science Corporation (4 August 2006)
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Briggs, David, Director, Lincoln Laboratory (12 April 2006)
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Appendix H
Table of Acronyms

AFRL	Air Force Research Laboratory
BLA	Baseline Algorithm
BMDO	Ballistic Missile Defense Organization
DCIS	Defense Criminal Investigative Service
DOD	Department of Defense
DOJ	Department of Justice
DSS	Defense Security Service
EKF	Extended Kalman Filter
EKV	Exoatmospheric Kill Vehicle
FBI	Federal Bureau of Investigation
FFRDC	Federally Funded Research and Development Center
FPA	Focal Plane Array
GAO	General Accountability Office
GFA	Gap-Filling Algorithm
IFT	Integrated Flight Test
IG	Inspector General
IR	infrared
LL	Lincoln Laboratory
MCDR	Management Control Deficiency Report
MDA	Missile Defense Agency
MIT	Massachusetts Institute of Technology
MRV	Mock Reentry Vehicle
NMD	National Missile Defense
NRC	Nichols Research Corporation
OSD	Office of the Secretary of Defense
OSTP	Office of Science and Technology Policy
POET	Phase One Engineering Team
SOW	Statement of Work
SPL	Sensor Payload
TRD	Technical Requirements Document
USD(AT&L)	Undersecretary of Defense for Acquisition, Technology and Logistics

Appendix I
Biographical Information

Norman R. Augustine graduated from Princeton University in 1957 and was awarded a BSE in Aeronautical Engineering, magna cum laude, and has been elected to Tau Beta Pi, Phi Beta Kappa and Sigma Xi. He subsequently was granted an MSE in Aeronautical Engineering, also from Princeton. In his practice of engineering he held the position of Vice President for Technical Operations of the Martin Marietta Corporation, was a licensed professional engineer in the State of Texas, served as president of the American Institute of Aeronautics and Astronautics, chairman of the National Academy of Engineering, chairman of the Defense Science Board, and as a member of the President's Council of Advisors on Science and Technology in both Democratic and Republican administrations. In business he served as chairman and CEO of the Martin Marietta Corporation and of the Lockheed Martin Corporation, the latter at the time of his service employing some 62,000 engineers and scientists. In government, Mr. Augustine has been Assistant Director of Defense Research and Engineering in the office of the Secretary of Defense, Assistant Secretary of the Army for Research and Development, and Under Secretary of the Army. In academia, he has served as a trustee of Johns Hopkins, MIT and Princeton, and has been a Lecturer with the Rank of Professor at Princeton University. Mr. Augustine is a fellow of the Royal Aeronautical Society, the American Astronautical Society, the Institute of Electrical and Electronic Engineers, the American Academy of Arts and Sciences, the American Association for the Advancement of Science, and the American Institute of Aeronautics and Astronautics. He has been awarded the Department of Defense Distinguished Service Medal five times and the Joint Chiefs of Staff Distinguished Public Service Award. He has received twenty honorary degrees and has been awarded the National Medal of Technology by the President of the United States.

Brendan B. Godfrey received a BS in Physics from the University of Minnesota in 1967, graduating with High Distinction, and a PhD in Physics from Princeton University in 1970. A member of the federal Senior Executive Service, he currently is Director of the Air Force Office of Scientific Research, responsible for the $400M basic research program of the U.S. Air Force. Dr. Godfrey began his professional career in 1970 as an Air Force officer at the Air Force Weapons Laboratory, Kirtland AFB, New Mexico, where he performed research on numerical simulation of plasmas. In 1972 he joined the Los Alamos National Laboratory, N.M., where he later was responsible for establishing the intense particle beam research program. He moved to the private sector in 1979 to manage and conduct intense microwave and particle beam research at Mission Research Corp., becoming Vice President and Regional Manager in 1987. In 1989 Dr. Godfrey returned to the Air Force as a civilian to be Chief Scientist of the Air Force Weapons Laboratory. His later assignments include Director of Advanced Weapons and Survivability of the Phillips Laboratory at Kirtland AFB, Director of the Armstrong Laboratory at Brooks AFB, Texas, and Director of Plans and Programs for the Air Force Research Laboratory at Wright-Patterson AFB, Ohio. Prior to his current assignment, he was Deputy Director of the 311th Human Systems Wing, Brooks City-Base, Texas. Dr. Godfrey is known for his contributions to computational plasma physics theory and applications. The Minneapolis native is the author of more than 200 publications and reports. Dr. Godfrey is a fellow of the American Physical Society and of the Institute of Electrical and Electronics Engineers. He twice received Meritorious Presidential Rank Awards, and numerous recognitions from the Air Force.

Responses to Recent Criticisms Regarding the U.S. Missile Defense Program

April 30, 2008
MDA Legislative Affairs
www.mda.mil
P: (703) 695-8520

THREAT

Statement: The threat from ballistic missile attacks has gone down since 2001, not up. (Philip Coyle, Center for Defense Information, April 16, HOGR Hearing)
Response: Today, there are 26 countries with ballistic missile capabilities, compared to 9 in 1972. Roughly 120 ballistic missile launches occurred in 2007 alone. The cost of one nuclear or weapon of mass destruction (WMD) attack could reach into tens of billions in damage to our country and our allies, not to mention the loss of thousands of lives.

Statement: There will be little justification for the BMDS if diplomacy succeeds and North Korea gives up its ballistic missile arsenal. (Coyle, April 16, HOGR)
Response: North Korea could be one of several potential adversaries with ballistic missile capabilities. New ballistic missile threats could emerge at any time. Missile defense accomplishes multiple goals: 1) Removes U.S. vulnerability to ballistic missile attacks. 2) Devalues ballistic missiles by creating doubt in the minds of potential adversaries about their capabilities. 3) Preserves U.S. freedom of action. 4) Reassures our allies.

Statement: North Korea and Iran will launch multiple ICBMs, not just one. (Coyle, April 16, HOGR Hearing)
Response: Both Iran and North Korea have conducted exercises in which they have launched multiple ballistic missiles with varying ranges. Each ICBM launch, however, is unique due to its trajectory and would represent a separate missile defense engagement. The BMDS is capable of intercepting multiple ICBM warheads from North Korea or Iran if required.

Statement: The ballistic missile threat today is limited and changing relatively slowly. There's every reason to believe that it can be addressed through measured military preparedness and aggressive diplomacy. The most serious threat the U.S. and her allies face are the short-range missiles confronting us in various theaters of operation, not the long-range missiles that are the focus of the bulk of the anti-ballistic missile budget. (Joseph Cirincione, Ploughshares Foundation, March 5, HOGR Hearing)
Response: Russia, China and North Korea continue to sell missile technologies for revenue and diplomatic influence. China continues to assist Iran in creating self-sufficient ballistic missile capabilities, supplying dual-use items, missile guidance systems and solid-fuel missile technology to Iran.
North Korea: Development of the Taepo Dong 2, which has the potential to reach the continental United States with a nuclear payload, continues despite a failed July 2006 test launch. North Korea also continues work on an intermediate range ballistic missile. Currently, North Korea has 600 to 800 deployable SRBMs and MRBMs.
Iran: Iran has the largest force of ballistic missiles in the Middle East, several hundred SRBMs and Shahab-3 MRBMs. Iran continues its efforts to develop and acquire ballistic missiles capable of striking Israel and central Europe. It has reportedly acquired, from North Korea, a version of the IRBM that North Korea is developing. Iran has made several claims in the press in 2008 describing its continued efforts at developing an indigenous space

program as well longer range and more capable ballistic missiles. With continued foreign assistance, Iran could have an ICBM capable of reaching the US as early as 2015.
China: China currently has less than 50 ICBMs capable of targeting the United States; however the number of ICBM warheads capable of reaching the United States could more than double in the next 15 years, especially if MIRVs are employed. The CSS-10 Mod-X-2 (DF-31A) ICBM can strike the continental United States and is joining China's operational inventory along with the less-capable DF-31. Other future ICBMs could include some with multiple, independently-targeted reentry vehicles (MIRVs) Beijing continues to develop new SRBMs, MRBMs, and IRBMs, and has fielded approximately 900 mobile SRBMs to brigades opposite Taiwan, increasing at a rate of over 100 missiles per year.

TESTING

Statement: "We have never, in the history of the last 20 years, had a realistic test of any of these systems [BMDS], the kinds you describe, that it's flown up against what we would actually expect even a primitive country to deploy, like North Korea or Iran." (Cirincione, March 5, HOGR Hearing)
Response: We have conducted multiple flight intercepts that have demonstrated the capability of the BMDS to intercept likely ballistic missiles from Iran or North Korea. Our latest test in September, 2007 was a successful long-range flight intercept of a threat-representative target. This test used operational infrastructure, operational fire control software, operational radars, and operational crews.

Statement: In early GMD tests, MDA flew the interceptor away from the sun and "over its shoulder" so that the sun was not shining into the "eyes" of the interceptor. (Coyle, April 16, HOGR Hearing)
Response: These early flight tests supported our proof-of-concept program for GMD. Since the 2002 decision to field, we have conducted hardware-in-the-loop ground tests where the systems ability to overcome flying directly into the sun has been demonstrated.

Statement: MDA has only conducted 2 successful flight tests in the last five years. It will take MDA about 50 years to conduct the 20 necessary successful flight tests to meet the requirements for realistic operational testing. (Coyle, April 16, HOGR Hearing)
Response: MDA testing plan is approved by DOT&E -- it is event driven, not schedule driven. In order to analyze the data from each test and roll the results into the next test, we can only conduct two intercept tests per year. DOT&E/OTA support the use of ground tests and models and simulations to further validate BMDS performance.

Statement: MDA has only conducted five GMD tests in the last five years, 3 of which failed, a success rate of 40 percent. (Coyle, April 16, HOGR Hearing)
Response: Since 2002, we have conducted 9 GMD flight intercepts of which:
-6 have been successful
-1 intercept missed because the EKV did not separate
-2 tests were no launches – intercept capability not tested
-We also had one no test due to a target failure

Statement: MDA has not included countermeasures or decoys in its tests over the last five years. (Coyle, April 16, HOGR Hearing)
Response: As the BMDS matures, MDA pushes the limits of system performance in modeling and simulation and increasingly complex flight tests – crawl, walk, run approach to

testing. After demonstrating the EKV and booster performance, we focused on intercepting a threat representative target, which did not include the use of countermeasures. The next long-range flight intercept (FTG-04) will include countermeasures.

Statement: MDA has not conducted an intercept test in bad weather, at night, or when the sun is shining in a disadvantageous position. (Coyle, April 16, HOGR Hearing)
Response: We have conducted and will continue to conduct day and night engagements. There are no scheduled tests that include testing under adverse weather conditions because of data collection and range safety. We are increasing the complexity of each test within range safety parameters.

Statement: MDA has not tested against an enemy reentry vehicle that is spin-stabilized to minimize its radar-cross section. The agency also has not launched an interceptor from Kwajalein at a target from Kodiak to simulate a long-range flight intercept more closely resembling a real ICBM trajectory. (Coyle, April 16, HOGR Hearing)
Response: We pay close attention to potential adversary countermeasure development and improvements in the performance of adversary offensive weapons. We tested against spin-stabilized reentry vehicles throughout early development and more recent tests. GMD plans to conduct a long-range flight intercept in FY09 (FTG-06).

Statement: MDA has not practiced its shoot-look-shoot CONOPs during its flight tests. The agency also has not launched multiple interceptors at multiple targets. (Coyle, April 16, HOGR Hearing)
Response: We have conducted multiple engagements by Aegis BMD when the ship engaged two SRBMs. THAAD will engage multiple targets in FTT-12 (2009). GMD has no plans to conduct a flight test with multiple targets because of cost and because the targeting and launch of each interceptor is treated by the fire control as an independent engagement. We conduct multiple ground tests and use models and simulation to test the performance of the interceptor in salvo-like engagements.

Statement: The countermeasures and decoys used in the first five tests didn't resemble the target reentry vehicle and the defender was provided advance information on how both the mock enemy target and the balloons would appear to the kill vehicle sensors. (Coyle, April 16, HOGR Hearing)
Response: The countermeasures used in early testing were designed to match to certain specific characteristics of the RV they accompanied – the characteristics are classified. Early testing was focused on proving the viability of hit-to-kill technology in midcourse. Today, the system does not have knowledge of the target that it will face.

COUNTERMEASURES

Statement: Shooting down an enemy missile armed with decoys and countermeasures is like shooting hole-in-one when the hole is going at 17,000 mph and the green is covered with black circles the same size as the hole – in other words, the defender has no idea what to aim for. (Coyle, April 16, HOGR Hearing)
Response: We proved this was possible in five intercept tests from 1999 to 2002 using the prototype of the current interceptor kill vehicle. The interceptor currently deployed is more advanced than the earlier models, providing even more capability against the type of countermeasures we would expect from countries like North Korea or Iran. We plan to test against targets armed with countermeasures in our next GMD flight intercept (FTG-04).

Future capabilities like better algorithms, volume kill, birth-to-death tracking, and layered defenses will be key to defeating complex countermeasures.

Statement: The enemy can use reflective white paint that would cause the ABL laser to bounce off. (Coyle, April 16, HOGR Hearing)
Response: ABL's lethality analyses have been done on a variety of missile targets in varying configurations and paint schemes, including white paint. In the 1995 timeframe, full-scale tests were conducted at HELSTF using the MIRACL laser to validate these analyses; during these tests approximately half of the test targets were painted white. These tests were successful. The Agency is currently exploring the potential impacts of more advanced countermeasures as part of a classified activity.

Statement: The enemy can release infrared burning pellets that might confuse defensive infrared interceptors. (Coyle, April 16, HOGR Hearing)
Response: A potential adversary may attempt to use counter-measures of this sort; however, such countermeasures are technically challenging and may be far too complex for most countries. The EKV has sensors other than infrared that can locate the enemy warhead.

Statement: The enemy can use radar absorbing materials on reentry vehicles to reduce their radar cross sections and make them more stealthy. (Coyle, April 16, HOGR Hearing)

Response: Radar absorbing material would not prevent the EKV's infrared sensor from finding the warhead. In addition, a potential adversary may attempt to use counter-measures of this sort but such work is very challenging and may be far too complex for most countries.

OPERATIONAL EFFECTIVENESS

Statement: "This is close as we've ever come to an unconstrained budget, and I would say that we're no further along in our ability to actually hit a real enemy missile now than we were 20 years ago. Some advances in sensors and guidance systems, but not significantly beyond where we were in the 1980s." (Cirincione, March 5, HOGR Hearing)
Response: We have made significant technical and scientific advances across the ballistic missile defense spectrum over the last twenty years. We have proven through robust testing that hit-to-kill technology works. MDA has developed the necessary sensors and discrimination technology that can discriminate and locate a threat-representative warhead. We have fielded operationally-capable short- and long-range missile defenses. In the 1980s, we had not proven any of these developments were even possible. While our research and development activities conducted in that era continue to be of value today, we cannot overlook how much ballistic missile defense technology has advanced since then.

Statement: MDA hasn't fixed the EKV anomaly that has persisted in the flight test program since 2001. (Coyle, April 16, HOGR Hearing)
Response: We have developed software to mitigate this anomaly and flight tested it. The anomaly has never affected interceptor performance during seven successful intercepts. This software has proved very effective and has been uploaded onto our operational GBI fleet.

Statement: The Pentagon has not developed operational metrics/criteria for fielding the BMDS (e.g., Clinton criteria: threat materialization, status of technology, affordability, and implications on overall strategic environment). (Coyle, April 16, HOGR Hearing)

Responses to Recent Criticisms Regarding the U.S. Missile Defense Program

Response: In 2002, the President directed DoD to begin fielding ballistic missile defenses based on the following: 1) The threat is real and urgent. 2) The technology would soon be ready for fielding. 3) BMD would have a positive effect on international environment. This direction was consistent with the National Missile Defense Act of 1999.

Statement: Under Secretary AT/L Aldridge was mistaken when he said in 2003 that the projected BMDS would be 90 percent effective. The system still can't provide that level of effectiveness even today. (Coyle, April 16, HOGR Hearing)
Response: The effectiveness of the BMDS depends upon a variety of factors including the launch point, the trajectory, range, and complexity of the enemy ballistic missile – actual numbers are classified. The warfighter has confidence that the BMDS will work against simple long-range threats. Effectiveness will increase as capabilities are added or upgraded.

Statement: The only way the SBX can track a baseball over San Francisco while located in the Chesapeake Bay is if the baseball is not moving and was standing still. (Coyle, April 16, HOGR Hearing)
Response: This statement is not accurate. Not only can we tell whether or not the baseball is stationary, we can also tell whether or not the baseball is spinning in flight.

Statement: The majority of BMDS assets are vulnerable to direct military attack including acts of terrorism. (Coyle, April 16, HOGR Hearing)
Response: The current CI threat perspective is that there are no known terrorist threats specifically targeting the BMDS. While BMDS assets are subject to direct military attack, the BMDS assets have been designated Security System Level "A" assets. This designation is assigned to assets that affect the U.S Strategic Capability and are afforded the highest security protection. The security architecture coupled with the Rules of Engagement by security forces enable us to provide adequate protection to all BMDS assets.

Statement: The primary purpose of the European Site is to defend U.S. radars in Greenland and the UK, not to defend Europe. (Coyle, April 16, HOGR Hearing)
Response: The European Site provides a 24/7 days a week defensive coverage for the European Site and augments existing U.S. defensive coverage against ballistic missile threats from the Middle East. In fact, the protection of Europe is why we are planning to use a 2-stage GBI – it has less burn time and can intercept earlier.

Statement: The EMR and the European Interceptor Site will be key targets. (Coyle, April 16, HOGR Hearing)
Response: The European Site will be able to provide protection against long-range threats to much of Europe and will supplement protection for the United States. The United States will provide additional defenses as needed to defend these sites, if warranted by a known threat.

Statement: The GBIs in Europe can be converted to offensive missiles – after all, they are based on a proven launch vehicle, the Pegasus. (Coyle, April 16, HOGR Hearing)
Response: The GBI only carries a kinetic warhead, not high explosives or any other type of offensive warhead. The GBI has never been integrated with an offensive weapons package. The United States already maintains a very effective strategic deterrent force without regard to these ten defensive interceptors.

Responses to Recent Criticisms Regarding the U.S. Missile Defense Program

Approved for public release: Case No: 08-MDA-3477

Statement: We don't have much to show for the $120B that we have spent on missile defense so far (more money than what was spent on the Manhattan and Apollo projects). (Coyle, April 16, HOGR Hearing)
Response: The current program has provided an initial defensive capability where none existed before in near record time. We can't forget that the BMD program has been modified significantly several times since 1983 - many programs were started and never completed. The BMDS has been used twice in less than 2 years in real-world situations to improve stability (July 2006) and safety (Feb 2008).

Statement: It is cheaper for the enemy to increase its offenses than it is for the defender to increase its defenses. (Coyle, April 16, HOGR Hearing)
Response: The consequences of even one nuclear, chemical or biological weapon attack makes our investment in ballistic missile defense worthwhile. Our missile defense system also reassures our allies and discourages proliferation.

Statement: STSS and SBIRS-High are billions of dollars over budget and years behind schedule. (Coyle, April 16, HOGR Hearing)
Response: SBIRS-high is an Air Force Space Command managed program, not a MDA program. STSS is over budget by about $320M. However, we expect to launch our first two demonstration satellites later this year. An STSS operational constellation could provide much needed a global birth-to-death tracking capability.

Statement: "I believe that the ballistic missile defense program is the longest-running scam in the history of the Department of Defense....And if you leave this decision to the Joint Chiefs, they won't spend anything near what this administration is requesting." (Cirincione, March 5, HOGR Hearing)
Response: The Missile Defense Agency was established in 2001 with the mission of protecting the U.S. homeland, deployed forces, and friends and allies from ballistic missiles of all ranges and in all phases of flight. Prior to MDA's establishment, several independent but related missile defense programs existed within the Services. Individually these theater and national ballistic missile defense systems could not accomplish MDA's mission. Multiple, independent ballistic missile programs would have resulted in highly cost-inefficient duplication, a lack of synergy, and prevented us from meeting the Secretary of Defense's program direction.

To accomplish this mission, we needed an integrated system that could engage multiple threats in several regions across the globe. A militarily effective system also had to be layered, capable of engaging ballistic missiles in all phases of flight. Moreover, to reduce costs and increase capability, we needed to leverage the overlapping functions of the various missile defense programs, maximize performance, and use resources more efficiently. MDA has accomplished these goals and has developed and fielded ballistic missile defense capable of providing a limited defensive capability against ballistic missile threats.

The FY02 Defense Authorization required the Joint Requirements Oversight Council (JROC) to annually review cost, schedule and performance goals, as well as the program plan for the Department's missile defense programs. JROC concurred with MDA's goals and plans for the development and procurement of the currently programmed BMDS. In addition, the BMDS remains at the top of the Integrated Priority List of the various combatant commanders.

Mr. TIERNEY. General, I do have to make some preliminary comments. One is that your full written statement will be in the record, and I know it's quite extensive.

We have several issues going on here today. One is that Mr. Ahern from Ireland is over here talking. Some Members will want to come and go to that. So I want to move the hearing if we can. We have a second panel as well and votes coming in. So I want to give you your full 5 minutes for your opening statement and then go to questions.

But I understand—I look at your statement, it's certainly longer than 5 minutes, and I understand you also want to show some slides or a video or whatever. So how you manage that and get it within the 5 minutes without making me look like an ogre for shutting you down will be appreciated because we will pretty much keep it to 5 minutes, maybe with a little bit of leeway. But it is up to you how you want to work on that. Then we'll let people ask questions and go from there.

I appreciate that. And you are recognized.

Mr. SHAYS. Mr. Chairman, could I make a request that he be given 10 minutes? This is the gentleman who is responsible for the entire program. It would seem to me that there's no logic to confining his testimony and letting us hear what he has to say.

Mr. TIERNEY. Mr. Shays, we'll be as generous as we can within the confines. We have those issues that are around here this morning. Certainly it's the witness' choice to use video or to testify. He can use his time as he wants. General, you are recognized.

STATEMENT OF LIEUTENANT GENERAL HENRY A. "TREY" OBERING III, USAF DIRECTOR, MISSILE DEFENSE AGENCY, OFFICE OF THE SECRETARY OF DEFENSE

General OBERING. Good morning, Mr. Chairman, Representative Shays, and other distinguished members of the committee. As the Director of the Missile Defense Agency, it is my role to develop, test and initially field an integrated, layered ballistic missile defense system. And I want to emphasize the integrated and layered nature of these capabilities which our critics overlook and which I will expand upon later.

I am happy to report that 2007 was the best year we ever had and it reflects the hard work of thousands of men and women across the country. This past year we've made progress in our fielding and testing and we've taken major steps to defend our homeland as well as our deployed forces and allies in the Pacific. With NATO's recent recognition of the merging missile threat by all of its member nations, its endorsement of our long-range defense proposals, and its tasking to propose options for shorter-range protection and integration, we will be able to defend our deployed forces and allies in that important theater as well.

In addition, we have active cooperation efforts with 18 nations worldwide. Our success to date has also affected our increasingly complex and realistic test program which we will continue to expand over the next several years. With the 10 of 10 successful intercepts in 2007, we have now achieved 34 of 42 successful hit to kill intercepts since 2001. We have not had a major system failure in our flight test program in over 3 years.

Two relatively recent milestones are worth highlighting. One was the success of our allied partner, Japan, in their first intercept flight test off the coast of Hawaii in December. And while it was not a test of our missile defense system, we were able to modify our sea-based element to destroy the errant satellite in February with just 6 weeks notice.

Now I would like to address some of our critics' opinions. The fact is that many of our critics disagree with the policy choice that we ought to deploy strategic or tactical systems to counter the ballistic missile threat. They have other approaches, to include denying that the threat exists or using more destabilizing or destructive solutions.

In pursuing missile defense even in a limited fashion, we are following a commonsense approach. To illustrate, let me quote a recently declassified draft Presidential memorandum, "a number of arguments for deployment of a less than perfect ballistic missile defense are most persuasive. A ballistic missile defense, even though of limited capability, could be very effective against a simple attack by a minor power, a small accidental attack, or a small attack constrained by arms control measures. Such a defense would contribute to the deterrence of blackmail threats and to the stability of arms control agreements. A ballistic missile defense of limited capability would contribute to the deterrence of large attacks by raising doubts of the attacker's ability to penetrate. Such a defense, even though limited, greatly complicates the design and tactics for offensive systems."

This memorandum was written 45 years ago on October 6, 1962; the President was John F. Kennedy. Signs of similar logic, the Congress passed and the Clinton administration signed into law the National Missile Defense Act of 1999. What we've seen from our critics is an attack of the overall policy to deploying missile defense using technical arguments, stating originally that we can't do hit to kill or that we cannot be effective against countermeasures or that in the future we cannot make boost-phased defenses work. But the fact is that we can do hit to kill. We can be effective against countermeasures and we are making boost-phased defenses work. So we are taking these technical arguments off the table one at a time through a comprehensive test program.

Our critics are also out of step with the mainstream. There's been bipartisan support by 11 Congresses, four Presidents, combatant commanders, a growing number of allies, including all NATO nations, not to mention the majority of the American people. Successive military commanders such as the head of U.S. Northern Command testified to Congress that our long-range defenses have made great strides and that the system is standing ready to defend the United States and its allied infrastructure and population centers. Indeed, for several years now a number of our combatant commanders have placed missile defense near the top of their needed capabilities list.

Defying the predictions of critics who maintained for years that we could not hit a bullet with a bullet, we have now shown that we can successfully do so. In fact, we can show that we can hit very precisely, within centimeters of where we're aiming.

Also contrary to what critics maintain, we are using realistic test criteria developed by the test community and the warfighter. The Director of Operational Test and Evaluation concurs that we've increased the operation and realism of all our testing, to include an end-to-end test of our long-range elements with operational assets.

The critics claim that the threat is not realistic unless it has simple or advanced countermeasures. We take countermeasures seriously and we have tested against several versions in the past. Our flight tests will include more complex threat suites in the future as our development program produces new sensors, algorithms and Kill Vehicles. However, the fact remains that there that are hundreds of missiles deployed today that we do not believe carry countermeasures and we have been successful against these types of threats.

What would our critics have us do, return this country and our forces to its previous state of complete vulnerability to missile attack? Missile defense must be considered within the entire balance of forces within the United States. It will complement our arms control and other dissuasive actions. It can bolster our defense capability. It can stabilize crisis situations, and when all else fails and a warhead is in the air, missile defense and only missile defense can save innocent lives.

Now, sir, with your permission I do have a few charts if I could go to illustrate this point.

Mr. TIERNEY. You still have time.

General OBERING. This is the integrated, layered system that I was talking about before. It comprises defenses in a boost phase, the mid-course phase of flight as well as the terminal phase. And we are building the integration and the engineering for these all to work together so the distinction between tactical and strategic blurs considerably supported by an entire family of sensors.

Next slide, please. This is the deployment of the system today, to include radars as far forward as Japan, Aegis ships of which we've modified 17 through long-range tracking, 12 to be able to launch sea-based interceptors and a whole host of elements, to include more than 24 interceptors that we've placed between Alaska and California, radars that we've modified, as well as new radars that we've deployed across the globe as well as a modified radar in the United Kingdom to be able to protect initially from threats from Iran.

Next slide. Now on our testing. If you go ahead and click on this first one very quickly. The first one—no, I'm sorry. Can you back up? The first one right here. OK. It's not in there? Go ahead to this last one then. I want to show just the last long-range testing we did in September. This was a test to emulate an attack. Go ahead and click on inside the frame there, please. To emulate an attack from North Korea into the United States. That's fine. It should start.

The target was launched from Kodiak, AK. This was a three-stage target emulating what we believed the North Koreans are capable of doing. This geometry was to emulate an attack from North Korea into Texas with an intercept from Alaska. We flew from Kodiak Island, AK down into the Pacific and we intercepted with an interceptor from Vandenberg, CA. Here is a target camera looking

aft on the target. The next you are going to see the interceptor flight leaving the silo in California. Now, I remind you that this was done by soldiers on the console operational hardware and software, operational interceptor, and the configuration that we have deployed to our interceptor silos in Alaska and California.

Again, the next you'll see is the silo being—the silo interceptor being launched from Vandenberg. We have a clamshell protection over the silos. This is a long-range shot from there. Here are the clamshell doors opening and the egress of the interceptor. Now this is our largest interceptor. It's about 60 feet long, three stages. It is capable of defending from either the East or the West. So we can use these interceptors to protect from both North Korea as well as Iran.

This is a three-stage version, as I said. We are proposing a two-stage, which we will remove the third stage for Europe. Here's the separation of the first stage, and you fly up. And the next shot you are going to see are some of the intercept scenes. This intercept occurred several hundred kilometers in space. So the first is an IR image that you'll see of the intercept. We know that we destroy about 50 percent of the warhead immediately, about 40 percent burns up in re-entry, and only about 10 percent debris hits the ground. This is just at 30 percent speed.

The final frame, you will see three boxes come up here and this is exactly what the Kill Vehicle sees. What you'll be able to see is that it's tracking multiple objects in those boxes with the three sensors. There's a little box that comes up. In every one of the boxes that you see here are objects that are in the focal plane of the Kill Vehicle. It's having to go through and determine what is a warhead, what is the third stage, what is debris that is in that field of view? In these two frames, you will see it selects the warhead just before we hit.

Sir, that's all I have. I just wanted to use that to illustrate I think the tremendous progress that we've made in our program.

[The prepared statement of General Obering follows:]

Unclassified Statement of

Lieutenant General Henry A. Obering III, USAF

Director, Missile Defense Agency

Before the

House Oversight and Government Reform Committee

National Security and Foreign Affairs Subcommittee

Regarding

Oversight of Missile Defense (Part 3)

Wednesday, April 30, 2008

Embargoed Until Released by the
House Oversight and Government Reform Committee
United States House of Representatives

Lieutenant General Henry A. Obering III, USAF
Director, Missile Defense Agency
Before the
House Oversight and Government Reform Committee
National Security and Foreign Affairs Subcommittee
April 30, 2008

Good morning, Chairman Tierney, Ranking Member Shays, distinguished Members of the Committee. Thank you for this opportunity to discuss the important contributions of the missile defense program to the security of our country. As Director of the Missile Defense Agency (MDA), I have the privilege of leading an outstanding group of thousands of men and women who work hard every day to develop, test and field an integrated, layered ballistic missile defense system to defend the United States, deployed forces, and allies and friends against ballistic missiles of all ranges in all phases of their flight.

The Ballistic Missile Defense System (BMDS), which began limited defensive operations in 2004, is becoming more integrated, robust, and global every day. The system already includes fielded assets operated by Air Force, Army, and Navy personnel under the integrated control of Combatant Commanders. We also have fielded transportable and sea-mobile defenses to protect deployed forces, allies, and friends against short- to medium-range ballistic missiles. Tying these assets together is a near-global command, control, battle management and communications capability.

Recent flight tests confirm technological progress and operational effectiveness for short-, medium-, and long-range defensive capabilities. 2007 was a particularly noteworthy year in our missile defense test program. The Missile Defense Agency and

the military services executed a successful long-range ground-based intercept using the Ground-based Midcourse Defense element, six sea-based intercepts of separating and unitary targets (one of those tests used a Japanese destroyer), and three THAAD intercepts of unitary targets.

Our record of international cooperation reflects the growing confidence in missile defense technologies among our allies and friends. With respect to the European Site Initiative, we have completed missile defense negotiations with the Czech Republic, and we are making progress towards reaching an agreement with Poland. Assuming we satisfy congressional requirements to proceed, and assuming the legislative bodies in Poland and the Czech Republic ratify the agreements, the Missile Defense Agency intends to begin site construction for up to ten long-range interceptors and a fixed-site radar in Europe to defend allies and deployed forces in Europe and expand homeland defense against limited Iranian long-range threats. We have undertaken substantive cooperative efforts with several European, Middle Eastern, and Asian nations, and we continue to engage Russian officials and technical experts to discuss threat perceptions and missile defense cooperation.

THE BALLISTIC MISSILE THREAT – WHY WE NEED MISSILE DEFENSE

Let me review why missile defense is so critically needed.

Our National Intelligence Estimates continue to warn that in coming years we will face threats from short-, medium-, and long-range ballistic missiles from a variety of

actors. There were over 120 foreign ballistic missile launches in 2007, significantly exceeding what we observed in previous years. This comes on the heels of a very active 2006, during which time North Korea and Iran demonstrated an ability to orchestrate multiple and simultaneous missile launches involving different ranges.

North Korea's ballistic missile development and export activities remain especially troubling. Currently, North Korea has hundreds of deployable short- and medium-range ballistic missiles. It is developing a new intermediate-range ballistic missile and a new short-range, solid-propellant ballistic missile, which it test-launched in June 2007. Pyongyang continues to press forward with the development of a nuclear-capable intercontinental ballistic missile (ICBM). While the firing of the Taepo Dong 2 in July 2006, launched together with six shorter-range ballistic missiles, failed shortly after launch, North Korean engineers probably learned enough to make modifications, not only to its long-range ballistic missiles, but also to its shorter-range systems. North Korea's advances in missile system development, particularly its development of new, solid fuel intermediate-range and short-range ballistic missiles, could allow it to deploy a more accurate, mobile, and responsive force. North Korea's nuclear weapons program makes these advances even more troubling to our allies and the commanders of our forces in that region.[1]

[1] Oral Statement by the Director of the Defense Intelligence Agency, Lieutenant General Michael D. Maples to the Senate Select Committee on Intelligence Annual Threat Assessment Hearing, 5 Feb 2008, http://www.dia.mil/publicaffairs/Testimonies/Statement29.pdf; Current and Projected National Security Threats to the United States , Lieutenant General Michael D. Maples, U.S. Army Director, Defense Intelligence Agency, Statement for the Record, Senate Armed Services Committee, 27 February 2007, http://www.dia.mil/publicaffairs/Testimonies/statement28.html.

Iran has the largest force of ballistic missiles in the Middle East (several hundred short- and medium-range ballistic missiles), and its highly publicized missile exercise training has enabled Iranian ballistic missile forces to hone wartime skills and tactics. In addition to its uranium enrichment activity, Iran continues to pursue newer and longer-range missile systems and advanced warhead designs. Iran is developing an extended-range version of the Shahab-3 that could strike our allies and friends in the Middle East and Southeastern Europe as well as our deployed forces. It is also developing a new Ashura medium-range ballistic missile capable of reaching Israel and U.S. bases in Eastern Europe.[2] Iranian public statements also indicate that its solid-propellant technology is maturing. With its significantly faster launch sequence, a new solid-propellant missile would be an improvement over the liquid-fuel Shahab-3.[3]

Iran has reportedly bought a new intermediate-range ballistic missile (IRBM) under development by North Korea,[4] underscoring the urgent need to work with our allies in the North Atlantic Treaty Organization (NATO) to field and integrate long-range missile defenses in Europe. Iran's development of a space launch vehicle using technologies and designs from its ballistic missiles is equally troubling. The Defense Intelligence Agency estimates that Iran could have an ICBM capable of reaching the United States by 2015.[5]

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[2] Statement of Lieutenant General Michael D. Maples, 5 February 2008.
[3] Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 January to 31 December 2005, Central Intelligence Agency, http://dni.gov/reports/CDA%2011-14-2006.pdf.
[4] Statement of Lieutenant General Michael D. Maples, 5 February 2008.
[5] Current and Projected National Security Threats to the United States Vice Admiral Lowell E. Jacoby, U.S. Navy Director, Defense Intelligence Agency Statement For the Record Senate Armed Services Committee, 17 March 2005, http://www.dia.mil/publicaffairs/Testimonies/statement17.html

Syria is working to improve its ballistic missile capabilities and production infrastructure. Today Syria is capable of striking targets in Israel and Turkey, our southern NATO partner, using rockets and ballistic missiles. Syria can produce longer-range Scud-variant missiles using considerable foreign assistance from countries such as North Korea and Iran.[6]

Our critics have downplayed the risks posed by ballistic missiles, and I disagree with some of their assessments. Some missile defense critics maintain the risk to national security of a weapon of mass destruction being smuggled into the United States by ship, truck or aircraft is far greater than the risks posed by ballistic missiles, and that smuggling is the only realistic option available to a terrorist group like al Qaeda. It is assumed that because a weapon is smuggled, it is untraceable and therefore this way of attack would offer anonymity.

Smuggling is not the only form of attack that can be accomplished anonymously. It may be possible, for example, for a terrorist group to acquire a ballistic missile that may be launched off the deck of a freighter against a coastal target. Yet the fact remains that ballistic missiles actually were used in two recent conflicts without concern for anonymity. Ballistic missiles have been used over the past two decades to further military ends, coerce political leaders, and provide regional prestige to governments. Iran, for example, has threatened to wipe Israel off the map, and it has boasted that it has the military capabilities, that is, the ballistic missiles, to accomplish that. Iran has also

[6] Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 January to 31 December 2005, Central Intelligence Agency.

threatened to retaliate, if provoked, by firing its ballistic missiles in mass across the Middle East, striking Arab states and Israel. The missile parades in countries like Iran and North Korea serve as ominous reminders to other states.

During Operation Iraqi Freedom, several conventionally armed ballistic missiles actually were launched against coalition forces and were engaged successfully by U.S. missile defenses deployed to the region. Ballistic missiles were the weapon of choice. In fact, one can make the case that some countries are replacing their national air forces with ballistic missiles.

We do know that potential adversaries of the United States are working very hard, spending a significant portion of their limited national resources, to acquire ballistic missiles and weapons of mass destruction. Clearly, our armed forces must be prepared to counter all threats to the nation and our interests abroad. The possibility of a threat posed by weapons of mass destruction smuggled into our country is clear enough, but so too is the threat posed by ballistic missiles armed with nuclear, biological, chemical, or high-explosive munitions.

Critics of missile defense also assume activities associated with ballistic missile and nuclear weapon development and operation would be readily detected by the intelligence services of the United States and its allies and friends and any threat dealt with promptly. We should not assume that we have a precise or full understanding of ballistic missile activities around the world. We have been surprised in the past. Most notably, we were surprised by North Korea's launch of a No Dong ballistic missile in 1993 and a long-range Taepo Dong ballistic missile in 1998. The nuclear weapon tests

conducted by India and Pakistan in 1998 and the detonation of nuclear material by North Korea in 2006 also caught the intelligence community by surprise.

Some of our critics have noted that only five countries currently have a capability to develop, test, and field ICBMs with nuclear warheads. While I accept the conclusion that the technical, organization, and management challenges associated with deploying ICBMs are daunting, the ability of another country to overcome such challenges, especially in the current proliferation environment, and to acquire a long-range attack capability is well within the bounds of the possible. I would note that the proliferation of foreign ballistic missiles and nuclear expertise, technology, and systems have drawn down many of the barriers to long-range ballistic missile development present during the Cold War. Today we are witnesses to long-range missile development in countries that are hostile to the United States, most notably North Korea and Iran.

Other countries now are able to develop ballistic missile systems on shortened timelines compared to what was possible during the Cold War. Much of the investment by governments interested in ballistic missiles is spent to increase the size, range, and accuracy of their ballistic missile forces. Many of these technologies and systems are now available on the global market. We have evidence of whole missile systems being transferred from one country to another. Importantly, some of the countries acquiring ballistic missile forces today also support terrorist groups. Iran is known to have assisted Hezbollah forces in the Middle East by supplying rockets carrying conventional munitions, which terrorist forces used to target Israeli cities in 2006. Already this year Palestinian militants have fired imported rockets into Israeli border towns.

So why would potential adversaries of the United States invest a significant share of their resources to develop ballistic missiles if, as our critics claim, it is easier to smuggle a weapon across our borders? The answer is that ballistic missiles offer significant military and political utility. Ballistic missiles provide a capability to swiftly strike populations and military targets hundreds or even thousands of miles away. These weapons offer a way to counter asymmetrically the conventionally superior armed forces of the United States. Ballistic missiles may be used to intimidate, coerce, or deter a larger power such as the United States and achieve a political or military end without firing a shot. For all these reasons, the acquisition of ballistic missiles remains a high defense priority in many countries.

We have had experience with tragic hostage situations involving individuals, and we have witnessed how enemy forces, to include non-state actors, have attempted to use hostages to coerce or blackmail us or our allies, oftentimes without fear of reprisal. Indeed, with the attacks of September 11, 2001, we have direct experience dealing with non-state actors, terrorist forces who strike without warning and without fear of consequences. Imagine an entire city held hostage by a state or a terrorist organization with ballistic missiles. Our nation was vulnerable to this threat prior to 2004. We must continue to make every effort to prevent that possibility from occurring again.

While it is true that we do not face the same ballistic missile threat we faced during the Cold War, when the Soviet Union targeted and placed on alert thousands of warheads against us, we need to be cautious about minimizing the consequences of even a single nuclear-tipped ballistic missile that reaches its target. It only takes one ballistic

missile carrying a nuclear or biological payload to inflict catastrophic damage on a city. While we would be able to retaliate militarily for a nuclear attack against one of our cities and punish the attackers, the unthinkable loss of life and trillions of dollars in economic losses would have already been inflicted. Simply stated, would it not be better to save lives by stopping such an attack in the first place rather than to inflict punishment on the enemy after the fact? With missile defense, we gain another option on the spectrum of possible diplomatic and military responses to a threat or an attack, an option other than deterrence or retaliation. I believe the ability to protect against threats of coercion and actively defend our forces, friends and allies, and homeland against ballistic missiles is essential to our national safety, today and in the future.

MISSILE DEFENSE PROGRAM BENEFITS TO THE NATION

Throughout the 1990s we made tremendous technological advances in computer processing, sensor and propulsion technologies, and light-weighting of materials, a reality that was reflected in national policy-making at the time. The 1990s were also a time rogue states were expanding the size and sophistication of their ballistic missiles arsenals. The bi-partisan Congress recognized the threat to our nation and the critical importance of fielding effective missile defenses when it passed the National Missile Defense Act of 1999, which the President signed into law in 1999. It became U.S. policy to deploy missile defenses "as soon as technologically possible" to defend the United States against limited ballistic missile attacks.

By 2001 the Bush Administration concluded that non-nuclear ballistic missile defense using hit-to-kill technologies had proven itself to be technologically possible and directed the deployment of a limited ballistic missile defense capability. Not only had most of the well-publicized flight tests been successful, but we also gained confidence in the feasibility of a missile defense capability through sophisticated computer simulations and ground tests. So in January 2002, the Secretary of Defense directed the Missile Defense Agency to restructure the missile defense program to deal with the urgency, enormity and complexity of developing, testing and building a missile defense system. This required the adoption of an evolutionary acquisition strategy to be executed by a single agency, a strategy that relies on continual assessments of the threat, available technology, and what can be built and fielded to provide a militarily useful capability in an urgent manner.

Having capitalized on our steady progress since the 1980s, we delivered to the Combatant Commanders in 2004 an initial missile defense capability to defeat the near-term long-range missile threat. Supported by an extensive command, control, battle management and communications (C2BMC) infrastructure, we connected additional system elements to the fire control system and put in place trained system operators, the logistics support infrastructure and support centers required for limited operations.

To date, we have made significant, unprecedented strides to deliver a capability where none existed before, one of the most complex defensive systems ever envisioned. And we did so while sustaining an aggressive development program that continues to feed new technologies into the system.

The missile defense investments of four Administrations and eleven Congresses in all aspects of missile defense, or roughly $115 billion through the FY 2008 budget, are paying off. With the initial deployment of a limited missile defense capability, the era of absolute vulnerability of our country to a long-range missile attack came to a close. This is important, because I believe a capability against even a single reentry vehicle has significant military utility. The modest long-, medium-, and short-range defensive capabilities we have today can help reduce the more immediate threats to our security and enhance our ability to defend our interests abroad.

I would like to review briefly our current fielding plan and explain the capabilities we have available today and expect to field in the near future. We have nearly completed deployments to defend the United States against a North Korean long-range missile and are well along in delivering missile defense force structure that contributes to the defense of our deployed forces, allies and friends. Subsequent deliveries will build on these long- and short-range defenses to improve protection of the U.S. homeland and provide increased protection for our forces and regional allies. We also are working closely with NATO and our European partners to provide our allies protection against ballistic missiles launched out of the Middle East.

This past year we saw an unprecedented pace of fielding of an integrated missile defense capability. In 2007 we emplaced 10 ground-based interceptors, for a total of 24 long-range interceptors in missile fields at Fort Greely, Alaska and Vandenberg Air Force Base, California. In 2008 we plan to increase interceptor inventories up to a total of 30 at the two sites. By 2011, we plan to expand our inventory of long-range interceptors up to 44 in the United States.

By the end of 2008, we will have 18 Aegis BMD ships that contribute to long-range defense by passing early detection, cueing, and tracking data across communications lines into BMD system communication and battle manager nodes located at Fort Greely and in Colorado Springs.

The transportable forward-based X-band radar at Shariki Air Base, Japan provides precise early detection and tracking to increase the probability we will destroy any lethal target launched by North Korea. In 2007 the Sea-Based X-band radar (SBX) completed crew training and testing off the coast of Hawaii and transited to the North Pacific to conduct a cold weather shakedown off Adak, Alaska, where it will be home-ported in 2009, and it is available to the warfighter for emergency operations during 2008. The SBX participated in system flight tests this past year, including the September 28 long-range intercept test and the December 17 engagement of a medium-range separating target at sea by our ally, Japan. This year the radar will again participate in a long-range intercept test.

Since 2002 we have expanded and improved terminal and midcourse defenses to defeat short- and medium-range threats from land and sea, protecting the forces we deploy abroad and our allies and friends. We began fielding SM-3 interceptors in 2004. We will have 38 in inventory by the end of 2008. By year's end, each of the 18 Aegis BMD ships--15 destroyers and 3 cruisers-- will have engagement capabilities. We also are upgrading the Aegis BMD weapon system, and the Navy is upgrading the SM-2 Block IV missile, the goal being to deploy up to 100 interceptors to provide a near-term sea-based terminal engagement capability on 18 Aegis BMD ships beginning in 2009.

We are working closely with the Army to develop and begin fielding in 2009 two Terminal High Altitude Area Defense fire units, with full delivery of the first two fire

units by 2010 and 2011 and delivery of the fire units 3 and 4 in 2013. THAAD is uniquely designed to intercept targets both inside and outside the Earth's atmosphere. Consisting of 48 interceptors and the associated radars and C2BMC, THAAD will provide transportable terminal protection from short- to medium-range ballistic missiles for our troops and our allies.

We are also upgrading key radars needed for protection of the United States- the upgraded early warning radars at Beale Air Force Base in California, Fylingdales in the United Kingdom, and Thule in Greenland. This past year we completed operational testing of the radars at Beale and Fylingdales and made them available to the warfighter for emergency situations. Together with the early warning radars in the United Kingdom, the Thule radar, which we will begin to integrate into the system in 2009, will ensure coverage of the United States against threats from the Middle East.

By devaluing Iran's longer-range missile force, European missile defenses could help dissuade the Iranian government from further investing in ballistic missiles and deter it from using those weapons in a conflict. We believe the long-range defense assets we are planning to deploy to Central Europe offer the most effective capability to defeat this threat. The sensors, interceptors, and C2BMC infrastructure planned for deployment in Europe are needed to improve protection of the United States and, for the first time, extend coverage to all European NATO allies vulnerable to long-range ballistic missile attack from Iran. This work focuses on upgrade and deployment of the test bed midcourse X-band radar, currently located at the Kwajalein test site, to the Czech Republic and the

establishment of an interceptor field in Poland, pending agreements with both governments.

Several countries in southern Europe do not face threats from projected Iranian long-range missiles. Yet these same countries are vulnerable to the shorter-range ballistic missiles currently fielded by Iran and Syria. Mobile intercept systems such as Aegis BMD, THAAD, and Patriot can be augmented by other sensors, like the European Midcourse Radar, and can engage slower short- to medium-range ballistic missiles systems. Together with other NATO missile defense assets, these missile defense forces could protect European countries vulnerable to short- and medium-range ballistic missiles when integrated into the NATO command and control structure.

What has the nation received for its investment in missile defense? We have successfully leveraged advanced technologies developed over the past twenty-five years and engineered a one-of-a-kind system of integrated layered defenses to provide our nation's cities, our sons and daughters deployed to regions of conflict, and friendly nations protection against limited missile attack. Much of that investment remains untapped, of course, such as the considerable work done on space defenses. It is important to note that only a portion of this investment in missile defense could be said to have been allocated to the development and fielding of long-range, or "strategic," defenses – roughly $64 billion through FY 2008. This $64 billion figure not only includes work conducted on Ground-based Midcourse Defense and National Missile Defense, it also includes the legacy work on these ground-based defenses and more future-oriented capabilities represented by space-based interceptors and sensors. We are

not able to leverage much of the space-related work today because of the termination of missile defense space programs back in the 1990s. About $48 billion was spent through FY 2008 developing and fielding defenses against shorter-range missiles to protect our troops and our allies. Of course, the successes we have with our long- and short-range, or regional and strategic, defenses have applicability across the spectrum of missile defense capabilities, and we can apply lessons learned in each functional area across the system.

Today our armed forces have available a real capability that our nation's leaders can use to achieve a military victory, stabilize a crisis, and minimize dangers to the American people. In fact, we already have real-world examples that help shed light on how useful a missile defense capability is to the United States today.

Operations Desert Storm (1991) and Iraqi Freedom (2003) demonstrated that missile defenses must be integrated into our regional military responses if we are to provide adequate protection of coalition forces, friendly population centers, and military assets. We must expect that troops deployed to regional hotspots will continue to encounter increasingly sophisticated ballistic missile threats. Indeed, Patriot Advanced Capability (PAC)–3 proved to be exceptionally effective during Operation Iraqi Freedom, when PAC-3 and PAC-2 GEM systems destroyed all threatening short-range ballistic missiles. At least one of the ballistic missiles destroyed had been on a course to strike a command base in Qatar. Thanks to our missile defenses, it did not reach its target.

When the North Koreans conducted their launches in the summer of 2006, for the first time in the history of the United States we had the capability to defend our nation's

cities against a long-range missile had it been necessary. Working closely with U.S. Strategic Command, we successfully took the system out of the development mode and handed it over to the warfighter for operation.

Alert activities included activation of the Ground-based Midcourse Defense and the deployment of a missile defense capability to the Sea of Japan. We had Aegis long-range surveillance and track ships stationed east and west of Japan and a forward-based X-band radar at Shariki Air Base, Japan during the missile firings. Had there been a successful long-range launch, data collected from these sensors would have helped identify whether it was a ballistic missile or a space launch vehicle and would have provided tracking data to the system. The situational awareness displays were operational and being monitored at the various commands. Given these events from the summer of 2006 and our ability to bring the system on line and prepare it for emergency use, I am very confident that the system would have operated as designed had the Taepo Dong-2 threatened the United States. Because we had a defense option, our leaders did not have to choose proposed alternative responses, one of which was to preemptively destroy the missile launch site, to minimize the threat to the country.

Finally, in February 2008 the Department of Defense called on our country's missile defenses to destroy a large tank of toxic fuel onboard an out-of-control U.S. satellite about to reenter the Earth's atmosphere. The uncertainty of when and where the satellite would reenter, and the near certainty that the fuel tank would survive reentry and possibly break up on Earth, drove the urgency of this mission. Using an extensively modified SM-3 interceptor and a modified Aegis Weapon System onboard the USS Lake Erie, the Navy

successfully destroyed the tank. The Department undertook this operation, carefully choosing an intercept altitude that would not add to the debris currently in orbit, to protect against the possible risk to life that a natural reentry of the satellite could have posed. After engagement, the toxic hydrazine dissipated in space, and, by now, most of the debris from the satellite body has burned up in the Earth's atmosphere.

This was a very successful joint mission involving the Navy, U.S. Strategic Command, the Missile Defense Agency, the National Aeronautics and Space Administration, the National Reconnaissance Office, and other national security offices. Missile Defense Agency engineers worked closely with the Navy to modify the interceptor and the Aegis weapon system for this one-time engagement. This was a case where the missile defense system was unexpectedly pushed into service and performed exceptionally well. While this stands as an example of what the nation received for its investment in missile defense, I want to be clear that it does not represent an operational anti-satellite capability. The time and level of technical expertise it took to plan and orchestrate this mission, the split-second fragility of the once-per-day shot opportunities, and the relatively low altitude of the satellite's decaying orbit did not approach the responsive and robust capability that would be needed to attack enemy space assets in wartime.

There is one real-world example where missile defense did not play a role that provides an important lesson – the September 11, 2001 terrorist attacks on our country. According to the Government Accountability Office, the direct cost of the September 11, 2001 attacks to New York City was $83 billion – and that was an attack that did not

involve a weapon of mass destruction.[7] As I indicated earlier, a ballistic missile attack against even just one of our cities, especially if that attack involved nuclear or biological weapons, would likely kill thousands, if not tens of thousands, of Americans and cause several trillion dollars in damages.[8] I think we need to keep these prospects in mind as we examine the investments we have made in missile defense over the past twenty-five years.

MISSILE DEFENSE TESTING

When the President charged the Missile Defense Agency with fielding an initial system in 2004, we had to take some risks and pursued technology development even as we were fielding capabilities. The system we fielded relied significantly on legacy technologies, to include the long-range interceptors, which we retrofitted to make them a critical part of the initial, limited integrated system. We were able to put in place a capability, a backbone of sensors, weapons, C2BMC, where none existed before 2004. At this point, we could begin to test and improve the system incrementally.

We were able to deploy beginning in 2004 because of the confidence we achieved through our testing program between 2000 and 2002, especially testing involving the long-range interceptor prototype. In 2002 and 2003, we successfully conducted four of five intercept tests against shorter-range targets using a prototype version of the sea-based Aegis SM-3 interceptors we are deploying today. These tests demonstrated the basic

[7] Government Accountability Office Briefing, May 29, 2002, http://www.gao.gov/new.items/d02700r.pdf; William C. Thompson, Jr. (New York City Comptroller), "One Year Later: The Fiscal Impact of 9/11 on New York City," September 4, 2002.

[8] See Pacific Northwest National Laboratory, "Thinking about the Unthinkable: Economic Consequences of Nuclear Attack," January 27, 2006, PNNL-SA-46083, http://environment.pnl.gov/accomplprodline/prodline_detail.asp?id=540

viability and effectiveness of a system that relies primarily on hit-to-kill technologies to defeat in-flight missiles. We had learned as much as we could with the long-range interceptor prototypes and decided it was time to restructure the Ground-based Midcourse Defense program to accelerate the testing of the initial operational configurations of the system elements. The successful testing we have had to date tells me this was the right decision.

Now that we have a basic system in place, we no longer have to take significant risk. Our capability-based acquisition model actually follows a "fly-before-you-buy" construct. We have in place a disciplined process to deliver early, partial, and full capabilities, with significant developmental and operational testing events throughout. We do not follow the Defense Department's traditional requirements process, laid out in the Joint Capabilities Integration and Development System (JCIDS), but do follow the acquisition principles in DoD Directive 5000.1. However, MDA does not follow the Milestone review process in DOD Instruction 5000.2. Given the complexity of the missile defense mission and the urgency to respond to the threat, in 2002 the Secretary directed MDA to try a different approach, and this new approach has been effective in delivering missile defense capability to the warfighter in a timely and disciplined manner.

We have consistently pursued a comprehensive and integrated approach to missile defense testing and are gradually making our tests more complex. Missile defense testing has evolved, and will continue to evolve, based on results. We have a system available for operational use today, a system evaluated by U.S. Strategic Command to have military utility, because of the capability-based acquisition approach we have followed

since 2002. This approach leverages collaboration with the warfighting community throughout development and testing to the point where we transition or transfer capabilities to the operators.

Testing under operationally realistic conditions is an important part of maturing the system. We have been fielding test assets in operational configurations in order to conduct increasingly complex and end-to-end tests of the system. Comprehensive ground tests of the elements and components precede each flight test. Our flight tests increasingly introduce operational realism, limited by environmental and safety concerns. Each system test builds on knowledge gained from previous tests and adds increasingly challenging objectives.

The Director, Operational Test and Evaluation (DOT&E), the Operational Test Agencies (OTA), and the warfighting community are very active in all phases of test planning, execution, and post-test analysis, to include development of an Integrated Master Test Plan. The plan documents the combined developmental and operational test approach that focuses on increasing operational realism. DOT&E and OTA participate independently in our Combined Test Force planning, test, and data analysis activities to integrate operational test and warfighter requirements into a system-wide test program, which enables independent operational assessments. The Agency also uses the warfighter's input to develop test objectives that evaluate new concepts of operations and exercise the warfighter's tactics, techniques, and procedures. Using criteria established by the warfighter and the Agency's system engineers, all ground and flight tests provide

data that we and the operational test community use to anchor our models and simulations and verify system functionality and operational effectiveness.

Last year alone we successfully intercepted targets in 10 of 10 attempts. Since 2001 we have successfully demonstrated 34 of 42 hit-to-kill intercepts. None of the failures we experienced in the missile defense program was a result of problems with underlying missile defense technologies. All flight-test failures occurred in components or software, which we fixed. Three of the eight failures occurred during tests of the PAC-3, which has already been combat-proven in Operation Iraqi Freedom.

In 2007 the Missile Defense Agency conducted 25 major tests and successfully met our objectives in 18 of 20 flight tests. In doing so, we used the test ranges available to us today to maximum capacity. Our flight test program for Ground-Based Midcourse Defense, Aegis BMD, and Terminal High Altitude Area Defense confirmed technological progress for short-, medium-, and long-range defensive capabilities.

After a legacy target failure in May 2007, we successfully completed Ground-based Midcourse Defense Flight Test-03a on September 28, 2007. In this test, an operationally configured ground-based interceptor launched from Vandenberg Air Force Base engaged a threat-representative intermediate-range target fired from Kodiak Island, Alaska using sensor information from the operational upgraded early warning radar at Beale Air Force Base in California. Trained crews manning fire control consoles reacted within a specified window under limited-notice launch conditions. This test leveraged fielded hardware and fire control software as well as operational communications, tracking, and reporting paths. The Exo-atmospheric Kill Vehicle successfully collided

with the target near the predicted point of impact, destroying it. According to the Director, Operational Test & Evaluation, FTG-03a "incorporated operational realism consistent with the maturity of the fielded system" and "demonstrated an end-to-end test of the system."

The growth in our confidence in this system's effectiveness is directly tied to our rigorous test program and our ability to practice with the system in operationally realistic ways. By having a system, even a limited system, in place that we can make operational in times of crisis, we compel our adversaries to ask themselves a very important question: do we gamble that the American missile defense system will not work?

We have been asked why we have not conducted more tests of the long-range defenses to date. The answer is that we have found it very difficult to do more than one or two a year. One of the reasons these flight tests are so expensive, upwards of $100 million a test or more, is that we employ several data collection assets. We want to make sure we capture every piece of information about the test that we possibly can. The result is that we collect so much data with each test that it takes months just to sift through it, catalogue it, and analyze it properly. It is important we understand the data from a flight test before we move on to the next test of a similar system element. Each test is intended to shed new light on the system technologies and integration. We do not want to conduct a test just to conduct a test, a reality that brings us to one or two long-range tests a year.

Our integrated ground tests, which involve the operational long-range defense elements and employ the actual operational hardware, have been enormously successful. We test the system end-to-end by simulating engagements. These ground tests,

conducted in a lab environment and in the field, involve the wider missile defense system community, to include the National Military Command Center, the Operational Test Agencies, and U.S. Northern Command. They teach us a great deal and give us confidence to move forward with our intercept tests.

We have had a string of successes with intercepts tests involving the shorter-range defenses, Aegis BMD and THAAD. Aegis BMD completed four intercept tests and one allied sea-based intercept tests in 2007. In all Aegis BMD tests, we do not notify the ship's crew of the target launch time, forcing crew members to react to a dynamic situation. The December 2007 test off the coast of Kauai in Hawaii marked the first time an allied Navy ship successfully intercepted a medium-range separating target with the Aegis BMD midcourse engagement capability. Terminal High Altitude Area Defense completed three intercept flight tests against threat-representative short-range unitary targets in the atmosphere and in space.

In 2008 we are planning two system-level long-range intercept tests, and two more in 2009, all of which will push the edge of the envelope in testing complexity. The intermediate-range target used in the next test, and most subsequent tests of the Ground-based Midcourse Defense element, will have countermeasures. We also plan three Aegis BMD intercept tests and four THAAD intercept tests in 2008 and 2009. Each of these tests also will involve increased operational realism and complexity.

I would like to briefly address the subject of countermeasures. Our critics frequently state that unless we conduct flight tests against midcourse countermeasures, we cannot claim that we have tested the system under operationally realistic conditions.

This implication is that the targets we been using in our tests are not threat-representative. I disagree. There are, in fact, hundreds of ballistic missiles deployed by potential adversaries that do not have countermeasures. Obviously, it is wrong to conclude that these systems are not threat-representative. And while our test program will incorporate increasingly complex countermeasures into our upcoming tests, we are also demonstrating the capability of the system against current threat-representative ballistic missiles, many of which are unitary systems that do not carry countermeasures.

We do not take the countermeasures threat lightly. The experience of the United States with missile defense countermeasures is extensive and several decades old. Flight-testing conducted by the United States over many years has uncovered weaknesses in many simple and more sophisticated countermeasures. Many objects designed to be countermeasures cannot be relied on to act as expected, even in the near vacuum of space. Just because a countermeasure appears to be "simple" does not mean it is simple to engineer or employ. On the contrary, we have found that credible, complex missile defense countermeasures are costly and difficult to develop and make effective, whereas cheap attempts could be countered by the ballistic missile defense system. We have been and are continuing to address the countermeasures challenge, both in terms of developing software, sensor, and kill vehicle solutions to counter these threats and gaining a better understanding of what potential adversaries would actually be able to do.

ADDRESSING FUTURE THREATS

The proliferation of ballistic missile technologies and systems means we will face unexpected and more challenging threats in the future. We need to ensure America's ballistic missile defense system remains effective and reliable and a major element in our national defense strategy well into this century. I would like to highlight the major activities in our development program that are intended to keep the BMD system capable of countering future evolving threats. Each one of these efforts is critical to maintaining our defenses in the uncertain years ahead.

Destroying ballistic missiles in boost phase will deprive the adversary of opportunities to deploy in midcourse multiple reentry vehicles, sub-munitions, and countermeasures, thereby reducing the number of missiles and reentry vehicles having to be countered by our midcourse and terminal defenses. As part of our layered defense strategy, we are developing the Airborne Laser (ABL) and Kinetic Energy Interceptors (KEI). In 2007 the ABL program met all of our knowledge point expectations and cleared the way for the installation of the high-power laser on the aircraft by the end of 2008. We successfully demonstrated ABL's ability to detect, track, target, and engage non-cooperative airborne targets and look forward to a full demonstration and lethal shoot-down in 2009 of a threat-representative boosting target. The KEI program is on track to develop a high-acceleration booster for a mobile, surface-based kinetic kill interceptor to counter ballistic missiles in the boost, ascent or midcourse phases of flight.

We are pursuing parallel and complementary efforts to develop algorithms that improve current sensor and weapon performance to counter complex countermeasures. In the years ahead we expect our adversaries to have midcourse countermeasures. The

Multiple Kill Vehicle (MKV) program is developing a payload for integration on midcourse interceptors to address complex countermeasures by identifying and destroying all lethal objects in a cluster using a single interceptor.

We are also developing the Space Tracking and Surveillance System (STSS) to enable worldwide acquisition and tracking of threat missiles, which also could include midcourse countermeasures and multiple objects. Sensors on STSS satellites will provide fire control data for engagements of threat reentry vehicles and, when combined with radar data, will provide improved threat object discrimination.

MISSILE DEFENSE OVERSIGHT AND ACCOUNTABILITY

The management of the missile defense program is highly scrutinized by the Department of Defense, this Congress and past Congresses, and the Government Accountability Office.

The Defense Department continues to have significant oversight over the activities of the Missile Defense Agency. I report directly to the Under Secretary of Defense (Acquisition, Logistics, and Technology) on all missile defense matters and meet with him regularly to discuss major program decisions and issues. The Missile Defense Agency also provides the Under Secretary Quarterly Execution Reviews, or in-depth program execution updates and reviews of schedule, budget, and performance goals and baselines.

Every two months, we receive guidance and oversight from the Missile Defense Executive Board. This board makes recommendations to the Under Secretary of Defense

(AT&L) and the Director of the Missile Defense Agency and oversees implementation of the Agency's strategic policies and plans, program priorities, and investment options. Senior principals from the Services, the Department's independent test community, the Joint Staff, and officials from appropriate outside agencies are members of the board.

The Missile Defense Agency's recent establishment of a new block structure has helped better describe our program of work and communicate plans and baselines for missile defense elements to the Department and Members of Congress. Each block in the structure now represents a discrete program of work, which will allow us to report schedule delays, budget increases, and performance shortfalls as variances of capability, not time, as was the case with our previous block structure.

The Government Accountability Office (GAO) continues to be actively engaged in reviewing the Ballistic Missile Defense program. GAO conducted eight audits of the missile defense program in FY 2007 alone. To further increase transparency, beginning in Fiscal Year 2008, I have agreed to provide GAO with quarterly summaries that include integrated baseline review schedules, percent complete, six month cost performance index, fiscal year cost variance, and cumulative cost variance. This information will be summarized annually in the BMDS Selected Acquisition Report for Congress.

CLOSING

Mr. Chairman and members of the Committee, missile defense is expensive. There is no arguing that point. We deal with the most advanced technologies, employ the best and the most talented engineers and scientists in our program, execute intercept

flight tests that cost upwards of $100 million each, deploy test interceptors and sensors and other site infrastructure across one-third of the globe, execute an aggressive research and development program to ensure that this nation remains the undisputed leader in missile defense, prepare and operate a manufacturing base, and operate agency facilities that employ thousands of people across the United States. We have to ensure that our quality controls are world-class, execute program activities that involve our allies, and live up to our obligations to account for all of our activities to the Department and the Congress. We were asked, on an urgent and top priority basis, to deploy a first-ever missile defense system to defend our country as soon as it is practicable and field mobile defenses to protect our forces and our allies worldwide. We are doing so. We could not have done this without substantial support from the Congress, particularly the Congressional defense committees, over several years through multiple administrations.

In the end, what we are doing in the missile defense program, or any other defense program, is not about cost. It is all about affordability. Can the nation afford the defenses we need? I believe it can. I believe it must. We have been good stewards of the taxpayers' dollars. To be sure, missile defense is not easy and it is not inexpensive. The good news is that our efforts over the past quarter century are proving that missile defense works, as we have demonstrated in our tests, and the system we have in place is already contributing to real-world national security situations. The bottom line is that, today, we can defend our cities against a limited ballistic missile attack, and that in itself has no cost comparison.

Mr. TIERNEY. Thank you very much, General.

We're going to proceed to questioning and a 5-minute rule on that basis, but I suspect that we'll have more than one round if Members wish.

General, I have a lot to go through here. So I want to start and sort of do it systematically if we can and go back to some of it. We talked a little bit about the threat that the country faces today and a number of people at the Defense Department point out that over two dozen countries currently have ballistic missiles. I know Vice President Cheney likes to say there are 27. But I want to break that down a little bit. Because as I said to you yesterday, we want to make some distinctions here between short-range, middle and medium-range, and long-range. We're really focusing on the GMD here. And that's what we're talking about.

So of the 27 or so countries that currently have ballistic missiles, how many only have short-range capability? And that is 300 kilometers or less.

General OBERING. Well, sir, first of all if we are going to address the $120 billion or $115 billion that—I want to remind the committee that is the entire program. So that includes——

Mr. TIERNEY. I understand. And I think you broke it down in your written testimony to $64 billion or so in the mid-course or whatever. And that is on the record, and I appreciate that.

General OBERING. Yes, sir.

Mr. TIERNEY. I'm not trying to get into a debate with you. I just wanted to focus on the question, of the 27 countries that the Vice President likes to refer, how many of those only have short-range capability?

General OBERING. The majority of those have short-range capability. There's two nations that are of very much concern. That is Iran and North Korea because they've been able to take the shorter-range SCUD technology and they've been able to grow that into longer and longer ranges. And so North Korea, in particular, was able to launch a long-range weapon in the summer of 1998 which, by the way, the intelligence experts did not believe was going to happen for 8 to 10 years. So the majority of those are short range and short to medium range to intermediate range. So we do know they're growing those capabilities.

Mr. TIERNEY. When you say North Korea has the capability of a missile, you are not trying to lead people to believe that they've tested it thoroughly and that every aspect of it and every component of it has been tested any particular number of times to show effectiveness, are you?

General OBERING. Sir, as a very robust development and test program in those countries that I mentioned. In fact just this year, for example, Iran fired a 2,000-kilometer missile in November. They again attempted a space launch vehicle in February. And as I stated, North Korea——

Mr. TIERNEY. You are conflating again. So I want to stick to one topic at a time if we can. And I think that's—I don't want to be sarcastic with you or anything, but I think there's been a tendency for some people to just conflate a lot of different issues.

General OBERING. Sir, I'm not trying to——

Mr. TIERNEY. I appreciate that. But I want to ensure we don't. I don't want to conflate long with middle with short. I don't want to conflate North Korea with Iran and 27 other countries. I want to focus down here if we can. Let me just ask the questions if I might and try to focus your answers on those specific questions. Likely you are talking about North Korea and Iran outside of France and Great Britain and China and Russia.

General OBERING. China and Russia, right.

Mr. TIERNEY. We then don't have a concern that they're going to start lobbing missiles at us any sometime soon, China, Russia, France or Great Britain. The system you have designed is not focused on them, it is not directed at them, right?

General OBERING. Right.

Mr. TIERNEY. So the system that you are talking about now would be the prospect of somebody might have 5,500 kilometers, or 3,500 miles capacity in a missile. You think at some point in time North Korea or Iran might get to that point?

General OBERING. Actually, yes, sir. And also when you start getting above 3,000 to 3,500 kilometers you now start to get in capabilities where you need the long-range defenses that we've produced.

Mr. TIERNEY. I get mixed up with kilometers and miles here. So it's 5,500 kilometers, 3,500 miles roughly equivalent.

General OBERING. No, sir. About 3,500 kilometers—about 3,500 kilometers or greater, you start getting into the long-range capabilities that you need.

Mr. TIERNEY. OK. We've had assessments from the Congressional Research Service and a lot of them saying that any number of intelligence estimates or studies have predicted that there would be more than five nations that have accomplished this capability in the next 40—at various times in the last 40 to 50 years. But that number hasn't really increased. You've got two, North Korea and Iran, and other than that it really hasn't increased beyond what was there quite a while ago.

General OBERING. Yes, sir. Again the facts are that those predictions oftentimes are not very accurate. You have to look at what is the sharing, the collaboration that's going on. And that's what makes it difficult to try to judge those.

Mr. TIERNEY. The other question we have, if Iran had the capability, if they had it, and which they currently don't, we'd know exactly where that missile was coming from, wouldn't we?

General OBERING. Well, sir, obviously it depends. It depends on whether or not—if it was fired from within their country, we would know the launch location of the missile. That's true.

Mr. TIERNEY. But we're not purporting that they have the capacity to launch it somewhere other than a country on an intercontinental ballistic missile, are we?

General OBERING. Well, one of the videos that I thought the folks loaded but they didn't, shows the fact that we can shoot—we actually launch shorter-range missiles off of our ships in our test beds.

Mr. TIERNEY. Again we're talking about intercontinental ballistic missiles.

General OBERING. I am talking about short range.

Mr. TIERNEY. I'm talking about intercontinental ballistic missiles. You are not purporting to tell me that Iran is setting them off from anywhere other than their own soil.

General OBERING. Yes, sir.

Mr. TIERNEY. So that would be the case, if they sent one off purposely or whatever, they could expect to have some pretty severe retaliation.

General OBERING. Yes, sir. And of course the warhead would land on our soil without missile defense that we would do nothing about. So we would have to apologize——

Mr. TIERNEY. What I'm talking about, General, obviously is, you know, you would have to think that somebody would be that crazed to send over something like that. Now Iran, last time I checked, is a country with a government, an elected government. They have roads. They have bridges. They have buildings. They have business. They're a functioning society over there. And you would have to make a leap of faith to believe that they would purposefully send off a missile, knowing there was going to be severe retaliation. That's the point that I make.

General OBERING. May I, sir, address that?

Mr. TIERNEY. Sure.

General OBERING. No. 1, just the possession of a long-range weapon would allow coercion of our allies or coercion of the United States to allow them to operate under a nuclear umbrella that I think would change dramatically the geopolitical situation in the world and would have severe policy consequences on the United States and our ability for unrestricted movement.

We saw what happened in Iraq where you had just the hostage taking of a number of individuals change the national policy of one of our allies. If you had a country that could hold entire cities at risk in Europe or other nations, what would that do to be able to coerce us? If I could get to your point directly.

Mr. TIERNEY. I wish you would.

General OBERING. What happens if they do not exercise control of those weapons? And we cannot guarantee that. So what happens if you have the equivalent of a nation state suicide bomber that wants to make a blow for their cause? And they don't care——

Mr. TIERNEY. Russia and China?

General OBERING. I'm talking——

Mr. TIERNEY. France?

General OBERING. I'm talking about Iran right now.

Mr. TIERNEY. In the case you are talking about, that could happen anywhere, whether it's Pakistan, Russia, China, France.

General OBERING. Yes, sir. Which is even—which is even more——

Mr. TIERNEY. But the system you are building is only focused on Iran and North Korea?

General OBERING. Actually the system that we are fielding is focused on Iran and North Korea for very good reason. Those are the two nations that have made very aggressive statements about their intent as well as the capabilities that they're backing that up within their program.

Mr. TIERNEY. So I guess your case is that you think that if they had the capacity, ever eventually got the capacity to throw a mis-

sile up there, that you think the threat to do so, knowing that there would be severe retaliation, would be effective enough to change U.S. policy?

General OBERING. I believe it could be effective enough to change ally policies. I think it would have severe consequences for our dealings in the alliance. And I think that's something that when we can close off that vulnerability, why wouldn't we?

Mr. TIERNEY. Well, I guess you would have to factor in a lot of other things in a cost-benefit analysis. We'll probably talk about that later, how many billions and hundreds of billions of dollars you want to get to that prospect at some point with all those factors thrown in.

We've had witnesses come in here, in fact, going back before that, back in 2000, the CIA's point person on missile threats, Robert Walpole, testified to Congress that in fact we projected in coming years U.S. territory is probably more likely to be attacked with weapons of mass destruction from nonmissile delivery means, most likely from nonstate entities, than by missiles, primarily because nonmissile delivery means are less costly and more reliable and accurate. They can also be used without attribution.

The National Intelligence Council report in 2000 entitled, "Global Trends 2015," reiterated that point. Other means to deliver weapons of mass destruction against the United States will emerge, some cheaper and more reliable and accurate than early generation ICBMs. The likelihood of an attack by these means is greater than that of a weapons of mass destruction attack with an ICBM.

Do you disagree with that, General?

General OBERING. Well, sir, first of all those are dated assessments. So I would recommend that you might get an updated assessment from the CIA and the DIA.

Mr. TIERNEY. I've had them, General. I serve on the Intelligence Committee as well. So having them, I still give you, this is the most recent written public assessments since 2001. And I notice that there has been no national intelligence assessment with respect to overall threats and prioritizing them and identifying them. And I have my own feeling that there's a reason for that, knowing what I know from the Intelligence Committee and what is real and what is not. We'll have to save that for another day because it's only insinuation at this point. But with respect to those two statements, do you disagree with that?

General OBERING. Sir, I don't disagree. What I would say is that we have to be prepared for both of the alternatives in terms of either a ballistic missile attack from a medium or long-range missile from a ship or from a smuggled nuke into a port. We can't pick and choose that. I think that the significant lesson from 9/11 was not how we were attacked. It was the fact that they expressed and acted on a will to attack. So the means by which that happens we have to be prepared for. So as soon as we say that we're not going to develop a long-range missile defense for this country, we are inviting that avenue of attack for our future adversaries.

Mr. TIERNEY. So you are an advocate of not making any priorities and not making distinctions and just spend every dollar we have on defense for every possible contingency you might have without deciding which one is more realistic than others?

General OBERING. Sir, what I would say is this, if you look at what we're spending on missile defense for the entire program, not just our long range, the entire program, it's less than 2 percent of our defense budget, less than 2 percent.

Mr. TIERNEY. It's about $150 billion to date with another anticipated over $200 billion going forward. And we'll talk about effectiveness and other things later. But my time has expired.

And nobody being on Mr. Shays' side, Ms. McCollum, you are recognized for 5 minutes. I'm sorry. Mr. Van Hollen is recognized. I didn't see him over there.

Mr. VAN HOLLEN. No. That's OK.

Mr. TIERNEY. You are recognized for 5 minutes, Mr. Van Hollen. You're not ready. Ms. McCollum, you are recognized after all.

Ms. MCCOLLUM. Thank you, Mr. Chairman. Well, I am ready.

After the expert testimony from the first two hearings, I believe it would make more sense to move the Missile Defense Agency to the White House Office of Faith-based Initiatives.

It's hard to believe and it's impossible for me to explain to my constituents why we're spending $10 billion every year on a cold war program that's based on a series of very questionable assumptions. In general, just from the last bit of the conversation that was going between you and the chairman, I would have to ask you, do you have any real fears that al Qaeda, who is our No. 1 enemy, would ever be able to build or launch a nuclear-tipped missile at the United States?

General OBERING. Ma'am, you put your finger on a very important concern, and that is, while the number of countries that have grown since——

Ms. MCCOLLUM. I asked you about al Qaeda.

General OBERING. I'm getting to that, ma'am.

Ms. MCCOLLUM. I only have 5 minutes. I asked you, do you have a fear that al Qaeda could be in possession——

General OBERING. I have fear that as the access to these weapons have grown because of the lack of missile defenses, I do believe that organizations like al Qaeda have a likelihood of getting their hands on them and being able to launch these weapons.

Ms. MCCOLLUM. In the near future?

General OBERING. We've already seen states pass missiles to nonstate actors in the Middle East. We've seen Iran and Syria handing over short-range missiles to——

Ms. MCCOLLUM. Our allies are the ones who possess the technology. Do you think al Qaeda's going to get this from our allies. Syria doesn't have—does Syria have this capability of giving this to al Qaeda?

General OBERING. North Korea has the technology. The experts agree, there was an article in the Washington Post just this year.

Ms. MCCOLLUM. General, I am going to move on because you and I disagree on this. I don't think al Qaeda has immediate capability on this.

Are there cheaper ways to strike the United States with weapons of mass destruction than long-range missiles? Yes or no.

General OBERING. Well, ma'am, first of all, I think that it depends on a number of different factors. No. 1, would it be cheaper or easier? I'm not an expert in smuggling in weapons of mass de-

struction. What I can say is it was very cheap, relatively speaking, for us to launch a target off of a ship off the coast of Hawaii.

Ms. MCCOLLUM. Sir, I asked you a question. This is hard for me to do this. I want you to know, we were stationed at Wright Patterson when my sister is born. This is with the utmost respect, but I only have 5 minutes. OK?

Are there cheaper ways to strike the United States with weapons of mass destruction than with long-range missiles?

General OBERING. Ma'am, I'm not an expert other than the missile threat. So I can talk about the missile defenses to those threats.

Ms. MCCOLLUM. So you are not aware that there are any more reliable or accurate ways at all than long-range missiles to attack the United States?

General OBERING. I do know that by launching a missile from the coast you control everything up to the launch of that missile——

Ms. MCCOLLUM. Mr. Chairman, I'm going to focus then on cost in the next round when I can go into it serving on the Appropriations Committee. Thank you for trying to answer my questions, General, for your attempt.

General OBERING. Yes, ma'am.

Mr. TIERNEY. Thank you. Mr. Van Hollen, do you want Mr. Welch to go? We're trying to accommodate your schedule. Mr. Welch, you are recognized for 5 minutes.

Mr. WELCH. Thank you. General, first of all, it's your job to obviously develop this. You've been assigned to do that, and you're doing the best you can. And I happen to have major reservations about the effectiveness of it. But Congress has approved it. So I think we bear a lot of the responsibility for this policy. But on this question of the threat, we don't have infinite resources. And it is possible to conceive of an infinite number of threats to our national security, and decisions have to be made about the deployment of limited resources to protect us. Would you acknowledge that there's a significant tactical use of asymmetric warfare-type tactics by adversaries of the United States that we're seeing throughout—in the whole war on terror?

General OBERING. Yes, sir.

Mr. WELCH. And wouldn't it be the case, as some witnesses have testified, that there is a serious threat that somebody may try to bring a nuclear device into this country on a ship or across a border and then detonate that device here in the homeland?

General OBERING. Yes, sir.

Mr. WELCH. And would you be in agreement that it would be important for us in terms of addressing that threat that we have a focus on some of the vulnerabilities at our ports and along our borders?

General OBERING. Oh, yes, sir.

Mr. WELCH. Do you have an opinion as to whether the threat of that type of means of delivery is greater than the threat posed by a long-range ballistic missile delivery system?

General OBERING. I do have an opinion. Yes, sir.

Mr. WELCH. And what's that?

General OBERING. I do believe that from our own experience, being able to launch a weapon from a ship into the United States in which you controlled everything up until the launch of that weapon and not have to rely on trusted agents or sneaking past sensors and these things is a real threat. That's something that can in fact happen.

Mr. WELCH. And the question I asked is whether—do you think that threat is a greater threat than delivery by these asymmetric means?

General OBERING. Sir, I don't know if I can quantify that. What I can say is that it is a threat that we can do something about.

Mr. WELCH. I actually think it's important to have some quantification. If there's limited resources and we have to decide to put those resources into protecting ports from a delivery by means of backpack or cargo container versus put our resources into acceleration of the missile defense program, and we can't do both, which do you think is a more imminent threat?

General OBERING. Again, sir, I'm not an expert in that regard. I'm only an expert in the missile portion of that, the missile defense portion of that.

Mr. WELCH. Well, I understand that. And again, this is not just you. That's your job, so that's what you've got to do. And I think all of us respect that and appreciate your history here. But from the perspective of threat—I mean obviously it's very important for national security reasons that people with experience like you and policymakers have threat assessments, right?

General OBERING. OK, sir, if I can answer it this way: I look at the intel books every day.

Mr. WELCH. You look at what?

General OBERING. I look at the intel assessments every day. I don't recall seeing any testing of a nuclear suitcase weapon in those books in the last 4 or 5 years—4 years that I've been—almost 4 years I have been Director. I have seen year after year after year, test after test after test, last year 120 of those missiles from a variety of countries around the world. So I'm paying attention to that capability. And if we have countries that are producing that capability in those tests and then some of those countries, a small subset are making very hostile statements against the United States, it's something that I am being paid to pay attention to and to see if we can do something about that.

I'll leave it up to the Congress and others to make a determination of how much is enough of what. All I can say is, from my personal perspective, I see this progression across the globe, and I see it's something that we can actually do something about.

Mr. WELCH. What countries are you focused on as a threat to our security through the delivery of missiles?

General OBERING. I think today Iran and North Korea have made very hostile statements against both the United States and our allies. They are backing that up with capability demonstrations. One of the lessons learned from the summer of 2006 is the North Koreans had carried on their Taepodong–2 program much beyond what we were anticipating and they attempted a launch of that long-range weapon. But more importantly, the shorter-range

weapons that they fired, they showed a dramatic improvement in the reliability and the accuracy of those weapons as well.

Mr. WELCH. Do you believe that our capacity for massive retaliation if there were a missile attack by Iran would serve as any deterrent on the launch of a ballistic missile against the United States from Iran?

General OBERING. If the controlling authorities were deterrable, yes, sir. If they're not, then the only thing you can do is protect yourself against that missile. And I think that is what I am trying to convey, and maybe not very well, is that we are no longer in the cold war. We no longer can rely solely on deterrence because we may face in this century organizations or countries that are nondeterrable.

Mr. WELCH. Right. Well, I actually agree with that. I mean, actors that are nondeterrable. And that's what the problem is with the asymmetric warfare tactics of folks who use terror as a political tactic. But our—as I understand it, our recent National Intelligence Estimate on Iran, our November 2007 intelligence estimate concluded, "Tehran's decisions are guided by a cost-benefit approach." Do you agree with that conclusion in the National Intelligence Estimate?

General OBERING. I will give you my opinion of that. There are three things that are necessary to deliver a nuclear weapon or weapon of mass destruction. You have to have—in a nuclear weapon, you need to have the enriched uranium to be able to produce the material. You have to have a weaponization of that and you have to have a weapons delivery vehicle. Now if you look at the cost-benefit analysis that is going through the Iranians right now, why are they investing so heavily in the weapons delivery vehicle systems; i.e., the missiles, if they're only interested in a small conventional warhead? Knowing the accuracies that they have, it doesn't make a lot of sense to me. That's my assessment. So I think that—and I think there's been followups to the NIE since then that talk about what that really meant in terms of halt and whether they've restarted etc. But I don't think it makes sense to say that they're going to stop weaponization and yet they're going to accelerate their missile programs.

So I believe that it doesn't make sense. I think it's something that we really have to pay attention to.

Mr. WELCH. So what's your threat assessment of the likelihood of Iran launching a first strike missile attack on the United States?

General OBERING. I believe that the ability to do that is several years away. The ability to do that is probably not before 2015 based on the intel experts that inform us. The problem there is, we have to be prepared for that because capability takes years to develop, both offensive as well as, by the way, defensive to be able to build a defense for that. But intent can change overnight. So I can't guarantee the Congress and can't guarantee the U.S. people that we will be protected from attack because they choose not to do so.

Mr. WELCH. What is my time?

Mr. TIERNEY. Your time has expired. We're going to have another round.

Mr. WELCH. OK. Thank you.

General OBERING. Yes, sir.

Mr. TIERNEY. Mr. Van Hollen, you're recognized for 5 minutes.

Mr. VAN HOLLEN. Thank you, Mr. Chairman. And again, thank you for holding this series of hearings. And welcome, General.

Just to frame the discussion, and it already has been, I think, very well framed by my colleagues, this is not a question of whether the United States should be spending any money at all in this area. The question is, the amounts of money that's being spent, especially given the other threats that are out there.

Now you have said that this represents 2 percent of the Defense Department budget which, as you know, is a huge budget. If you take the $10 billion, it represents one-third of the entire budget for the Department of Homeland Security. And that's the issue being raised here because according to most intelligence analysts, while I understand what you've been saying, that you're not an expert on comparing the risks, the intelligence folks who do make it their business to do that have indicated that you're more likely to have a threat, especially in the near to mid-term of a nuclear weapon being smuggled into this country. And the fact of the matter is we're spending very little to defend against what is a more probable and realistic threat at this time compared to what's being spent to look at what may be a threat way out there on the horizon. But I want to focus on the effectiveness issue as well because if we're going to be investing this kind of money, we would hope that it would be an effective system.

And you state in your prepared remarks that under the Missile Defense Act of 1999, "it became U.S. policy to deploy missile defenses as soon as technologically possible to defend the United States against limited ballistic missile attacks."

There's also another portion of that language in that directive that says, "but it should be an effective national missile defense system."

Now in a prior hearing in this committee we heard from a number of experts and scientists in this area, including Richard Garwin—and I'm sure you are familiar with Mr. Garwin. He's been focused on this area for a very long time—who said that should a state be so misguided as to attempt to deliver nuclear weapons by an ICBM—and I assume he said that for the reasons Mr. Welch was talking about, because if you're a state launching an ICBM against the United States, for example, we know where it came from. We have overwhelming ability to retaliate. But if they were to be so misguided as to do that, they could be guaranteed against intercept in mid-course by the use of appropriate countermeasures.

A 1999 NIE judges specifically that Iran or North Korea could have such measures at the time of their first ICBM task. Now you were talking in your remarks about the year 2015. Would you judge that by that timeframe that any of these potential threats that you've been focused on North Korea or Iran would have very effective countermeasures if they were to at that time be able to have this missile capability?

General OBERING. We are anticipating that to be the case.

Mr. VAN HOLLEN. OK. Let me ask you this: Do you believe that the systems you've tested to date would be able to defeat the countermeasures that would—and this is a total hypothetical. It wasn't

a hypothetical at the time of the Soviet Union. It's obviously much less likely now. But I'm just asking you the technology question.

Would your system be able to defeat the type of countermeasures that could be deployed by Russia if, hypothetically, it were to launch an ICBM against the United States?

General OBERING. In 2015 or today?

Mr. VAN HOLLEN. Today.

General OBERING. Not today. So very complex countermeasures. The system would not be able to handle for either the short, medium or long-range system.

Mr. VAN HOLLEN. Right.

General OBERING. But the types of countermeasures that we would anticipate a country like Iran or North Korea to be able to employ, we believe it can.

Mr. VAN HOLLEN. So you are not testing now against the kind of countermeasures that hypothetically Russia——

General OBERING. Yes, sir, we are. But not in our intercept program. We've had a very robust countermeasures test program. So we've actually flown very complex countermeasures against our sensors and our systems. We've had eight flights over the past several years in which we have collected immense amounts of data and being able to—that's how we're deriving our algorithms for our sensors and radars to be able to counter those in the future.

And in addition, one thing that I mentioned in my opening remarks, we can't lose sight of the fact that we're building a layered system. So what we would like to do is destroy that missile before it ever is able to deploy or employ a countermeasure. That's what our boost phased defenses are for. Once they do that, we have the ability to deal with those more complex countermeasures by virtue of what we're doing with our sensor programs, our algorithms development, and our Multiple Kill Vehicles where we're able to take out the credible objects that we're able to discriminate.

So in answer to your question, I believe that today we are able to counter the simple countermeasures that we would anticipate from a country like Iran or North Korea. And for the future, we have a robust program laid in to be able to counter those.

Mr. VAN HOLLEN. But in the year 2015 that you are talking about, what kind of countermeasures capability would you anticipate from——

General OBERING. I would have to go into a classified session to talk about that.

Mr. VAN HOLLEN. OK. But are you suggesting that by the year 2015 you would be able to effectively respond to countermeasures that could be deployed by—again, this is hypothetical—but by Russia, Russian ICBMs?

General OBERING. We should have a pretty good leg up, yes, sir, based on our algorithms, based on our sensors and then based on the follow-on Multiple Kill Vehicle programs and then eventually the boost-phased defenses just shortly thereafter.

Mr. VAN HOLLEN. Last question, Mr. Chairman. What would you do to fully deploy the kind of system——

General OBERING. Sir, can I make one clarification?

Mr. VAN HOLLEN. Yeah.

General OBERING. It would not be directed at Russia because that presents a different challenge. I'm talking about a country like Iran and North Korea that would have the kind of countermeasures on their fleets. So for example, if you're talking about trying to counter a Russian attack, absolutely not because you are talking about hundreds of missiles and thousands of warheads. That's not what I'm referring to. I want to make sure you are talking about the kind of countermeasures themselves that would be deployed on a single missile.

Mr. VAN HOLLEN. Well, then, based on that assessment, what kind of missile deployment are you basing your calculation—with respect to Iranian or North Korea missile capabilities in terms of numbers? Because the point you are making, I understand, you know, if you are talking about one missile, you may have that ability but—so based on your estimate here, what kind of fleet of missiles are you, in terms of your hypotheticals, are you using for this assessment?

General OBERING. Well, actually we get that from the intel community and what they think and assess their abilities would be. And we factor that into our force structure that we recommended to the Department. So right now that consists of about 44 missiles in the United States, 10 in Europe. So a total of 54 of the long-range missiles. We would have—by 2013, we would have approximately 133 of our sea-based interceptors. We would have approximately 100 of our THAAD interceptors with four or five units capable of deployment. Then shortly following that, we would begin to ramp up with a long-range sea-based missile that we call the SM–3 Block IIA, and those numbers have yet to be determined in terms of what that would be.

Mr. VAN HOLLEN. And again, we're going to hear some more testimony after you. But there are obviously serious questions have been raised about whether the testing program that you've undertaken really tests under realistic type scenarios with respect to the countermeasures. And I understand your testimony here. But I think——

General OBERING. I can address that if you like.

Mr. TIERNEY. We're going to do that I'm sure in the course of questioning, sir.

Mr. Shays.

Mr. SHAYS. Thank you, Mr. Chairman. Thank you, General Obering. I am pretty stunned by the fact that given that you're in charge of this program that you wouldn't have been given the opportunity just to make a presentation. If it took 5, 10, 15 or 20 minutes, I would have thought you would have been given that opportunity. And I can't imagine why this committee would be reluctant to do that. You're in charge of the program. We've had a number of hearings where all we've heard from primarily have been critics with one witness that we're allowed to introduce as a counter. And the only reason we introduced a counter in support of the program is, we want there to be a counter. If they had all—only people favoring it, we would have had a counter the other way. But it strikes me, one, that you have a lot more to say and you would have had a lot more to introduce that should have been made part of the record, and I deeply regret it. I can't even tell you

how deeply I regret it. It makes me feel that this committee does not want to really know how this system works. They just want to score points.

Mr. TIERNEY. Mr. Shays, you will have ample time to ask your questions.

Mr. SHAYS. No. No. I don't have ample time.

Mr. TIERNEY. We're going a number of rounds.

Mr. SHAYS. I'm just going to make a point to you.

Mr. TIERNEY. You've made your point.

Mr. SHAYS. You have interrupted me and I will claim back my time. I have deep respect for you, Mr. Chairman. But when it comes to this, I think this is a fraud. I think this is an absolute joke. You should have been given as much time as you needed. And had I been chairing this committee and it was the other way around, I would be doing that. It's no sense to bring in someone of such expertise and tell him he has 5 minutes and then we'll give you an extra 2 or 3 minutes and make him rush through a presentation that he was not able to finish. It's just a fraud.

I found myself not being a supporter of this program when it started out because I didn't think you could hit a bullet with a bullet. I didn't think you could do some of the technology. And it's really a surprising thing to me, frankly, that it is unfolding the way it has. I have been one that says it should not be deployed until it works. I have to tell you, though, when Iraq was sending SCUD missiles into Israel, I thought, oh, my God, we didn't—the PATRIOT didn't work all that great. But it did serve some function. Does this system have any capability in a much shorter-range theater? And if Israel had the kind of technology today, would those SCUD missiles have penetrated the way they had penetrated?

General OBERING. Sir, what I can do is talk about the latest fight in Iraqi Freedom. There were several missiles launched against coalition forces. They were all totally destroyed. Those that were going into defended areas were totally destroyed by the PATRIOT systems that we had deployed. That included the PAC–3 by the way. One of those—at least one of those trajectories we now know would have impacted a very heavily populated area in the coalition force arena. So that—the money we're spending is for the short-range defense as well as the medium and the long-range defenses.

And may I say that, you know, obviously other nations than the United States are making the cost-benefit analysis to go do this. Because we are—we are, frankly, being inundated by several countries to help them to build missile defenses very rapidly. As I said in my opening statement, there are actually 18 nations around the globe that we're working with to help them build a missile defense system as well.

Mr. SHAYS. Explain to me the support of NATO because I'm surprised. I thought some of our NATO allies were pretty critical of this system. So I don't know how to interpret your comment that there's support among NATO for a missile defense system.

General OBERING. Sir, in the Bucharest Summit Communique that was released in April, there was a statement in there—I think it was paragraph 37, and what they did is they basically welcomed the U.S. long-range defense proposals that we are—that's the pro-

posal to put 10 interceptors in Poland and a radar in the Czech Republic to provide—to begin to provide long-range protection for our deployed forces in that region along with our NATO allies. And they also went—they took it a step further and they tasked their own infrastructure to come back at the 2009 summit with options for how they build shorter-range defenses, missile defenses to integrate with the longer-range systems. And we are helping that process. In fact, we had a demonstration in January of how we could take the command and control system that we have deployed for the U.S. components and what NATO is building. NATO is building a theater missile defense program today that's called an active layered theater missile defense program. And the NATO Air Command and Control System is the command and control system for that. We're showing how we can integrate those two together by taking radar track data, mission data, those types of information, and running that on the NATO system, then taking the NATO data and running it on our system.

Mr. SHAYS. Is it conceivable that contrary to the wishes of, say, the leader in North Korea or the powers that be in Iran, that someone could direct a missile at the United States without their leadership knowing about it?

General OBERING. Sir, that would have to do with the command and control of the weapons in the country. It's something that I'm not an expert in. But it certainly is within the realm of the feasible that could be done without the knowledge of a government, depending on how loosely or how tight those controls are.

Mr. SHAYS. Thank you. Thank you, General.

Mr. TIERNEY. Thank you, Mr. Shays. Mr. Hodes, you are recognized for 5 minutes.

Mr. HODES. Thank you, Mr. Chairman. General I want to talk a little bit about some of the testing that's been done. But I'd also like to put this in the context of costs. We've spent approximately $125 billion over the last 25 years. For missile defense last year, $9.9 billion, the CBO estimates that if the MDA continues on its course, the taxpayers are going to spend an additional $213 to $277 billion between now and 2025. So in the context of those kinds of numbers, I want to ask some questions about testing.

Is it true that over the past 5 years, there have been only two successful GMD flight intercept tests?

General OBERING. In the new configuration, yes, sir, but the total configuration, including the prototype of what we deploy today, there are now six of nine over the last—since 2001.

Mr. HODES. How many GMD flight intercept tests will you do before you introduce flight intercept tests with more than one mock enemy missile in the attack, when do you plan to do that?

General OBERING. Well, first of all, I think we have that plan for later in our program. But in reality, the ability to deal with multiple missiles is better tested in our ground tests and our modeling simulation. Because looking at the geometry and physics of these attacks, each—each attack, each missile attack is, in essence, an isolated event, so we learn more from that from our flight tests.

Mr. HODES. We have heard—we have had testimony that in March 2002, the MDA told Congress that the first GMD tests with

multiple targets, that is, with several mock enemy missiles launched at once could take place as early as 2005.

You're now saying that's going to take place later in the program, and you say that other means are better than mock tests. When did you make the determination that the other means were better than the mock tests that you said would take place as early as 2005?

General OBERING. So that says we gain more and more confidence in our modeling and simulation program that's what—that's what would prompt that.

Mr. HODES. In other words——

General OBERING. I want to—I'm sorry, go ahead.

Mr. HODES. I just wanted to make clear. In other words, you switched, after 2002, your assessments of what kind of testing you wanted to do?

General OBERING. Sir, we do that all the time.

Mr. HODES. And when was that change made?

General OBERING. I don't recall. I would have to submit that for you for the question for the record.

Mr. HODES. And when you say later in the program, what do you mean by later in the program terms of when you're going to be conducting the actual tests with multiple, multiple targets?

General OBERING. I'll have to submit that. I want to make sure I'm accurate in that. I know it's what we call our Integrated Master Test Program, but let me get back to you on that.

Mr. HODES. All right. And I'm sorry, I didn't want to cut you off, you were going to add something.

General OBERING. Sir, just the fact that we do salvo testing, which is what you're referring to. In—in our short range—in our short range defenses, we have done that with our sea-based where we launched two targets in the air simultaneously, and we've engaged with two inceptors because it makes sense in a tactical situation.

In the long range by the time you've grown that geometry over thousands and thousands of miles having two intercepters in the air at the same time, against two different targets. What I'm trying to say is each one of those is like an isolated engagement that is fully capable of being tested in a single engagement.

Where we really are—what you're really stressing there is your commander control, your sensors, that type of thing and we can inject and we can do a better job with our simulations to be able to—to stress that system, not just with two but with 10 or 20 at the same time.

Mr. HODES. When do you plan to conduct a flight intercept test to demonstrate that the GMD is effective at night?

General OBERING. Let's see, sir, we had—we actually had a night launch, as I recall, that was—that was scrubbed because of—because of one of the intercepting issues, but that was several years ago. Again, I will submit the answer for the record in terms of when that will be.

Mr. HODES. And just to jog your memory, our understanding is that according to previous testimony the first nighttime test was to have been back in December 2002. So we haven't yet had a success-

ful nighttime test, and that's just that we're about 6 years behind schedule on nighttime testing?

General OBERING. Sir, it depends. We went to a different configuration on the kill vehicle between the 2002 timeframe and the 2004 timeframe. So I'll have to—again, I would have to submit that answer for the record.

Mr. HODES. What about conducting a flight intercept test to demonstrate that the GMD system is effective in bad weather?

General OBERING. We will probably not do that with respect to actual flight tests because we want to make sure we gain as much information as we can from these launches because of the money we spend on them. And, for example, we want to make sure we have optical tracking in case we do have a problem that we can gain the data from that.

Mr. HODES. So you—I'm just going——

General OBERING. It is not something that we're very much concerned about frankly.

Mr. HODES. You're not very much concerned about whether or not the system is effective in bad weather, or not concerned about sort of in flight testing for bad weather?

General OBERING. We're not concerned about—we're not concerned that weather will have a major impact on the system is what I'm trying to say. For example, I mean we've launched—well, we've launched out of Vandenberg in heavy inter—in heavy cloud layer of marine layer. We did that in FTG–2, which was a year ago, a little over a year ago now, a year and a half ago.

There is some—you can get some degradation with some climate effects on sensors. But in order for that to be a factor, it would have to be every sensor that you have in the program at the same time, which is not a high likelihood. And in addition, you can test those effects in our modeling and our simulation and our test program much more—with much more scope and much more expansiveness than doing in a flight test. And it is much cheaper to do it that way. Does that answer your question?

Mr. HODES. Yes and no. Perhaps I'll followup at a later time. My time is out. Thank you.

Mr. TIERNEY. Thank you, Mr. Hodes.

General, I just want to follow in that same vein. That 1999 National Intelligence Estimate on accounting measures, I don't know that Mr. Hodes read the whole thing. "We assess that country's developing ballistic missiles would also develop various responses to U.S. theater and national defenses. Russia and China have each developed numerous countermeasures and probably are willing to sell the requisite technologies. Many countries such as North Korea, Iran and Iraq probably would rely initially on readily available technology including separating RVs, spin stabilize RVs, RV rear orientation, radar absorbing material, boost-er fragmentation, low powered jammers, CHAF, and simple balloon decoys to develop penetration aids and countermeasures. These countries could develop countermeasures based on these technologies by the time they flight test their missiles."

I assume that you agree with that, that by the time they flight test the missiles, they could develop those kinds of technologies.

General OBERING. They could, sir. Yes, sir, but go ahead.

Mr. TIERNEY. So let me ask you—I don't—I didn't hear if this was asked. Have you had a test against a flight incept system test where you introduce decoys that resemble the target RV in the infrared signature size or shape?

General OBERING. Sir, if I answer that, I will have to do it in closed session in terms of what we have actually flown against, but we have flown against countermeasures in our program.

Mr. TIERNEY. Well, I think I have that—in unclassified form here. I'm going to go over it in detail and it's certainly public record out there. So we can wait until then if you'd like.

General OBERING. But—what—when you get to an operation and deployed system what you can and can't do with respect to capabilities and limitations becomes classified. And the ability to deal with certain types of countermeasures. What I can say is that we are, we have flown against countermeasures in the past to try to decoy the kill vehicle. We are flying against countermeasures in our next flight test for the long range system, for next two this year. And we will continue to expand that in our future test program. So if that answers your question.

Mr. TIERNEY. Well, it does and doesn't. I mean, we have information about what you've flown against, it is public information. It's out there and publicly gone.

General OBERING. Sir, we changed the kill vehicle capabilities since those tests were done. We have an operationally deployed kill vehicle now that is different than the prototype that was flown in the countermeasure tests. We learned what we wanted to learn from that testing.

Mr. TIERNEY. But against which there have no real operational tests taken, right? But you have not done realistic operational tests.

General OBERING. Sir—again, we believe that there are missiles that have been deployed that do not have the countermeasures, in fact, the vast majority. And this argument, by the way——

Mr. TIERNEY. We're not talking about short range and medium range here. We're talking about intercontinental ballistic missiles. And in that sense, you don't even think that Iran or North Korea has the current capacity to send those against the United States. So, we're talking here I think about, what you think is going to happen on 2015.

General OBERING. Sir, to have this conversation in a genuine fashion I need to go closed. Because I can tell you what—I can tell you what we have seen, and what we have experienced, and what we have flown against.

Mr. TIERNEY. I have to tell you, General, this stuff, you know, how the American public's supposed to decide on something with this kind of enormity and expense and speculation on some of the capabilities is mind boggling when it goes on a classified sense. We overclassify so much in this country.

Back when the President made the decision that he wanted to try to deploy this inoperable system back in 2004, we asked for Government Accountability Office to study this. It was done. There were 50 questions. Mr. Coyle, you know, had 50 of the questions in previous testimony that were addressed in that study. It came

back, and the minute that it came back it was classified all of a sudden.

I have to tell you they don't classify stuff when it is good news around here these days, they classify what is bad news apparently. I don't think it does a service to the American people at all to this Congress to keep classifying everything on that basis. And I think we just have to go on from here. But I hope that's not going to be your answer to every question about the capability of these systems.

General OBERING. Sir, I am being as honest and candid as I can. First of all, and I'll repeat, we have flown against countermeasures in the past with prototypes of the kill vehicles that we deployed. And we are successful in those tests. We actually identified the warhead and we engaged the warhead in those tests. And that included not just the ability to do that using infrared data, but we also used our radar data to be able to make that determination so that is a fact.

The particular types of countermeasures and the particular capabilities and the signatures and everything else are classified. When we now move into the operational configuration, which is the big difference, that's what happened in 2004 is it became an operational system. It was not an open research and development system. And we changed the capabilities. We frankly robusted the capabilities of the kill vehicle in terms of algorithms that we're using. And what you saw in the video in terms of the discrimination techniques that we were using, that became classified. Because I'm sure, Mr. Chairman, you would not want us to transmit in an open hearing to enemies around the world in Iran and North Korea any kind of data that they could take advantage of in trying to overcome the system for the future. I know you wouldn't want to do that.

Mr. TIERNEY. Of course not. And that's a tremendous red herring that we're not even talking about here. So——

General OBERING. That's exactly what we're talking——

Mr. TIERNEY. What we're talking about is the capacity of this and people in this country spending hundreds of billions of dollars on a system. They ought to know against what it will work and against what it won't work. And I'm not sure that information is going to affect any other country's capacity going on here on that basis, but it should effect our decisionmaking process how to spend the taxpayers money. Let me go on for a little bit, if I can, on this as far as we can go before we find out that everything is classified here. Have you tested against booster fragmentation?

General OBERING. Pardon me?

Mr. TIERNEY. Have you tested against booster fragmentation?

General OBERING. Yes, sir. We have—not in an intercept test, but again, in our flight tests we have.

Mr. TIERNEY. But not an intercept test?

General OBERING. Right.

Mr. TIERNEY. How about low power jammers.

General OBERING. No, sir, not yet.

Mr. TIERNEY. How about CHAF?

General OBERING. We have tested it in our flight test and we also tested low power jammers in our flight tests, but not intercepts.

Mr. TIERNEY. Ms. McCollum, you are recognized for 5 minutes and I'll come back.

Ms. MCCOLLUM. Thank you, Mr. Chair. Sir, I'm going to read from your testimony on page 17. "There's one real world example of where missile defense did not play a role and that provides an important lesson. September 11, 2001, terrorist attacks on our country. According to the Government Accountability Office, the direct cost of the September 11, 2001, attacks in New York City was $83 billion. That was an attack that did not involve Weapons of Mass Destruction." And I know you and I also reflect a great sadness of the loss of life on September 11th.

So this is my dilemma, we need to have a comprehensive threat assessment across all sectors, ballistic missile threats, smuggled nukes in cargo containers. So General, I want to find out, have you been part of interdepartment considerations that involved both defense and Homeland Security to try to figure out the right funding mix across this entire country? We have limited resources.

General OBERING. Ma'am, that—my role in that is to provide what the costs would be to protect against a ballistic missile attack both by deployed forces for short range, intermediate range and long range.

Ms. MCCOLLUM. Do you believe as a citizen, as a patriot of this country, as a person in your capacity, though, that funding decisions should be based on the overall threat assessment to all threats——

General OBERING. Obviously.

Ms. MCCOLLUM [continuing]. To the United States?

Over the next 5 years the Pentagon has requested another $62.5 billion for missile defense. If Congress supports this spending on missile defense by the end of 2013, over $110 billion will have been spent since 2003. I want to say that again. $110 billion will have been spent just since 2003. That's not counting the missile defense spending and the previous 10, 20, 40 years.

So I have a couple of questions that maybe you can help with me, as I point out, I also serve on the Appropriations Committee. How much money is it going to cost to complete the overall BMD system? And when will the overall BMD systems be complete? How much money will it cost to complete the ground-based GMD system? And when will the GMD system be complete?

The Congressional Budget Office has estimated for us that if the Missile Defense Agency continues course, the taxpayers will spend an additional $213 to $277 billion between now and 2025. Do you agree with this assessment? And if not, could you tell me as specifically as you can why you do not. I would like to get down to the money because there are other defense needs.

General OBERING. OK. If I go back to your first question, am I concerned or would I be interested in or as a citizen or patriot in terms of the overall flight assessment, the answer is yes. Do I believe that we have the option or the freedom to pick and choose which one of those that we can ignore? No, ma'am, I don't.

Ms. MCCOLLUM. General I didn't say about ignoring, I just—I just wanted——

General OBERING. OK, but I'm saying maybe if I can answer it. I think it is important that we cover all of those threats, because as soon as we announce that we are not going to cover a missile defense threat or a missile threat, that would be the avenue by which we are attacked, No. 1. You asked me about what it will take to finish the program. If you can tell me what the threats are going to be in the next 10, 15, and 20, to 25 years, I can answer that, but nobody can.

Ms. MCCOLLUM. Sir, did we not have a goal with stated objectives when we started this program of where we would be?

General OBERING. Yes, ma'am, I can tell you we're meeting—we're meeting our goals for the first phase of the ground-based midcourse system is the way I describe it, which is, we are buying with the 2009 budget the last of the missiles we would need for the installation in the United States, the 44 interceptors.

Ms. MCCOLLUM. So——

General OBERING. We've already paid—we've already paid for the sensors. Pardon me?

Ms. MCCOLLUM. Everything is on track.

General OBERING. It's on track for the ones that we have in place, or that we have planned to place in the United States.

Ms. MCCOLLUM. On track with no cost overruns?

General OBERING. Ma'am, actually that cost for the GMD contract would have been, right now, 9 percent estimated completion of that cost, which is pretty good in terms of the Department standards. That's an effort that's been ongoing over 10 years now. It is about an 8- to 10-year contract. The next phase, if you want to call it that, would be the deployment to European site. We have costed that to be anywhere from $3½ to $4 billion, that includes the interceptors, the radars, the support for that, the communications and everything.

Ms. MCCOLLUM. Let me go back then. Do you agree with the Congressional Budget Office that we're going to spend an additional 2——

General OBERING. No, ma'am, I don't, I don't. I don't agree.

Ms. MCCOLLUM. Can you submit to the committee why you disagree with the congressional——

General OBERING. Yes, ma'am I can. I will do so. I will tell you why I would not agree with that. Because they are making assumptions about what we will continue and what we will not continue that I don't think are accurate so I'd like to do that in writing.

Ms. MCCOLLUM. Sir, with all due respect, you just said that this program has no end because you have to completely be reassessing——

General OBERING. Yes, ma'am, but I'm talking about a matter of degree. About which programs you carry in total. Let me give you an example. Do we need two boost phase defense programs? The communicator sat there in the airborne laser, the answer is no. If the airborne laser works and if we can make that operation affordable, then we would pursue that program. So I believe what we're

talking about is a matter of degree in terms of what we carry forward.

Ms. MCCOLLUM. Thank you. Mr. Chair, I realize my time is up, but I want to note that your budget of $10 billion is one third of the total budget for Homeland Security and that is the dilemma this Congress faces. Thank you, Mr. Chair.

Mr. TIERNEY. Thank you, Ms. McCollum.

Mr. Welch, you're recognized for 5 minutes.

Mr. WELCH. Thank you. General, one of the concerns I have is that the budgeting for this program is in the research and development component of the Defense Department; is that right?

General OBERING. Pardon me? Yes, sir, yes, sir.

Mr. WELCH. And obviously this program going on 25 years at this point has a pretty strong life of its own. My understanding is that there are plans for very substantial purchases. According to the information I have, this is for new interceptors between now and 2013. It includes interceptors for the GMD system in Alaska and California, 111 SM–3 interceptors, 100 terminal sea-based interceptors for the Aegis BMD system, 96 THAAD interceptors, 400 Patriot Pack 3 interceptors. It adds up, left a few out, to about 635 new interceptors proposed to be bought in the next 5 years.

I have two questions. First, why can taxpayers be confident that our money is being well spent when this very significant acquisition plan is not in the regular procurement sections of the DOD budget?

General OBERING. Well, first of all, the fact that it is or is not in a regular procurement mode I would submit is not an accurate measurement of whether it is being well spent frankly. I think that is a matter of looking at——

Mr. WELCH. What's the point of having a regular procurement system?

General OBERING. Well, first of all, sir, the procurement system that you are referring to is one that has grown up over the years primarily out of the cold war timeframe, and in the missile defense era, and in the missile defense mission area, the reason that we are using our RDT&E money for the majority of our program, although we are transitioning that to procurement for a portion of that beginning in 2010——

Mr. WELCH. Well, my understanding of a budget is that the real world decisions and choices have to be made with cost and benefits weighing the opportunity costs. If you choose to spend dollars here, you're not going to be able to spend them there. In my understanding of a basic procurement and budgeting process is that it is intended to impose some discipline so hard decisions about threat assessment, something that we were talking about at the beginning of your testimony have to be made.

General OBERING. But they can be made at the RDT&E level as well is what I'm trying to say. And there's Defense wide accounts that you can make those decisions and determinations in. But if I can answer your question——

Mr. WELCH. Well——

General OBERING. We have a good track record in being able to manage these programs with respect to cost and schedule No. 1. No. 2, in terms of the number of interceptors, the ones that you

quoted we actually are being asked for more of those by the warfighters, and that has been approved recently by the Joint Requirements Oversight Counsel that's chaired by the vice chairman of the Joint Chiefs of Staff. They are not only asking for what you just quoted, they are asking for about double those in the land mogul and the sea-based area.

Mr. WELCH. We have a bit of a disagreement here.

Mr. Chairman, my concern is there is not some centralized approach where some people who are looking at the information coming in from the warfighters and folk advocating for this program are also hearing from folks who are who are concerned about Homeland Security and the threat that comes perhaps from a backpack delivery of a very serious nuclear device. So this is isn't an argument really I have with the General, it's a concern I have with the process of budgeting where hard decisions and threat assessments are not made.

Just with respect to a second question, General, that is—655—635 new interceptors. What is it that you describe as the threat for which we're purchasing 635 interceptors?

General OBERING. If I could for the budget that the Defense Department oversees and is responsible for, there are hard decisions made. And those budget trades are being made within the Department.

With respect to what are those numbers of interceptors geared for, they are geared for the numbers of missiles that we see, the North Koreans and Iranians deploying, and capable of using in the regional fights, along with the anticipated long-range missiles that we believe that those countries will be capable of producing over the next several years.

Mr. WELCH. Is it fair to say—I've been listening to your testimony carefully, and what I hear you say is that this program is essentially necessary in order to deal with the threat that has been assessed to be presented by Iran and North Korea.

General OBERING. For the missile defense program that we have fielded, yes, sir.

Mr. WELCH. Already. And—that's it, my time is up. And I yield back, Mr. Chairman.

Mr. TIERNEY. Thank you, Mr. Welch.

Mr. Hodes, you are recognized for 5 minutes.

Mr. HODES. Thank you, Mr. Chairman.

General, I would like to continue down some of the line I was following before about reality testing for our systems. I understand and note your testimony that modeling is something that you are relying on as opposed to flight intercept tests primarily.

When do you plan to conduct flight intercept tests to demonstrate the GMD systems effective when multiple attempts are needed to bring down a single target and can work when more than one missile is launched?

General OBERING. Sir, we do that already in term of our ground testing. We already test how many missiles, which locations, what the stressing conditions are. We do multiple runs of those over a period of days and dozens and dozens of runs within our system.

Mr. HODES. When you say you do dozens of dozens and dozens runs, are those in flight tests or are those the simulations?

General OBERING. Those are simulations.

Mr. HODES. OK, and so you're—and my question was when do you plan to take from simulation to real life testing?

General OBERING. We don't have any plans to be able to fly dozens and dozens of targets against—our interceptors against dozens of targets. That would be too cost prohibitive.

Mr. HODES. So you're going to rely solely on simulation for that?

General OBERING. Sir, that's not unusual. We do that in many other programs in the United States, including reliance on modern simulation for space shuttle for other programs.

Mr. HODES. The answer to my question is yes, you're going to rely on simulations?

General OBERING. But it is anchored by flight tests, sir. So I want you to—I want you to understand that. We are in the process of going through, validating and verifying our models and our SIMs. We should have that process complete by October of next year. But in that validation verification process, we use the flight test that we conduct to make sure that we anchor those. If we could—if I still have my briefing I would like to show you a chart and I would just like to show you one example of what I'm talking about.

Could we bring up my briefing please, if that's OK. And if you could please go to slide—this is just one very, very small example, but it is illustrative. And could you go to slide No. 9, please. Keep going, right there, stop.

OK, I'll use the satellite interceptor we did in February. We did this in about 6 weeks as I mentioned in my opening statement. And what you see here is these are modeling and simulation predictions of what the intercept would look like if we engaged that satellite. With—first of all, on the left is without hitting the tank. And the one on the right is as if we hit the hydrazine tank that was posing the threat. So we ran through our models and our SIMs, what would that look like if we did that?

Now, let me show you a clip one more time. This is the actual image of the intercept. So our ability to predict what that was going to look like in real-time was pretty significant.

We also used our models and SIMs to predict performance as they do fly outs to predict where we're going to hit on the target and we know that very precisely within centimeters. We use it to predict how it's going to operate in different environments. We use it to predict how we can stress the systems with respect to different trajectories, geometries, etc., so that's what I'm referring to.

Mr. HODES. On April 1, 2008, the GAO testified that they were unable to assess whether MDA met its overall performance call because there have not been enough flight tests to provide a high confidence that the models and simulations accurately predict BMDs, ballistic missile defense system performance.

Moreover, the test that have been done do not provide enough information for DOD's independent test organization to fully assess the BMD's suitability and effectiveness. And we heard testimony at a previous hearing that the Pentagon has yet to demonstrate the U.S. ground based missile defense [GMB] system, is capable of defending against a long range ballistic missile in a real world situation, because the tests have demonstrated the kill vehicle is able

to hone in and collide with an identifiable target but under highly scripted conditions.

Are these valid criticisms of the progress to date your program?

General OBERING. No, sir, I don't think so.

Mr. HODES. And why not?

General OBERING. Let me attack them one by one, or answer them one by one. All right. No. 1, the one—the validity in the assessment by the GAO of the models in SIMs is correct, it is what I talked about. We're going through the process of doing that verification. Now, do we have validated and verified models? The answer is not yet. Do we have any problems though in what we have seen in terms of the predicted data, in terms of our flight testing and in terms of what we're seeing in terms of real world performance? The answer is no, we have not seen any show stoppers. We have not seen anything that would have an affect with respect to our program that would tell us we're on the wrong path.

I think that if you ask the Director of Operations, Test and Evaluation today he would agree that we're on the right path to do this verification and validation of our models.

In terms of the numbers of flight tests, again the Director of Operational Test Evaluation, also testified that he felt that we are on the right path, that we have, in fact, conducted a test of our long-range system with the operational assets. And this includes, as I tried to point out in the video, operational realistic conditions. The one condition that we did not have on the—on the target was complex countermeasures. And I've already gone through that doesn't necessarily have to—you don't have to have complex countermeasures to be operationally realistic is my point. You will for the future, but you don't necessarily have do for today and they've agreed with that.

Mr. HODES. So just to put a final point on it. The GAO's assessment is just wrong.

General OBERING. I didn't say it was wrong. What I said was I don't agree in total with what they came to conclusions. We meet with the GAO all the time. In fact, I met with them yesterday. You can have people come to different conclusions based on the data. But we do know our data better than anybody, that's a fact.

Mr. HODES. Thank you, Mr. Chairman.

Mr. TIERNEY. Thank you. Thank you. General, there have been some questions raised in some of the earlier hearings about what some people said was lack of clarity of discourse with respect to MDA and public announcements. And one example that recently the MDA pointed out that there five early flight intercept tests that used simple round balloons as decoys. Your public affairs director then told the press that five successful intercept tests from 1999 to 2002 used the type of decoys we would expect from countries such as North Korea and Iran. But the decoys in those tests did not resemble the target reentry vehicle. With respect to the five early tests the decoys used were round balloons, not ice cream cone shaped like the marked target with much different infrared signatures.

The information we have is that MDA has never done a GMD flight intercept test where decoys resemble the reentry vehicle in shape or infrared signature. In the report that was issued on Feb-

ruary 28, 2002, the Government Accountability Office reviewed the technical challenges of conducting flight intercept tests with decoys that closely matched the target. And then they explained why the MDA decided then to use decoys that did not resemble the target reentry vehicle. Basically they said the MDA and its advisors felt that such tests would be too stressing, so why take the chance that the test might fail?

Let me go over those five tests, because I want to find out if your public relations person was given the direct scoop on that or whether there might be some misunderstanding. The first in October 2, 1999, is IFT3. That test was labeled successful. The only decoy used in that test was a large 2.2 meter diameter balloon from IFT1-A and IFT2. It had an infrared signature six times higher than that of the marked warhead. Because the decoy was so much brighter than the marked warhead the EKV saw at first, once the EKV realized that the balloon's infrared signature did not match up with the target that it had received prior to the test the interceptor shifted to the nearby target.

IFT–4, January 18, 2000. In this test the interceptor failed to hit the target. The failure to intercept was because the cryogenic cooling system failed of the EKV failed to cool the IR sensors down to their operating temperatures in time because of an obstructed cooling line. The only decoy used was a single large balloon from the previous test. Smaller balloons originally had been planned but they were dropped in an attempt to simplify the test presumably because the Welch Panel made those recommendations.

In IFT–5 July 8, 2000. This test also failed. The failure to intercept was a direct result of the EKV not separating from the surrogate booster due to an apparent failure in the 1553 data bus in the booster. The decoy balloon did not inflate properly causing the MDA official to decide to use a different decoy in the future.

The IFT–6 on July 14, 2001, was a repeat of the IFT–5, but this time was mostly successful. Over the prototype X-Band Radar the XBR used did not process all the information it was receiving properly causing it to falsely report that the interceptor had missed its target. I guess if that had happened in a non-test situation, more interceptors would have been launched to assure a hit of the target and probably needlessly so in that case.

One large decoy balloon was used, this one was 1.7 meters in diameter, so it's slightly smaller than the largest balloon used earlier as a decoy. It still had an infrared signature much brighter, about three times brighter than the marked warhead.

An IFT–7 on December 3, 2001. That was a successful test, so labeled. The only variable change from IFT–6 was the target booster. Instead of Lockheed Martin's Multi-Service Line System, the Orbital Target Launch Vehicle was used. Targets—that was a modified MinuteMan ICBM carrying a mock warhead and a single decoy which did not change from the previous one. It was the same one used in IFT–6.

And then March 15, 2002 IFT–8. A most successful test, three decoyed balloons, one large, two small, were used to increase the difficulty in determining the target's location, the critics have pointed out that the infrared signals of the balloon is different from that on the marked warhead. The large balloon had a much larger

infrared signature than that of the mock warhead. Whereas the two smaller balloons had much smaller signatures.

The IFT–9 October 14, 2002 that is said to have included the same three decoy balloons, one large, two small as target cluster. But specifics are unknown as you started classifying your decoy details in May 2002.

In the IFT–10, May 11, 2002, that failed when the Raytheon-built Exo-Atmospheric Kill Vehicle did not separate from its booster rocket. And a modified Minuteman ICB was being used as a surrogate until a more advanced booster rocket could be developed.

The failure to separate precluded the EKV from attempting to intercept the target missile. That was the first night test that you mentioned earlier, because the intercept failed the objective of IFT–10 was to demonstrate it effective at night was not demonstrated.

All of that, I guess, leads to the question of, if North Korea or Iran or anybody else were to attack the United States, wouldn't it be reasonable to think it would also try to confuse our missile systems? I think we pretty much agreed on that previously, right?

General OBERING. Yes, sir, but you have some inaccurate information there toward the end. The signature of the warhead was embedded in the signatures of the decoy—the decoys that were used for the last, I believe it was the last two flight tests if not the last three. Otherwise we had objects that were slightly dimmer and objects that were slightly brighter. But you're not going to be able to have—unless the attacker fully understands the capabilities of our system, that means the capability or our radar in detail and degree or with our infrared focal planes and with our sensors to be able to exactly identify and accurately model that would be very difficult. So having it embedded as much as we can justify or as much as we can anticipate what that would be is perfectly reasonable and perfectly realistic.

Mr. TIERNEY. If the signature is sometimes six times greater or three times greater?

General OBERING. Oh, what I said was that they were much more closely aligned than what you describing there toward the end of the those series of flight tests. Again, it is a crawl, walk or run approach that I wasn't the director then, but that's how—that's how they were approaching their test program.

Mr. TIERNEY. Well, it seems to make sense that if North Korea is smart enough to make a balloon of one particular diameter, they could make it of other diameters as well and make it resemble the warhead.

General OBERING. Yes, sir. And then there, as I said, there are techniques we're using today that are more advanced than what we used then. There are capabilities that we are integrating and merging together as part of our program. And it was—one thing I want to make sure you understand, is when we, after IFT–10 and the failure to separate, my predecessor, General Kaddish, made a determination and an assessment based on all the data that they had learned as much as they were going to learn especially after IFT–9 which was so very successful, including the decoy programs, as well as the ability of radar and kill vehicles to work together. That was an incredibly successful test. So he decided to make the deter-

mination to go to the operational—the full operational configuration.

Now while we maintained 75 percent of the same kill vehicle in terms of characteristics, we did modify about 25 percent of the hardware and software on the kill vehicle. And then we went to a totally now booster that we began to fly in the 2002, 2003 timeframe. And so when we went back into the air—attempted in December 2004, when I was a director, we had a failure of a ground support—at that time was a software timing failure in that test on the interceptor. It was a one parameter one line of code change to fix that.

We attempted again in February 2005 and that's when we had a piece of ground support equipment. And again, when you went to a new configuration, new locations, a different configuration of silos you are going to have these kinds of glitches, but to make sure that we did not have a systemic problem across the board, I'm the one that said we're going to stop, and we're going to reevaluate, and start from scratch.

And I asked for an independent team to come in and take a look at that. And the independent team recommended the series of flight tests that were on today, getting back into the air with a flight test of the vehicle because it was in the new operational configuration first without a target. Next flying against—they actually recommended that we do not fly against a target for another two flight tests. We accelerated that because of the success of the first one. So this idea that we somehow found countermeasures too hard and we shied away from it is just flat wrong. We did it for totally different reasons. And now we are reintroducing it as we understand the performance of our kill vehicle. Based on our testing, we are reintroducing the countermeasures to be able to fly against what we think are the kind of threats that we would be facing from Iran and North Korea.

Mr. TIERNEY. Thank you. Ms. McCollum.

Ms. MCCOLLUM. No more questions.

Mr. TIERNEY. Mr. Hodes.

Mr. HODES. General, there has been testimony about the launch against the satellite, the errand satellite. It's really—that wasn't really a test of our defense capability, was it?

General OBERING. It was not a test of our missile defense capability because we don't have an operational capability to do that. We were able to—if you want to go ahead and ask your question maybe I can get to the answer.

Mr. HODES. I just wanted to clarify that—I mean that wasn't a test of our defense capability.

General OBERING. No. Let me tell you why, we modified the interceptor to be able to achieve that intercept. We also had to modify the radar and we had to modify the ship's weapons system, because the ship could not execute that test by itself. It had to have off-board information that was integrated into the ship's fire control system to be able to accomplish that.

Now, but were tremendous lessons learned from that, that were indeed applicable to our missile defense system.

Mr. HODES. I've seen chart of the FTG–3A that you showed us. And there was a chart the BMDs hit to kill testing history, and my

understanding is that since 2001, it explains that in test FTG–3 the target failed to reach sufficient altitude; is that correct?

General OBERING. FTG–3.

Mr. HODES. Yeah.

General OBERING. Yes, that was in May—May 2007.

Mr. HODES. How high did it get?

General OBERING. I don't recall. I do recall it was about 1 to 2,000 kilometers short. So it was not in the engageable box so to speak.

Mr. HODES. Short does that mean that was how far short of down range it failed?

General OBERING. Yes, sir. Yes, sir.

Mr. HODES. You don't have the altitude figures.

General OBERING. No, sir. We had to—we could not launch against it because for range safety purposes it was not within the range safety area.

Mr. HODES. Was the interception scrubbed because the target didn't go to the place it was expected to go?

General OBERING. Because it as not within the safety constraints. We issued notifications to mariners in our flight test about areas to stay away from in terms of our flight test. And this would have come outside of that area.

Mr. HODES. OK. One of our previous witnesses stressed the importance of MDA having so called independent red team when it comes to testing our capabilities. An independent red team who would play the role of North Korea or Iran. Do we have one? If not, why not? And are there plans to institute a red team in the future?

General OBERING. Yes, sir. We have used red teams in the past, in the agency, yes, sir.

Mr. HODES. Do you plan to continue using them?

General OBERING. Oh, we have a variety of independent teams in addition to just the red team.

Mr. HODES. We've also heard testimony that the current GMD program has no operational criteria for success. Is that so and if not, what are the operational criteria that you've established?

General OBERING. Sir, we didn't establish them, the Director of Operational Assessment Evaluation established them. And that—there's—as I recall, there's about seven or eight criteria that—that they have outlined. We include that in our integrated master test plan. And in fact, I think in the last DOT report it annotated what those were and what the track record was against the various interceptors.

Mr. HODES. Since I don't have that here——

General OBERING. I'll provide you a copy.

Mr. HODES. That would be—that would be great.

For my purposes today if I boiled this down to sort of a layman's question, how good is the GMD system supposed to be? In percentage terms, how good is it today and how good is it expected to be and when?

General OBERING. I can't give you a percentage because, again, of the classification. But I will tell you this, it was good enough that when the North Koreans stacked their tapered on to it in the summer of 2006, the President was relying on this as opposed to taking the advice of some senior, former senior officials to preemp-

tively strike that site. And so that's what I mean by previous testimony about being a stabilizing factor in crises.

We believe that the capability of the system is very high against the threats that we are designed against. That will improve over time as we get more and powerful, and more capable centers, and algorithms into our system, that will only increase, but it is very high today.

Mr. HODES. Can you quantify the effectiveness of the currently employed GMD system in the event of an actual attack?

General OBERING. Yes, sir, we can. And we can do that in a classified document.

Mr. HODES. And is it your testimony that if the additions you proposed to the GMD system is funded by the Congress that quantitative effectiveness would increase?

General OBERING. Yes, sir. And in fact, most of those have already been funded by the Congress, and we're in the process of completing those.

Mr. HODES. And this information you say would need to be done in a classified section?

General OBERING. Yes, sir, to give you the specific data.

Mr. HODES. Thank you. Thank you, Mr. Chairman.

Mr. TIERNEY. Thank you, Mr. Hodes.

General, going back to our comments earlier about there being some clarity issues here. I want to get your best assessment of the current effectiveness of the program. In July 2006 North Korea tested the Taepodong–2 missile. Two days after that test, President Bush was being interviewed by Larry King, in part on the capability of the missile defense system. And the President stated, "If it headed to the United States, we've got a missile defense system that will defend our country."

A year and a half later, the Missile Defense Agency's own fine print in the fiscal year 2008 budget estimate stated, "This initial capability is not sufficient to protect the United States from the extant and anticipated rogue nation threat."

Can you describe for me the discrepancy in those two statements?

General OBERING. Oh, well, first of all the flight, the flight of the Taepodong–2 could have been one missile. And that was based on the number of interceptors that we had deployed at the time. So it is probably, in terms of the number of rates of missiles and where we were on the deployment of interceptors. And as I stated earlier today, we have two dozen that have been placed.

Mr. TIERNEY. I guess the discrepancy is that in July 6, 2006, the President was saying, if headed to the United States we have a missile defense system that will defend our country. And in a fiscal 2008 budget estimate, you're saying this initial capability is not sufficient to protect the United States from the extant and anticipated rogue nation threat. So have we gone backward or——

General OBERING. No, sir. Again, it is in term—remember rate size and the number of missiles that could be launched, but I will have to get you an answer for the record.

Mr. TIERNEY. I hope so. Because so far we haven't gotten the answer to that.

General OBERING. I don't know what you're referring to when you're—you are talking——

Mr. TIERNEY. I'll give it to you again, on July 6, 2006, the President——

General OBERING. No, sir, I understand that part. The other——

Mr. TIERNEY. The Agency's own fiscal year 2009 budget estimate. "This initial capability is not sufficient to protect the United States from the extant in anticipated rogue nation threat."

General OBERING. I'll have to get back to you, because obviously there is a matter of degree probably in terms of the number of missiles that we would think of all ranges that could be deployed by North Korea and Iran. And——

Mr. TIERNEY. We're talking about ones that reach the United States, that's the specific one that the President——

General OBERING. OK, I'll have to get back to you on that.

Mr. TIERNEY. We had testimony from a Congressional Research Services expert on this, of course, only five countries to date have successfully developed and deployed the operational nuclear round ICBMs. And the fact that more nations have not done this is perhaps witnessed in part to the extraordinary technical effort it took. He noted that you need sophisticated propulsion system, a completely self-contained guidance system that's immune to jamming. A miniaturized and hardened nuclear bomb, a reentry vehicle that can survive a field of ionized plasma, and the management capacity to integrate and test all these systems together. And he went on to talk about how many tests would have to be done and how visible and obvious it would be.

So it would seem, going back to this point that a few balloons that roughly match a warhead size is not something that would be in the capacity of a country that could do all of that to get a missile up there, that's why we keep going back to that countermeasure issue.

General OBERING. Sir, could I address that?

Mr. TIERNEY. Sure, yeah, sure.

General OBERING. There are aspects again that I can't go into in this open session. But what I can say is there are a lot of assumptions that were just stated that do not come from concrete hard evidence. I just said that we flew against countermeasures, in our—of use countermeasures in our flight test program eight times. I can tell you that's not very easy. It's not as easy as the analyst is assuming it is, especially to get the effects you want to get in terms of that test program.

Mr. TIERNEY. I'm not sure the analyst is assuming it is easy at all. What he's talking about is how difficult it is to put a missile up. Are you are telling us it is more difficult to put a decoy or a countermeasure up than it is to——

General OBERING. When you add that complexity to it, it makes it even more difficult. And there's also payload penalties that you pay, trajectory penalties that you pay from that. So I agree it's not easy to do and there are a handful of countries that can do that. However we see that handful growing. And we see countries that we have not paid attention to in the past and we think we need to today.

Mr. TIERNEY. But you see their capacity growing in terms of being able to have missile technology, but you don't seem to see the capacity growing in terms of having decoys and countermeasures. I think the point he makes is if you are sophisticated enough to go over all of those burdens and hurdles to make a missile program, then you are probably sophisticated enough to have some pretty good decoys and countermeasures.

General OBERING. So I can give you an answer directly as to why I don't think that's true necessarily. But I will also tell you that we are growing our ability to deal with those countermeasures as well.

Mr. TIERNEY. I think we just want to wrap up a few other things. Mr. Hodes has an area he wants to go into. I just wanted to address a couple of things that were in your written testimony that we haven't really talked about today. One of those is the Multiple Kill Vehicle program that you were talking about. Now we've had testimony about how difficult it is for a single target with a single inceptor to hit, and that's been done. What we're talking about here with the Multiple Kill Vehicle is sort of hitting a lot of targets with a lot of bullets to speak the vernacular on that all at once. The difficulty, I guess, would be that each smaller interceptor, each one of those multiple interceptors has to carry sensors, guidance, propulsion systems, all that added weight; is that correct?

General OBERING. Yes, sir.

Mr. TIERNEY. So won't that limit the number of—the number of kill vehicles that you have on a particular system?

General OBERING. The limit there will be primarily on the mass that will be required and the volume that you have to be able to launch those within your interceptor shroud volume. But the numbers that we can achieve in that program are what we believe to be very effective.

Mr. TIERNEY. And you don't believe it would be overwhelmed by somebody who is anticipating that this might be the case that you have these Multiple Kill Vehicles.

General OBERING. We believe that through a common—again, we keep wanting to isolate on a particular aspect of the program and then say, well, that's not going to work. And you can't do that. You have to look at the entire program. So by the time an attacker has flown through our the layers. By the time that he's gone through the mid course discrimination that we would be able to accomplish and boiled that down to the credible objects where we ignore those things that are not credible and then use those Multiple Kill Vehicles to go after that, yes, sir, we did believe that would be effective.

Mr. TIERNEY. How costly is that going to be?

General OBERING. We are just into that program in terms of what that would be. And we are doing the cost estimates now. One of the things that we do that we actually did at the recommendation—well, it wasn't a recommendation, but it was a recommendation made in other programs is we picked up the idea of knowledge points.

So we try to drive down the risk before we build a major acquisition program to go off and to be able to accomplish whatever the program is, Multiple Kill Vehicle or Kinetic Energy Receptor or

whatever. It is a technique that we believe it is prudent to try to make sure we make these as least as expensive as we can.

So I can't answer your question until we've outlined our ability to detail the knowledge points and then get a good idea of what we're going to do and how we're going to go about accomplishing those. And we're at the beginning of that journey of the program today.

Mr. TIERNEY. I would hope that it would take some—there was at one point of time, standards with this program back in the 1980's, when Nimsky was there, and having it be less costly to build your defense than it would be for somebody to build something that could overwhelm your defense. I hope that's going to be a consideration going forward.

General OBERING. We always want to try to make the attacker have the cost imposing penalties as opposed to us, that's true.

Mr. TIERNEY. On the Airborne Laser, if we could just touch on that for a second because it is also something that you put in your testimony. There was testimony at an earlier hearing that we had here that the Airborne Laser an enemy might use white paint as a countermeasure. And there was some objection, apparently by your public relations, public affairs guys seem to be pretty active. He was talking about the United States—he sort of mocked it, he said, well, if the United States will spend more than $4 billion on a weapon system that could be defeated by a coat of paint, it might make a good sitcom, but has no basis in fact. That was his clever response.

The issue is, though, that the testimony that was had here it is about $8 billion, not $4 billion that's anticipated. But also, it's not just reflective white paint, that it could be dark colors that absorb almost all the laser energy and allow only 10 percent to be reflected.

The white paint, I guess, would be pretty durable on that, but also another countermeasure would require more laser power and those things could be added as well. If it rotated, it would be almost no effort and that would be a problem for us. So what kind of testing has been done against the darker objects or lighter objects. One expert calls it the ablative coating that burned off the outside of the enemy missile. What about all of those things in your laser program.

General OBERING. We have evaluated literally hundreds of coatings and ablatives and paint as part of the program. And we have tested using laser facilities against those.

Mr. TIERNEY. When you say testing, what kind of testing are you talking about?

General OBERING. We are talking about very small scale testing, and we're in the process of doing much larger scale testing.

Mr. TIERNEY. Now the ABL aircraft is anticipated it will fly at a reasonably safe distance——

General OBERING. Yes, sir.

Mr. TIERNEY [continuing]. From that.

And you are going to some issues as well with keeping the laser focused over that time—that area?

General OBERING. No, sir. We have actually demonstrated the fact that we can do that.

And by the way, that is a technique that we've been using for many years, so——

Mr. TIERNEY. So the atmosphere doesn't weaken the beam?

General OBERING. Yes, sir. Let me explain how it works. We actually have three lasers that will be on the aircraft and we've flown. We have fired the high energy megawatt class over 70 times in a 747 fuselage at Edwards. That—and that, by the way, required almost simultaneous ignition of the laser modules, synchronizations that many of our so called critics said we could never do. Well, we did that. And we achieved the full duration and operational power in that laser.

We then took in parallel—we took the aircraft and we heavily modified that to obviously fire the laser. But there are two other lasers on the aircraft. There is a tracking laser and atmospheric compensation laser. This last year, we flew the aircraft with those two lasers along with a surrogate of the high energy. And we demonstrated all the steps that we need to do the shootdown.

What that entails is being able to track the end point on the missile. In this case it was a simulated target that we used both the Big Crow aircraft as well as a boosting accelerating F–16 for that tracking. We then used the atmospheric compensation laser to go out and measure the distortion that you're talking about in the atmosphere, and feed that information back and we deform the mirrors onboard the aircraft. And then we fire the high energy in a diffused state. And then it uses the atmosphere just like your glasses to focus the beam on the target. And we demonstrated all of the technical steps to go do that.

Mr. TIERNEY. And when you say demonstrated that, you did it in a real life——

General OBERING. In flight testing.

Mr. TIERNEY. In the right atmosphere and the whole thing?

General OBERING. Yes, sir. And then we're going to—we have the aircraft back on the ground, we've had it back on the ground for several months. We now install the high energy laser modules on the flying aircraft. We are in the process of cleaning up the installation. We should be back in the air by the first part of next year. And then we intend to shoot down a boosting missile in midyear.

Mr. TIERNEY. And if the missile's rotating or is shiny or reflects off or sloughs off some of the laser energy, that doesn't create a problem.

General OBERING. That's all part of the test program that we have data on, sir.

Mr. TIERNEY. So we tested, all that happening so far or are you going to test that?

General OBERING. We have tested a major portion of that and others. We have done the analysis, but we feel like we're on the right track.

Mr. TIERNEY. The Boeing 747 is it a potential that may not be big enough?

General OBERING. Oh, it is big enough. In fact, we would most likely use a 747 8F version for the next one. But we are going to take it in a transition period. We'll collect up all the information that we've learned, and we will apply that to ensure that we can make an affordable capability.

Mr. TIERNEY. So it is too premature to ask you how long the laser has to stay focused on the target to actually kill it, or if it is rotating in flight what happens, that's all the testing?

General OBERING. What I can tell you is the time it takes to do that is certainly within the operational—it is operational realistic, I'll put it that way.

Mr. TIERNEY. From a distance.

General OBERING. Yes, sir.

Mr. TIERNEY. So there's no pros—these plays are up there, if we're going to have this effect, are they going to be over North Korea or are they going to be flying around there 24/7, right?

General OBERING. It would be the concept of operations. If you are familiar with AWACs or Joint STARS, it would be very similar. Otherwise, you'd get indication and warnings. You would deploy the aircraft, it would be a 24/7 orbit that would be obviously you'd have to swap aircraft as part of that. But we do that, as a matter of routine, at AWACs and Joint STARS.

Mr. TIERNEY. So how many of these particular ABL systems do think are going to have to have filled to keep something up there 24/7?

General OBERING. I think it's—the estimates—the initial estimates were two and a half to three-aircraft orbit. But again, once we do the initial shootdown we continue a very a—what I call a continuous flight testing program. But then we're going to go in and we're going to take this data and understand what it is we can do to make this operational and operationally affordable.

Mr. TIERNEY. What are the prospects that one of these ABLs is going to exhaust the chemicals and have to go back and replenish.

General OBERING. It is a matter of routine. If it shot out its load, but again, it is the only—it's the only intercept, if you'd like a capability we have in which we can shoot down multiple missile with a single component.

Mr. TIERNEY. It looks to be another fairly complex and expensive aspect of this. You estimate about $5.1 billion on the first aircraft through 2009, but now you think you need how many aircraft to make this operation——

General OBERING. I can't tell you until we go through this operational affordability. We are going to go through a redesign transition not unlike what we did with the THAAD, sir. It will be a revolutionary capability, not just a complex one.

Mr. TIERNEY. The information that was provided to the Congressional Budget Office led them to estimate $1.5 billion per production aircraft. The Air Force Air Combat Command proposed that the Air Force would buy seven production aircraft.

General OBERING. Right.

Mr. TIERNEY. But the Pentagon didn't support it.

General OBERING. Sir, that's because it was premature to do that, not until we get the information I just talked about.

Mr. TIERNEY. The plan now is that the MDA will build the first two prototypes before Boeing goes into production. Is that still on track?

General OBERING. We do not have money funded right now against a second aircraft tail member.

Mr. TIERNEY. The ABL program office has estimated that each aircraft will take a couple years to build.

General OBERING. Yes, sir.

Mr. TIERNEY. Seven aircraft at about $1.5 billion would be about $10.5 billion, probably the price is escalating on that. If it takes 2 years to build each one of these, it will take the Air Force 14 years to get the first fleet if they had budgeted one per year.

General OBERING. Again, that's data based on existing configurations, not necessarily what we would come out of the transition program with.

Mr. TIERNEY. But if that holds true, you are looking really until 2025 before this thing is up and operational. That means that it meets all the tests and it is actually doable on that basis. OK.

Mr. Hodes, do you have any further questions?

Mr. HODES. I wanted just to followup a little bit sort of the discussion we were having about the assessment of the effectiveness of the system, understanding your reluctance to tell us in open session a quantitative assessment, so to speak. And I would point out that the head of the Missile Defense Advocacy Alliance has stated, I believe we have a ballistic missile defense system that is at least 90 percent effective against limited attack. When we're talking about a single attack from a single missile, we're probably higher than 95 percent because we can do multiple shots, and we have increased our efficiencies and capabilities.

General, do you agree with that assessment of our current effectiveness?

General OBERING. Sir, again, I will be happy to give those numbers to you in private in terms of what they actually are.

Mr. HODES. Well, all I'm asking you now in this session as to whether you agree or disagree with the number that has already been put out there by somebody else.

General OBERING. Sir, but if I validate or not validate that number, that's the same thing as releasing classified information, and I will not do that.

Mr. HODES. Your predecessor as head of the MDA was asked to comment on statements made by Pete Aldridge who was U.S. Under Secretary of Defense for Acquisition Technology and Logistics who assessed the effectiveness of the deployed GMD system before the Senate and ended up saying, as of today, the projected effectiveness would be in the 90 percent range. Am I correct that you don't want to voice an opinion as to whether you agree with that assessment?

General OBERING. No, sir.

Mr. HODES. He also said—your predecessor as head of the MDA, was asked about the Aldridge statement. And he said, if you assume a certain level of success for each interceptor missile, which doesn't have to be very high, not greater than 50 percent, and if you did a math probability calculation and you used six of those interceptor missiles to attack a single incoming warhead, Secretary Aldridge was very correct on a pure math basis; Aldridge was correct.

So your predecessor, as head of the MDA, apparently did his math calculations and agreed with Mr. Aldridge's assessment of a 90 percent effectiveness.

My question to you is, has the MDA ever conducted a GMD flight intercept test where you have demonstrated the capability in flight, actual flight intercept test, to bring down an enemy missile by firing six interceptors?

General OBERING. By firing, I'm sorry, how many?

Mr. HODES. Six interceptors, as was suggested by your predecessor as head of the MDA.

General OBERING. Six interceptors?

Mr. HODES. Correct. Have you ever conducted a flight test——

General OBERING. I don't understand where you are getting the number six from, sir. Could you help me there?

Mr. HODES. Yes. Let me go back briefly. Your predecessor as head of the MDA was asked about Mr. Aldridge's previous statement about 90 percent effectiveness. In his answer, he did some calculating and said, if you did a math probability calculation and if you use six of those interceptor missiles to attack a single incoming warhead, Secretary Aldridge was very correct.

In other words, your predecessor as head of the MDA was commenting on the 90 percent effectiveness testimony that had been given. And apparently under—using his calculations—and he knows a lot more about this, certainly, than I do—was saying, yeah, it's 90 percent effective if you use six interceptor missiles to attack a single incoming warhead.

So my question to you is, has the MDA ever conducted a GMD flight intercept test where you've demonstrated, actually demonstrated, the capability to bring down a single incoming enemy warhead by firing six interceptors——

General OBERING. In a flight test, no, sir.

Mr. HODES. OK. Have you done it in simulation?

General OBERING. I would have to go check that. I know that we do, in our simulations, we do fire at times multiple interceptors against single targets.

Now if you want me to help you with the math a little bit, if you have an interceptor that is 70 percent effective on a single shot or 80 percent effective on a single shot and you fire two, you are now at a 91 or 96 percent effectiveness for the overall engagement. So that's just a simple probability of statistics in terms of the performance. But that does not relate to what I would call a realistic performance because I won't get into that in the open session.

Mr. HODES. OK. Thank you, Mr. Chairman.

Mr. TIERNEY. Thanks, Mr. Hodes.

General, I want to try to wrap this up for you. You've been good to spend all this time with us. We appreciate it. You answered Mr. Hodes's question about operational criteria earlier. But I didn't hear you say whether or not that existed in writing somewhere.

General OBERING. Oh, yes, sir. It does.

Mr. TIERNEY. What would that publication be?

General OBERING. Pardon me?

Mr. TIERNEY. What would that publication be termed?

General OBERING. As I recall, it's in the DOT&E report for this year. And I believe, if I am not mistaken, it is also in our integrated master test plan, but we can provide that documentation for the committee.

Mr. TIERNEY. Thank you. I appreciate that. Does it indicate how good the system is supposed to be, whether its effectiveness is supposed to be 1 percent, 10 percent 90 percent?

General OBERING. It talks about the characteristics—I mean the criteria that would need to be achieved in the flight test to be operationally realistic.

Mr. TIERNEY. Does it talk about percentage of effectiveness?

General OBERING. I don't remember it doing that. But again, that is normally derived from our testing.

Mr. TIERNEY. Does it indicate how many interceptors should be required to defeat a single target?

General OBERING. No, sir. That is what we call shot doctoring, and that is derived from the specifications and the performance of the specifications that have been demonstrated in our flight test and our ground test.

Mr. TIERNEY. The so-called Clinton era tests, that was a four-parter: One was whether the test, you know, material on whether the challenges are materializing. The other is a status of technology based on the initial series of flight tests and proposed systems' operational effectiveness. The third is whether the system is affordable. And the last is implication that going forward with the national missile defense deployment would hold for the overall strategic environment and our arms control objectives. Are those four criteria incorporated in any way in the current objective criteria?

General OBERING. You are talking about in terms of deployment of the overall system. No, sir. We're well beyond that. We're well beyond that stage in terms of deployment.

Mr. TIERNEY. And on Mr. Nitze's criteria, the three systems. That he had back in the Reagan years: that the system should be effective; that it be able to survive against direct attack; and that it be cost effective at the margin. So I mentioned earlier about it being less costly to increase your defense than it is for the opponent to increase their offense against it. Are those incorporated in any way in the current——

General OBERING. Again, that's for deployment, which we've already achieved.

Mr. TIERNEY. All right. So the operational effectiveness for deployment is different than operational effectiveness for another reason?

General OBERING. Yes, sir. It is. Again, in the environment and in the world we live in, when you have a mission area in which you are totally vulnerable and you have no defense, that is a different calculation than you may do in a cold war era where typically you are replacing your weapons system in the field with one that's supposed to be better. And so you have a different calculation.

What I can tell you is the calculation that the administration went through on deployment was, did we have an emerging threat? The answer was yes, and what we saw happening in North Korea and Iran, that was of concern. Were they making hostile statements? The answer was yes. Did we have a technological capability to achieve an intercept? The answer was yes. And we had dem-

onstrated that in our flight testing with the prototypes of the interceptors that we deployed.

Mr. TIERNEY. Without decoys or anything of that nature?

General OBERING. That was using decoys in the flight test.

Mr. TIERNEY. Were those the ones I was talking about earlier?

General OBERING. Yes. And did we fly an operational configuration of the booster? The answer was, yes, we had done that. And was it affordable? And the determination by the administration and by the Congress, by the way, was, yes, it was.

Now it goes back to the statement that Ms. McCollum made earlier about what is the relative cost not just to an adversary but more importantly to the innocent people that could be killed if you don't defend them as well as the damage that could be done to a single American city on the order of hundreds and hundreds of billions of dollars if you can't stop that missile, even one missile? So I think that was the calculation that went into the deployment.

Mr. TIERNEY. And in that consideration, somewhere was the political consideration, I guess, about the implications of going forward with that kind of deployment and how that would effect the overall strategic environment——

General OBERING. Oh, sir, in fact, I think that's one of the strongest arguments for what we're doing.

Mr. TIERNEY. You may think that, but that was a political consideration that was made.

General OBERING. Well, sir, I hope so because what we're trying to do is change the politics.

Mr. TIERNEY. No, I understand your position on it. I'm just——

General OBERING. If I may——

Mr. TIERNEY [continuing]. Makes a decision on that.

General OBERING. We've had tremendous proliferation of these weapons over the past several years. Access to them has gotten much greater.

Mr. TIERNEY. You are talking—you are conflating again on me, General. You have two countries that you think may some day join the club of the existing five that have intercontinental ballistic missiles. All the rest you are talking about is short range and medium range.

General OBERING. Yes, sir. But that's part——

Mr. TIERNEY. But it's not part of what we're talking about focussing on here, is the $64 billion being spent on an intercontinental ballistic defense system that has not had realistic operational tests yet under a number of conditions that we continue to procure on. We're buying things. We're putting them on the ground. And it's not been shown that it's going to work in that sense.

Let me ask you, just to wrap it up here, suppose this administration's negotiations with North Korea have success. Suppose that they some day wake up and decide they want to talk to Iran, and they have success in those negotiations. What happens to the budget of the MDA at that point?

General OBERING. Well, sir, that's not—that's a hypothetical. I would say that would be up to the administration and the Congress at that point. I will say that historically you have always—always—been better off at being able to negotiate from the position of strength and not weakness. So if you are walking in on negotia-

tions against an adversary in which you have a glaring vulnerability against missile attack and they have an capability to exploit that, you are not in a very good position. That's something that I think is also a part of the calculation as we go forward in the future.

In addition, if you can assure me that is the only threat that we'll be facing in this century over the next 10, 15 years, I'd be happy with that. But I don't know that we can do that.

Mr. TIERNEY. Well, General, if you can assure me that we have an endless supply of money that we just want to keep putting on and on and on, I guess that would resolve everybody's issue on that.

I thank you for your time and for your testimony here today and for your service to the country.

General OBERING. Thank you.

Mr. TIERNEY. We'll take a brief recess before the next panel comes on. A couple of minutes.

[Recess.]

Mr. TIERNEY. OK. The subcommittee will now receive testimony from our second panel of witnesses.

Philip E. Coyle III: Mr. Coyle is the senior advisor for the Center for Defense Information. As the former Assistant Secretary of Defense, Mr. Coyle was the longest-serving director of the operational tests and evaluation in a 20-year history of that defense office. He oversaw the tests and evaluation of over 200 major defense acquisition systems and reported to the Secretary of Defense and to Congress on the adequacy and results of Defense Department testing programs. He is the associate director emeritus of the Lawrence Livermore National Laboratory where he started in 1959. He was appointed by President George W. Bush to serve on the 2005 Defense Base Realignment and Closure Commission. Mr. Coyle is an expert on military research, development, and testing on operational military matters, and on national security policy and defense spending, including defense acquisition reform and defense procurement. He has an extensive background in missile defense, in military space systems and nuclear weapons.

The Honorable Henry F. Cooper: Ambassador Cooper is currently the chairman of the High Frontier Organization. He served as the first civilian director of the Strategic Defense Initiative [SDI], from 1990 to 1993. President Reagan appointed Ambassador Cooper as deputy and then chief U.S. negotiator at the Geneva Defense and Space talks with the former Soviet Union from 1985 to 1989. Ambassador Cooper is also currently chairman emeritus of Applied Research Associates, a visiting fellow at the Heritage Foundation and a private consultant.

Joseph Cirincione: Mr. Cirincione is president of Ploughshares Fund. He was most recently vice president for the National Security and International Policy at the Center for American Progress. He is the author of an article in the most recent issue of Foreign Policy entitled, "The Incredible Shrinking Missile Threat," and the recent book "Bomb Scare: The History and Future of Nuclear Weapons." He also teaches at Georgetown University and was some years ago a staffer on the predecessor of this subcommittee as well as on the House Armed Services Committee.

We want to thank all of you for being with us today. Obviously your experience, your knowledge of the topic's going to help us address the questions that were raised in the earlier hearing and generally. As you all know from previous experience, it's our policy to swear in witnesses. So if you please stand and raise your right hands.

[Witnesses sworn.]

Mr. TIERNEY. Thank you. The record will please reflect all of the witnesses answered in the affirmative.

You know from past experience as well that your full written statements will be put in the record by unanimous consent.

We ask you that you try to keep your oral statements to 5 minutes in duration or as close thereto as you can so there will be plenty of time for questions. We will be a little bit limited. We know people's sensitivity of the time, and we want to be able to have some questions for the panel and get you folks out of here at a decent hour as well.

So if we might, Mr. Coyle we'd benefit from your testimony, if you would.

STATEMENTS OF PHILIP E. COYLE III, SENIOR ADVISOR, CENTER FOR DEFENSE INFORMATION, ASSOCIATE DIRECTOR EMERITUS, LAWRENCE LIVERMORE NATIONAL LABORATORY; HENRY F. COOPER, Ph.D., CHAIRMAN, HIGH FRONTIER; AND JOSEPH CIRINCIONE, PRESIDENT, PLOUGHSHARES FUND

STATEMENT OF PHILIP E. COYLE III

Mr. COYLE. Thanks Mr. Chairman.

My opening remarks are quite brief. Chairman Tierney, Representative Shays, distinguished members of the committee, I very much appreciate the opportunity to appear before you again to support your examination of Department of Defense programs and missile defense.

In my testimony 2 weeks ago, I raised a number of issues that the Congress should examine. They are: the limited and inadequate technical and operational performance of the ground-based missile defense [GMD] system, and the lack of operational criteria by which the Congress can judge success; inconsistent and inaccurate information from the Pentagon with respect to system performance and the threat; the lack of demonstrated performance of the GMD system against realistic threats involving decoys and countermeasures as well as in common operational environments; the cost, which you've already spent some time on in this hearing; the vulnerability of the GMD system to direct attack; the successes of U.S. diplomacy, which have been our most effective missile defense; and, finally, the ways in which missile defenses can undermine America's arms control and nonproliferation objectives.

In my formal testimony today, I expand on my earlier comments regarding the GMD program, also on the proposed U.S. missile defenses proposed for Europe and on the airborne laser and add new comments regarding the Multiple Kill Vehicle program which you had brought up earlier this morning.

Today I only touch briefly on the Navy's Aegis program and do not discuss at all the THAAD program, the PATRIOT PAC–3, or the PATRIOT/MEADS Combined Aggregate Program, which I hope will be topics for future hearings and increased oversight and review by the U.S. Congress.

The DOD Missile Defense Agency programs need to be re-established as bona fide R&D programs, which they are presently purported to be but are not. The Congress and the American taxpayer are being misled about the capabilities of these programs both in terms of their effectiveness to provide dependable defenses and in terms of their readiness for procurement.

The MDA programs have become large program—large procurement programs masquerading as R&D programs with hundreds of new interceptors, not to mention scores of other systems, subsystems and support facilities proposed to be bought between now and 2013.

Through these large procurements, the American taxpayer is being misled that these systems defend the United States when they do not. And our friends and allies in Europe are also being misled that the proposed U.S. missile defenses would defend Europe as well.

This is all the more troublesome as these programs have no demonstrated effectiveness against realistic threats and under realistic operational conditions. This applies to the GMD program in Alaska and California, to the new missile defense system proposed for Europe, to the Multiple Kill Vehicle program, and especially to the airborne laser program.

Several other programs also require increased oversight and review by the Congress, including the Aegis BMD program, the THAAD program, and PATRIOT PAC–3, and PATRIOT/MEADS programs.

Mr. Chairman, this concludes my opening remarks. Thank you very much for your attention.

[The prepared statement of Mr. Coyle follows:]

Prepared Remarks before the:

House Committee on Oversight and Government Reform,
Subcommittee on National Security and Foreign Affairs

"Oversight of Ballistic Missile Defense (Part 3):
Questions for the Missile Defense Agency"
Wednesday, April 30, 2008
10:00 a.m.
2154 Rayburn House Office Building

Philip E. Coyle, III
Senior Advisor
World Security Institute

Chairman Tierney, Representative Shays, distinguished Members of the Committee, I very much appreciate the opportunity to appear before you again to support your examination of the Department of Defense programs in missile defense.

I am a Senior Advisor to the non-profit Center for Defense Information, a division of the World Security Institute, a Washington, D.C.-based national security study center. To help insure our independence, the World Security Institute and the Center for Defense information do not accept any funding from the Federal government, nor from any defense contractors.

In 2005 and 2006, I served on the nine-member Defense Base Realignment and Closure Commission, appointed by President George W. Bush and nominated by House Democratic Leader, Nancy Pelosi.

Beginning in late 2004, I served on Governor Arnold Schwarzenegger's Base Support and Retention Council, from which I resigned to serve on the President's Commission.

From 1994 to 2001 I served in the Pentagon as Assistant Secretary of Defense and Director, Operational Test and Evaluation. In this capacity, I was principal advisor to the Secretary of Defense and the Undersecretary of Defense for Acquisition, Technology and Logistics on test and evaluation in the DOD. I had OSD OT&E responsibility for over 200 major defense acquisition systems including the present-day missile defense programs.

From 1959 to 1979, and again from 1981 to 1993, I worked at the Lawrence Livermore National Laboratory. Over those 33 years I worked on a variety of high technology programs, and retired from the Laboratory in 1993 as Laboratory Associate Director and deputy to the Director.

In my current capacity at the Center for Defense Information I am called upon to provide independent analysis on various defense matters. I have over 40 years of experience involving U.S. and worldwide military research, development and testing, on operational military matters, and on national security policy and defense spending.

Introduction

In my testimony two weeks ago, I raised a number of issues that the Congress should examine. They are:

1. The limited and inadequate technical and operational performance of the Ground-based Midcourse Missile Defense (GMD) system, and the lack of operational criteria by which the Congress can judge success.
2. Inconsistent and inaccurate information from the Pentagon with respect to system performance and the threat.
3. The lack of demonstrated performance of the GMD system against realistic threats involving decoys and countermeasures, as well as in common operational environments.
4. The cost.
5. The vulnerability of the GMD system to direct attack.
6. The successes of U.S. diplomacy, which have been our most effective missile defense, and
7. The ways in which missile defenses can undermine America's arms control and non-proliferation objectives.

In my testimony today, I expand on my earlier comments regarding the GMD program, on the proposed U.S. missile defenses proposed for Europe, and on the Airborne Laser, and add new comments regarding the Multiple Kill Vehicle (MKV) program.

Today I will only touch briefly on the Navy Aegis program, and do not discuss at all the THAAD program, the PATRIOT PAC-3, or the PATRIOT/MEADS Combined Aggregate Program (CAP), which I hope will be topics for future hearings and increased oversight and review by the U.S. Congress.

Mr. Chairman, former Senator Sam Nunn has said it best: "National missile defense has become a theology in the United States, not a technology."

As a result, U.S. missile defenses are being deployed without well-established operational criteria, and the Congress has no basis from which. to evaluate these missile defense programs.

The "Unsophisticated Threat"

The Missile Defense Agency (MDA) says that it can only defend against "an unsophisticated threat," that is, just one or at most two missiles from Iran (or North Korea), with no decoys or countermeasures.

Should you be expected to believe that Iran (or North Korea) would be reckless enough to attack Europe, or the United States, with a single missile - with no decoys or countermeasures - and then sit back and wait for the consequences? As we know, ballistic missiles have return addresses.

If Iran (or North Korea) were reckless enough to attack Europe or the U.S, they wouldn't launch just one missile, and if they launched several missiles with decoys and countermeasures, U.S. missile defenses couldn't deal with it.

Decoys and countermeasures are the Achilles Heel of missile defense. Shooting down an enemy missile going 17,000 mph out in space is like trying to hit a hole-in-one in golf when the hole is going 17,000 mph. If an enemy uses decoys and countermeasures, it's is like trying to shoot a hole-in-one when the hole is going 17,000 mph and the green is dotted with black circles the size of the hole. The defender doesn't know what to aim for.

In 1999 and in 2000, our Intelligence Community provided assessments that North Korea or Iran would soon know how to field decoys and countermeasures. [1]

From a target discrimination point of view, recent GMD flight intercept tests have been simpler and less realistic than the tests more than five years ago. None of the GMD flight intercept tests have included decoys or countermeasures during the past five years.

The GMD system has no demonstrated effectiveness to defend the U.S. or Europe, under realistic operational conditions.

In its FY-08 budget request the Pentagon acknowledged this, saying, "This initial capability is not sufficient to protect the United States from the extant and anticipated rogue nation threat."

The MDA budget also reveals that the MDA wants the proposed missile defenses in Europe to protect existing radar sites in Greenland and the United Kingdom, not first and foremost to defend Europe.

In the past five years, only two GMD flight intercept tests have been successful. Yet, the MDA must conduct about 20 additional, different flight intercept tests before it might be prepared for realistic operational testing. At that rate, MDA could need 50 years to be ready for realistic operational testing.

Developmental tests are still needed to show that the system can work at night, in bad weather, when the sun is shining in the wrong direction, when the enemy re-entry vehicle uses stealth, when more than one missile is launched by an enemy, and so on.

Proposed U.S. Missile Defenses in Europe

If, as proposed, the U.S. missile defense system for Europe is to defend both Europe and the U.S., this requires the system in Europe to handle BOTH intermediate-range ballistic missiles aimed at Europe and intercontinental missiles aimed at the U.S.

As such the proposed system in Europe must operate as both a mid-course system and a post-boost, ascent phase system.

This is something that the Ground-based Interceptors (GBIs) in Alaska and California cannot do, and which has never been demonstrated with GMD interceptors in any location.

To be effective with this dual mission, the proposed system must be able to demonstrate a capability that the prototype system in Alaska and California

has never demonstrated and cannot do from those locations.

The interceptors proposed to be located in Poland would be much closer to Iran than GBI interceptors in Alaska and California are to North Korea. This means the time available for response and engagement would be much shorter than the time available to intercept missiles from North Korea.

Such short timelines have never been attempted with the GMD system in a flight intercept test.

These shorter timelines would be stressing enough if the radar proposed to be located in the Czech Republic had adequate range to detect an Iranian missile launch as soon as it cleared the horizon. However, as pointed out by Dr. Gronlund in her testimony before this Subcommittee on April 16th, "recent technical analysis suggests that the radar's range is too short to provide track data or discrimination for long-range missiles launched from the Middle East toward the United States."

In addition, Iran could perhaps field intermediate range missiles more easily than ICBMs, and so to be effective the proposed European system might have to deal with several intermediate-range missiles fired at Europe, requiring multiple, simultaneous engagements by the proposed interceptors in Poland.

This capability has never been demonstrated through flight intercept tests with the GMD system.

Before deciding to fund the proposed system in Europe, the U.S. Congress should examine in considerable detail the results from future flight intercept tests that will attempt to demonstrate the capabilities described above, and review whether then the system has "demonstrated through successful, operationally realistic flight testing, a high probability of working in an operationally effective manner," as required by the FY-2008 Defense Authorization Act and as signed by President Bush. [2]

To match the near-term plans that the MDA has for beginning construction in Europe and for deploying U.S. missile defenses in Europe, these tests will need to be planned, scheduled, and conducted soon.

Recent MDA Claims Regarding Target Discrimination

Recently, the MDA has pointed out that there were five, early, flight intercept tests that used simple round balloons as decoys. The MDA Public Affairs Director has told the press that five successful intercept tests from 1999 to 2002 used the type of decoys we would expect "from countries such as North Korea and Iran." [3]

But the decoys in those tests did not resemble the target re-entry vehicle (RV).

With respect to those five early tests, the decoys used were round balloons, not ice-cream cone shaped like the mock target, and with much different infrared signatures.

MDA has asserted that North Korea or Iran would do exactly what MDA has

done, namely, use round balloons as decoys that had infrared signatures that were different from the RV, not balloons that resembled the RV in shape and/or signature.

If North Korea or Iran were to attack the United States, why would North Korea or Iran not try to confuse our missile defenses? Are we to believe that North Korea or Iran is smart enough to make balloons that are both larger and smaller than would be required to fool us, but not the proper size to fool us?

Do we believe that North Korea is smart enough to make a 1.7-meter diameter balloon that has a larger infrared signature than the target RV, but not a 0.6-meter diameter balloon that has the same infrared cross section as the target RV?

MDA has never done a GMD flight intercept test where the decoy or decoys resembled the RV in shape and/or infrared signature.

In a report issued on February 28, 2002, the GAO reviewed the technical challenges of conducting flight intercept tests with decoys that closely match the target, and explained why the MDA decided then to use decoys that did not resemble the target RV. [4]

Basically, the MDA and its advisors felt that such tests would be too stressing. why take the chance with tests that might fail?

Thus it is misleading for the MDA to suggest now that those early flight

intercept tests demonstrated the capability to discriminate real targets from well-matched decoys, or decoys that would be representative of what the Intelligence Community has assessed North Korea or Iran could field today.

Below is a tabulation of the five early tests to which the MDA has referred, including those that failed in the same time period. The numbers on the successful tests, 1 through 5, show which tests MDA is counting. The unsuccessful tests are not numbered.

1. IFT-3 Oct. 2, 1999

This test was successful.

The only decoy used in IFT-3 was the large 2.2-meter diameter balloon from IFT-1A and IFT-2. It had an IR signature six times higher than that of the mock warhead. Because the decoy was so much brighter than the mock warhead, the EKV saw it first. Once the EKV realized that the balloon's IR signature did not match up with the target data it had received prior to the test, the interceptor shifted to the nearby target.

IFT-4 Jan. 18, 2000

In this test the interceptor failed to hit the target. The failure to intercept was because the cryogenic cooling system of the EKV failed to cool the IR sensors down to their operating temperatures in time because of an obstructed cooling line.

The only decoy used was the single large balloon from the previous tests. Smaller balloons originally had been planned to be a part of IFT-4, but were dropped in an attempt to simplify the test (partially because of the Welch panel recommendations).

IFT-5 July 8, 2000

This test also failed. The failure to intercept was the direct result of the EKV not separating from the surrogate booster due to an apparent failure in

the 1553 data bus in the booster.

The decoy balloon did not inflate properly, causing MDA officials to decide to use a different decoy in the future.

2. IFT-6 July 14, 2001

This test was a repeat of IFT-5, but this time mostly successful. The prototype X- Band radar (XBR) used in IFT-6 did not process all the information it was receiving properly, causing it to falsely report that the interceptor had missed its target. If that had happened in a non-test situation, more interceptors would have been needlessly launched at the target to ensure a hit.

One large decoy balloon was used. This one was 1.7 meters in diameter, so it was slightly smaller than the large balloon used earlier as a decoy. This new decoy still had an IR signature much brighter (approximately three times) than that of the mock warhead.

3. IFT-7 Dec. 3, 2001

This test was successful. The only variable changed from IFT-6 was the target booster: instead of Lockheed Martin's Multi- Service Launch System, the Orbital Target Launch Vehicle was used.

The target set, a modified Minuteman ICBM carrying a mock warhead and a single decoy, did not change.

There was only one decoy in IFT-7, and it was the same one that was used in IFT-6.

4. IFT-8 March 15, 2002

This test was successful.

Three decoy balloons (one large, two small) were used to increase the difficulty of determining the target's location; however, critics pointed out that the infrared signals of the balloons differed from that of the mock warhead. The large balloon had a much larger infrared signature than that of the mock warhead, whereas the two small balloons had much

smaller signatures.

5. IFT-9 Oct. 14, 2002

This test was successful. IFT-9 is said to have included the same three decoy balloons (one large, two small) in its target cluster as were used in IFT-8, but the specifics are unknown as MDA classified decoy details in May 2002.

IFT-10 Dec. 11, 2002

IFT-10 failed when the Raytheon-built exo-atmospheric kill vehicle (EKV) did not separate from its booster rocket, a modified Minuteman ICBM that was being used as a surrogate until a more advanced booster rocket could be developed. The failure to separate precluded the EKV from attempting an intercept o the target missile. This was the first night test of the GMD flight test program, but because the intercept failed, the objective of IFT-10 to demonstrate effectiveness at night was not demonstrated.

Costs

It's not easy to keep track of what missile defense is costing the U.S. taxpayer.

The FY-09 the president's budget asks for $13.2 billion for DOD spending on missile defense. Two weeks ago I submitted testimony that the request for FY-09 was $12.4 billion. But as sometimes happens with the press, I missed about $800 million of proposed missile defense spending in FY-09.

Over the next five years, the DOD FY-09 budget request calls for $62.5 billion to be spent on missile defense.

In a House of Representatives hearing on Thursday, April 17, 2008, the

MDA budget request for FY-09 was said to add to $46 billion over the next five years. [5] However, that only counts those portions that are in the MDA budget, and not quite all of that. If you count all DOD missile defense spending it comes to $62.5 billion over the next five years. To be more exact, $47.6419 billion in the MDA budget plus $14.8439 that is for missile defense not in the MDA budget adds to $62.485 for the FYDP total.

If the Congress supports this, by the end of 2013 over $110 billion will have been spent since 2003, not counting prior spending in the previous decades.

Since there are no operational criteria established for the system, the Pentagon does not know what the eventual costs might be.

Costs are open ended and there is no end in sight.

The Vulnerability to Direct Attack

Two weeks ago I also pointed out that major elements of the U.S. missile defense systems are vulnerable to direct attack. For example, the floating Sea-based X-band Radar (SBX) is literally a sitting duck.

So are the early-warning radars in Greenland and in England, as would be the radar proposed to be sited in the Czech Republic.

The Pentagon does not explain it, but we need to remember that if we ever need to rely on missile defenses against enemy ICBMs, it would be in an all out nuclear war, Mushroom Clouds and all.

The Congress should examine whether missile defenses could be depended upon under those conditions.

The Successes of Diplomacy

Diplomacy has been our most effective missile defense. In my full statement two weeks ago, I described how in 1999 Dr. William Perry, and now more recently Ambassador Christopher Hill, have shown that effective diplomacy is hard to beat.

The U.S. proposal to site missile defenses in Poland and the Czech Republic has alienated Russia and upset the overall strategic balance to a degree not seen since the height of the Cold War. But the proposed U.S. system has no demonstrated operational effectiveness to defend Europe, nor the U.S.

Americans have a tendency to over-rely on technology as the first, best hope to solve our problems. With missile defense the United States has been trying for 60 years without success. Other approaches are needed.

The Multiple Kill Vehicle Program

To try to deal with enemy countermeasures the MDA is pursuing the Multiple Kill Vehicle program. Conceptually, the MKV is a set of smaller interceptors, that is, small kill vehicles, carried onboard a GMD Carrier Vehicle. [Potentially MKVs might be carried on the Kinetic Energy Interceptor or on Aegis interceptors, also.] If hitting a single target with a single interceptor is like hitting a bullet with a bullet, the MKV is like hitting a shotgun with a shotgun.

The MKV concept is "many on many," the idea being that the MKV will be able to carry as many small kill vehicles as the enemy would put up targets and decoys.

A difficulty is that each small interceptor must carry sensors, guidance, and propulsion systems, and these features add weight. For this reason the MKV interceptor may only carry a few small interceptors. Artist's renderings of the MKV show a dozen small kill vehicles, but in actual practice only a few small kill vehicles may be all that will fit.

The MKV is like hitting a shotgun with a shotgun when the defender's shotgun shell only has a dozen or fewer pellets. If the enemy launches more warheads, or launches more countermeasures and RV targets than the number of small kill vehicles the MKV can carry, the MKV will be overwhelmed. This would be an illustration of a lack of "cost effectiveness at the margin," discussed in my prepared testimony two weeks ago.

In prepared testimony before the Senate Armed Services Committee on April 1, 2008, the MDA Director explained the MKV as follows:

"In the years ahead we expect our adversaries to have midcourse countermeasures. The Multiple Kill Vehicle (MKV) program is developing a payload for integration on midcourse interceptors to address complex countermeasures by identifying and destroying all lethal objects in a cluster using a single interceptor."

The single interceptor referred to in the MDA Director's statement would be the Ground-based Interceptor (GBI), or something similar to the interceptors

now deployed in Alaska and California. Each GBI would carry a Carrier Vehicle that in turn would carry a number of small kill vehicles as described above. [6]

The MDA hopes to demonstrate MKV capability by 2017. [7]

Airborne Laser (ABL)

Since your hearing two weeks ago, the media has noted my suggestion that to defeat the Airborne Laser an enemy might use white paint as a countermeasure. For my testimony then I chose as a "countermeasure" a basic white paint to illustrate the approach an enemy might take to counter the ABL. I could have chosen other surface preparations that are even more reflective than white paint.

However, in an e-mail response the MDA Public Affairs Director wrote to Reuters, "That the U.S. would spend more than 4 billion on a weapon system that could be defeated by a coat of paint might make a good sitcom but has no basis in fact." [8]

It would have been more accurate if the MDA Public Affairs Director had written, "... spend more than $8 billion on a weapon system that could be defeated ... ...," rather than "... spend more than $4 billion on a weapon system that could be defeated ..." According to the GAO, if the Congress supports the MDA budget request through FY 2013 the ABL program would spend over $8 billion in 2008 constant dollars. The ABL was started in 1996 with the idea that it would take $1 billion and five years to take it to the point where it could demonstrate its capabilities, that is, shoot-down a

target. Instead, the program has been ongoing for twelve years with funding requested for it for at least another five years. [9]

If an enemy applies relatively simple countermeasures, the ABL will not be effective. For example, missiles painted with dark colors will absorb almost all of the laser energy and only 10% will be reflected. For missiles painted with an ordinary white paint, a white paint that is 90 percent reflective to the laser, 90 percent of the laser energy bounces off. Missiles with polished aluminum surfaces can reflect about 95% of the energy. Special coatings can raise reflectivity further, to 98% and more.

So by choosing white paint I wasn't trying to pick the most reflective surface coating that an enemy might employ, just something that would be doable by a country smart enough to build nuclear weapons, long-range guidance systems, and ICBMs.

Another "countermeasure" that will require more laser power in the ABL is if the enemy missiles rotate. As the enemy missile rotates the spot of the ABL laser would no longer being in the same place. Just as burning a leaf with a magnifying glass requires keeping the sun focused on one spot, the ABL will have a better chance of working if the enemy missile is not rotating. Since missiles tend to rotate anyway, this would take almost no effort on the part of an enemy.

Yet another countermeasure against the ABL would be an ablative coating that burned off the outside of the enemy missile. The ABL laser might burn the ablative blanket but not the missile inside.

A major question to be examined with the ABL is whether the output power of the laser can be expected to actually bring down an enemy ICBM, especially if the enemy employs simple countermeasures, such as white paint, and especially if the ABL aircraft flies at reasonably safe distances from the enemy where laser propagation through the atmosphere becomes an issue. Directing and focusing a high-powered laser beam through the atmosphere at a target is very challenging. The atmosphere itself interferes with and weakens the beam, and if the target is rotating, as missiles do, or is too reflective, the laser could bounce off without doing much damage. This is especially the case if the ABL is going to be sold for boost-phase defense where the laser must pass through the atmosphere to reach its target.

If an enemy missile is rotating, shiny, and reflects or sloughs off too much of the laser energy, to compensate for these effects, the U.S. Air Force would need a bigger laser, and possibly something bigger than a Boeing 747 in which to carry the ABL.

Considering such issues, how big does the laser have to be and how long does the laser have to stay focused on an enemy target to kill it? If the enemy missile is rotating in flight, as missiles do, what happens then?

What is the range of the laser under realistic operational conditions, and won't that require that the ABL aircraft to fly too close to the enemy? A stretch 747 makes a big target.

And how many times can the ABL fire its laser before it has to go back to

base for new chemicals? A recent Congressional Research Service report pointed out that the ABL "would likely not have chemical replenishment capabilities, which would necessitate return flights to the United States if the laser is used." Thus, the CRS says, the "enemy could wait until an orbiting ABL is being refueled, or is absent before initiating a missile attack." [10]

Also, when and how exactly is the MDA going to do the first "shoot down" demonstration? Reportedly, the first "shoot down" is to be with a missile silhouette painted on the side of another airplane.

Other major questions have to do with whether the ABL can be effective under realistic operational conditions.

To keep one 747 in the air within range of an enemy missile launch site 24/7, the Air Force would need multiple ABL aircraft, all carrying big lasers. Those aircraft would need to fly close to enemy territory, where they would be vulnerable targets themselves. And if the enemy can launch more than one missile, the chemicals that power the lasers carried on board those 747s would quickly be exhausted.

The Pentagon had planned to purchase seven ABL aircraft, though now the plan is that no production would take place until the second ABL is tested. Maintaining a full ABL orbit would require at least five aircraft and maybe seven. Seven could be required so that one can always be on station 24X7, hovering off the coast of North Korea, say, while the others are in transit, being repaired, etc.

The MDA claims one ABL orbit can defend against all launch points in North Korea, but that means one ABL that maintains station presence 24x7x365, again requiring many aircraft. Also the MDA acknowledges that larger countries, such as Iran, would require more than one orbit and many more costly ABL aircraft.

MDA estimates it will spend a total of $5.1 billion on the first ABL aircraft through 2009. However, the Pentagon decided not to purchase enough aircraft to cover even a single enemy missile launch site. This indicates that the Pentagon does not think the ABL is ready for procurement and that much more research and development is needed.

The ABL program office has provided information to the CBO for its budget estimate to Congress. CBO arrived at an estimate of $1.5 billion per production aircraft. The Air Force Air Combat Command had proposed that the Air Force would buy 7 production aircraft, but the Pentagon did not support that. The plan now is that MDA will "build" the first two prototypes, before Boeing goes into production. The ABL program office has estimated that each aircraft will take "a couple of years" to build. Seven aircraft at $1.5 billion each equals $10.5 billion. That's a lot of money, and it wouldn't be surprising if the price has gone up since. If it takes two years (conservatively) to build each one, it will take the Air Force 14 years to get the first fleet if they budget for one per year.

If everything goes well, this means they might not have a full fleet until 2025, which doesn't make sense if the MDA believes we have a justifying threat from North Korea today.

The ABL program needs to be restructured with plans for production put way back on the back burner.

In my testimony two weeks ago, I commented that there is much misinformation about missile defense, and the ABL is no exception. For example last year, The Missile Defense Advocacy Alliance put out a press release which said:

"A mobile laser at high altitude that can take multiple shots at the speed of light is an unmatched defensive capability to defeat accelerating ballistic missiles that have thousands of pounds of explosive propellant in their first few minutes of flight. Within a second, a directed energy laser beam can penetrate the outer and protective skin of a ballistic missile, burning it through completely and halting the flight of the ballistic missile. The ability to destroy missiles in their boost phase, eliminates the concern of multiple, advanced warheads that ballistic missiles may carry. This further demonstrates the technical ability and philosophy to eliminate offensive ballistic missiles." [11]

What the MDAA writes is an example of the misunderstandings behind this program, namely, that "a directed energy laser beam can penetrate the outer and protective skin of a ballistic missile, burning it through completely and halting the flight of the ballistic missile."

The ABL is not actually designed to burn through the outer skin of an enemy ICBM; that takes way too much power. Instead the plan has always been that the laser would weaken the outer skin such that it might fail during launch acceleration, something that still remains to be demonstrated.

Even then, the ABL still might not "halt the flight" of an enemy missile or its warheads, since they might already be well on their way to the target.

Another thing to be examined is whether the ABL is so complex that it will be undependable in battle.

Safety issues also should be examined. The crew will not be able to access the laser in flight, as the pilots and crew will be behind a protective barrier for their safety. A chemical leak in flight would be a problem for the crew, but they may not know about a leak until they land which could be too late.

Aegis BMD

With respect to the Aegis system I give the Navy credit for making the most with what they have. The Navy has refrained from making exaggerated claims about Aegis and has worked steadily to increase the operational realism of their flight tests. The current SM-3 missile is too slow, so the Navy has set up their flight intercept tests to be within range of the interceptors they have. The Aegis BMD system faces many more flight intercept tests before it will have demonstrated the capability to defend the U.S., Japan or other territory from enemy attack under realistic operational conditions. The Navy still faces significant obstacles, not the least of which is developing a new, faster interceptor and beginning to deal with countermeasures.

The U.S. Aegis BMD system has achieved twelve successful intercepts out of fourteen attempts. The most recent flight test intercept by a U.S. ship occurred on November 6, 2007 and was a success; the most recent (and

only) flight test intercept by a Japanese ship occurred on Dec. 17, 2007, and also was a success. However, the primary cause of an earlier Aegis flight test failure - the Solid Divert and Attitude Control System (SDACS) – still is not being tested in its most advanced mode, and needs to be tested to demonstrate maneuverability against more demanding targets.

The Navy has a tradition of doing quite realistic tests with new, developmental systems at sea, and this tradition has carried over to its missile defense work. Nevertheless, missile defense is one of the most challenging programs the Navy has ever tried to develop and it won't get any easier as the program moves forward.

An exception to my comment above regarding Aegis eschewing exaggerated statements has been the claims made following the Aegis shoot down of an NRO satellite last February. As impressive as that was on many fronts, it was not a demonstration of Aegis BMD missile defense effectiveness. You needn't take my word for it.

As Vice Chairman, Joint Chiefs of Staff, Gen. James Cartwright explained forthrightly in a recent interview, the satellite shoot-down did NOT prove anything about the dependability of U.S. missile defenses. [12]

Conclusion

The DOD Missile Defense Agency programs need to be reestablished as bona fide R&D programs, as they are presently purported to be, but are not.

The Congress and the American taxpayer are being misled about the

capability of these programs, both in terms of their effectiveness to provide dependable defenses, and in term of their readiness for procurement.

The MDA programs have become large procurement programs masquerading as R&D programs, with hundreds of new interceptors, not to mention scores of other systems, subsystems, and support facilities proposed to be bought between now and 2013.

Through these large procurements, the American taxpayer is being misled that these systems defend the United States when they do not, and our friends and allies in Europe are also being misled that the proposed U.S. missile defenses there would defend Europe as well.

This is all the more troublesome, as these programs have no demonstrated effectiveness against realistic threats and under realistic operational conditions.

This applies to the GMD program in Alaska and California, to the new missile defense system proposed for Europe, the Multiple Kill Vehicle program, and especially to the Airborne Laser program.

Several other programs also require increased oversight and review by the U.S. Congress, including the Aegis BMD program, the THAAD program, and also the PATRIOT PAC-3 and PATRIOT/MEADS Combined Aggregate Program (CAP).

End Notes

[1] Statement for the Record to the Senate Foreign Relations Committee on Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015, by Robert D. Walpole, National Intelligence Officer for Strategic and Nuclear Programs, September 16, 1999.

[2] H.R.4986, National Defense Authorization Act for Fiscal Year 2008 (Enrolled as Agreed to or Passed by Both House and Senate)

SEC. 226. LIMITATION ON AVAILABILITY OF FUNDS FOR PROCUREMENT, CONSTRUCTION, AND DEPLOYMENT OF MISSILE DEFENSES IN EUROPE.

[3] Letter to the Editor, Boston Globe, Rick Lehner, U.S. Missile Defense Agency, Washington, DC., April 11, 2008.

[4] GAO-02-124, *Review of Results and Limitations of an Early National Missile Defense Flight Test,* issued in February 2002.

[5] HEARING OF THE STRATEGIC FORCES SUBCOMMITTEE OF THE HOUSE ARMED SERVICES COMMITTEE;
SUBJECT: 2009 DEFENSE BUDGET, MISSILE DEFENSE PROGRAMS;
CHAIRED BY: REPRESENTATIVE ELLEN TAUSCHER (D-CA);
WITNESSES: JOHN YOUNG, UNDERSECRETARY OF DEFENSE FOR ACQUISITION, TECHNOLOGY AND LOGISTICS; CHARLES MCQUEARY, DIRECTOR, OPERATIONAL TEST AND EVALUATION, DEPARTMENT OF DEFENSE; LIEUTENANT GENERAL HENRY OBERING, U.S. AIR FORCE, MISSILE DEFENSE AGENCY; LIEUTENANT GENERAL KEVIN CAMPBELL, U.S. ARMY, SPACE AND MISSILE DEFENSE COMMAND, U.S. STRATEGIC COMMAND;
LOCATION: RAYBURN HOUSE OFFICE BUILDING, WASHINGTON, D.C., Thursday, April 17, 2008.

[6] Testimony, Lieutenant General Henry A. Obering III, USAF
Director, Missile Defense Agency
Missile Defense Program and Fiscal Year 2009 Budget
Before the Senate Armed Services Committee

Subcommittee on Strategic Forces
April 1, 2008

[7] Defense Acquisitions, Progress Made in Fielding Missile Defense, but Program Is Short of Meeting Goals. GAO-08-448, March, 2008.

[8] Reuters, April 17, 2008.

[9] HEARING OF THE STRATEGIC FORCES SUBCOMMITTEE OF THE SENATE ARMED SERVICES COMMITTEE; □SUBJECT: BALLISTIC MISSILE DEFENSE PROGRAMS IN REVIEW OF THE DEFENSE AUTHORIZATION REQUEST FOR FY2009 AND THE FUTURE YEARS DEFENSE PROGRAM; □CHAIRED BY: SENATOR BILL NELSON (D-FL); □WITNESSES: JOHN YOUNG, DEFENSE UNDERSECRETARY FOR ACQUISITION, TECHNOLOGY AND LOGISTICS; GENERAL HENRY OBERING III, DIRECTOR OF THE MISSILE DEFENSE AGENCY; GENERAL KEVIN CAMPBELL, COMMANDING GENERAL OF THE ARMY SPACE AND MISSILE DEFENSE COMMAND; CHARLES MCQUEARY, DIRECTOR OF OPERATIONAL TEST AND EVALUATION AT THE DEFENSE DEPARTMENT; PAUL FRANCIS, DIRECTOR OF ACQUISITION AND SOURCING MANAGEMENT AT THE GOVERNMENT ACCOUNTABILITY OFFICE; □LOCATION: 232-A RUSSELL SENATE OFFICE BUILDING, April 1, 2008.

[10] Congressional Research Service, Airborne Laser (ABL): Issues For Congress, CRS RL-32123, Update July 9 , 2007.

[11] See "Blinded by the Light," Press Release by the Missile Defense Advocacy Alliance, June 22, 2007.

[12] "DOD News Briefing with Gen. Cartwright from the Pentagon February 21, 2008:

Presenter: Vice-Chairman, Joint Chiefs of Staff Gen. James Cartwright

Coyle

4/30- Short Statement

Chairman Tierney, Representative Shays, distinguished Members of the Committee, I very much appreciate the opportunity to appear before you again to support your examination of the Department of Defense programs in missile defense.

In my testimony two weeks ago, I raised a number of issues that the Congress should examine. They are:

1. The limited and inadequate technical and operational performance of the Ground-based Midcourse Missile Defense (GMD) system, and the lack of operational criteria by which the Congress can judge success.
2. Inconsistent and inaccurate information from the Pentagon with respect to system performance and the threat.
3. The lack of demonstrated performance of the GMD system against realistic threats involving decoys and countermeasures, as well as in common operational environments.
4. The cost.
5. The vulnerability of the GMD system to direct attack.
6. The successes of U.S. diplomacy, which have been our most effective missile defense, and
7. The ways in which missile defenses can undermine America's arms control and non-proliferation objectives.

In my testimony today, I expand on my earlier comments regarding the GMD program, on the proposed U.S. missile defenses proposed for Europe,

and on the Airborne Laser, and add new comments regarding the Multiple Kill Vehicle (MKV) program.

Today I will only touch briefly on the Navy Aegis program, and do not discuss at all the THAAD program, the PATRIOT PAC-3, or the PATRIOT/MEADS Combined Aggregate Program (CAP), which I hope will be topics for future hearings and increased oversight and review by the U.S. Congress.

The DOD Missile Defense Agency programs need to be reestablished as bona fide R&D programs, as they are presently purported to be, but are not.

The Congress and the American taxpayer are being misled about the capabilities of these programs, both in terms of their effectiveness to provide dependable defenses, and in term of their readiness for procurement.

The MDA programs have become large procurement programs masquerading as R&D programs, with hundreds of new interceptors, not to mention scores of other systems, subsystems, and support facilities proposed to be bought between now and 2013.

Through these large procurements, the American taxpayer is being misled that these systems defend the United States when they do not, and our friends and allies in Europe are also being misled that the proposed U.S. missile defenses there would defend Europe as well.

This is all the more troublesome, as these programs have no demonstrated

effectiveness against realistic threats and under realistic operational conditions.

This applies to the GMD program in Alaska and California, to the new missile defense system proposed for Europe, to the Multiple Kill Vehicle program, and especially to the Airborne Laser program.

Several other programs also require increased oversight and review by the U.S. Congress, including the Aegis BMD program, the THAAD program, and also the PATRIOT PAC-3 and PATRIOT/MEADS Combined Aggregate Program (CAP).

Mr. Chairman, that concludes my opening remarks. Thank you very much for your attention.

Mr. TIERNEY. Thank you, Dr. Coyle.
Dr. Cooper.

STATEMENT OF HENRY F. COOPER, Ph.D.

Mr. COOPER. Thank you, Mr. Chairman. Chairman Tierney, distinguished Members—oh, I'm sorry.

Chairman Tierney, Representative Shays, distinguished Members, I appreciate the opportunity to appear before you to discuss our missile defense programs.

As SDI director in the 1990 to 1993 time period, I redirected SDI away from defending the U.S. homeland against a massive attack by thousands of nuclear re-entry vehicles to protecting the United States and our overseas troops, allies and friends against a limited ballistic missile attack. And I advocated that we work with Russia to build such a global system.

I believe a global defense still should be the goal of our missile defense programs. And I now would include among the threats of concern terrorists who might launch SCUDs or cruise missiles from ships off our coast.

As SDI director, I was privy to all the classified information related to dealing with offensive countermeasures, against all potential missile defense system concepts, at least of that time. And I concluded then and remain confident today that we can build a layered defense that would be effective and affordable.

My prepared testimony summarizes the nature of the complementary measure-countermeasure tension between the boost, midcourse, and terminal phases of the ballistic missile's flight. Taken together, a mature layered defense against ballistic missiles in all their phases of flight can achieve many intercept attempts and frustrate attempts of the offense to focus on one or the another of these phases of flight. For example, boost-phased defenses, which work while the hot slowly moving rocket is very vulnerable, can destroy a threatening rocket before it can dispense its warheads and associated decoys, defeating such midcourse countermeasures. If the offense develops a higher-acceleration booster to defeat the boost-phase defense, it will pay a weight penalty that reduces the midcourse countermeasures suite, thereby reducing the challenge to a midcourse defense. Furthermore, a terminal high-endo-atmospheric defense can defeat the midcourse countermeasures as re-entry strips away light decoys and chaff. If a maneuvering re-entry vehicle is designed to defeat high-endo-atmospheric defense interceptor, the weight penalty will also degrade the midcourse countermeasures suite.

My prepared testimony discusses the legacy of the ABM Treaty in frustrating the development of such a layered defense which has left the current program focused on the most difficult midcourse defense problem, largely to the exclusion of the other two phases. This is not surprising because the purpose of that treaty was to keep the United States and the Soviet Union vulnerable to ballistic missile attack, each with their single ground-based sight. Still, our original program on my watch included a follow-on combined endo-exo-atmospheric interceptor, which we called E2I, to strip away lightweight decoys that might get by an exo-atmospheric-only defense.

Development of sea-based, air-based, and mobile land-based defenses had to be limited to a theater missile defense role. A legacy of these constraints is that the sea-based defenses today continue to be restricted to a theater defense role, even though they have an inherent capability against long-ranged ICBMs, as shown by numerous theoretical studies over the past decade and to some degree demonstrated by the recent adaptation of the Aegis standard missile to shoot down a satellite traveling faster than an ICBM. Space-based defenses could not be limited to a theater missile defense role. Still, space-based sensors were permitted and needed to support ground-based defenses but research and development on space-based interceptors had—I'm sorry—had to be limited by technology-to-technology demonstrations for which Congress appropriated in 1993 some $300 million before the Clinton administration ended research and development on what I believe was the best product of the SDI years and the only one with the prospect of meeting the so-called Nitze criteria, to which you referred earlier, that effective defenses should be survivable against direct attack and cost effective at the margin against offensive countermeasures.

Thus ended the technology pathway that could have long before now led to lightweight Kill Vehicles that, for example, would have enabled the Navy sea-based interceptors to reach substantially higher velocities, providing greater reach to defend much larger areas, including against ICBMs.

Even though President Bush withdrew from the ABM Treaty in 2002, the current missile defense program has not been redirected to reflect the basic lessons that I further elaborated in my prepared testimony. Instead, most of the resources have been placed against the 1993 scaled-back ground-based defense program, albeit expanded to include mobile components previously prohibited by the ABM Treaty and with ground-based interceptors at other than the Grand Forks site permitted by that treaty.

Given the 1999 congressionally mandated policy to deploy as soon as technologically possible an effective national missile defense system against limited attack, continuing debate should not be about whether to build a system and sustain it but rather about how. I believe a return to basics would include a reinvigorated technology development effort to assure viable missile defenses into the future, whether at the Missile Defense Agency, at DARPA, or in the services as their respective components of a global defense architecture matures.

Increased funding for sea-based offenses to exploit fully their inherent flexibility of operating in international waters and to provide defensive options in all three phases of flight is an important objective. In many ways, the Navy's sea-based defenses are the closest to an operational global defense capability today, but they have been limited arbitrarily I believe to a theater defense role. A revival of efforts to exploit the obvious benefits of the space-based defense, beginning with the President's proposed test bed in space, is also I think a good idea.

Finally, I want to emphasize the possibility that terrorists could purchase SCUDs or cruise missiles and use them to launch weapons of mass destruction at our coastal cities from ships off our

coast. And even a single nuclear armed SCUD that detonates a nuclear weapon high above the United States killing no one directly could create an electromagnetic pulse that could produce lasting economic havoc throughout the United States. This is not a new threat, and it could circumvent the major expenditures now being made to prevent the smuggling of weapons of mass destruction into the United States, a subject, I might add, that I spend most of my time today worrying about. It can and I believe should be countered by outfitting the Aegis ships that normally operate in our ports and along our coasts so that they can shoot down these cruise and ballistic missiles.

As one who lives along the East Coast, I strongly urge Congress to fund additional missile defense capabilities on our Aegis ships in the Atlantic. And I would note that by the end of this year, 18 will be in the Pacific; only 2 in the Atlantic. As an extension, I believe we should also have an East Coast test range to dedicate to their testing and help provide both a deterrent and a real defense against this threat.

Thank you, Mr. Chairman, for permitting me to share my views on these issues.

[The prepared statement of Mr. Cooper follows:]

House Committee on Oversight and Government Reform,
Subcommittee on National Security and Foreign Affairs

"Oversight of Ballistic Missile Defense (Part 3):
Questions for the Missile Defense Agency"
Wednesday, April 30, 2008
10:00 a.m.
2154 Rayburn House Office Building

Prepared Remarks by
Henry F. Cooper
Chairman, High Frontier
500 North Washington Street
Alexandria, Virginia 22314

Chairman Tierney, Representative Shays, distinguished Members of the Committee, I appreciate the opportunity to appear before you to support your examination of the Department of Defense missile defense programs.

I am chairman of High Frontier, a non-profit organization that has since the early 1980s advocated effective active defenses against ballistic missiles. We accept no funding from the Department of Defense, nor from any Defense Contractor engaged in missile defense activities.

In addition, I am Chairman Emeritus of Applied Research Associates, Inc., an independent contractor which works on national security issues, including for the Department of Defense, but I have avoided involvement with any work ARA may do related to missile defense issues so as to avoid any conflict of interest regarding my views on missile defense—sometimes to the chagrin of my ARA colleagues. The only missile defense related ARA work I know of involves high altitude physics important to the hardening of missile defense components to nuclear effects, and detailed lethality considerations important to modeling the intercept physics. The closest I come to missile defense programs in my personal ARA efforts is my work for the Department of Homeland Security (The Domestic Nuclear Detection Organization) and the Department of Defense (Defense Threat Reduction Agency) to develop technical and political-military concepts to counter the smuggling of nuclear weapons and materials into the United States.

I hold a PhD in engineering and have been involved since 1960 in a variety of technical and policy issues related to strategic offensive and defensive programs, from detailed technical research to supporting development of national security policies at senior levels. Regarding Ballistic Missile Defenses, I worked on Nike Zeus at Bell Labs in the early 1960s, helped set the criteria for the Safeguard system in the late 1960s, served in the mid-to-late 1970s on several Air Force Scientific Advisory Boards and Defense Science Boards that considered the possible role of missile defense in improving the survivability of our land-based ICBMs—and oversaw many of these activities as a Deputy Assistant Secretary of the Air Force with oversight responsibilities for Air Force strategic and space systems, including the development of penetration aids to defeat Soviet ballistic missile defenses. Among these projects was the development of the miniature homing vehicle eventually launched from an F-15 to shoot down a satellite in 1985—a proof-of-principle that we could "hit a bullet with a bullet."

As Assistant Director of the Arms Control and Disarmament Agency for Strategic Programs in the early to mid 1980s, I was responsible for backstopping our bilateral negotiations with the Soviet Union and led the interagency process at the Assistant Secretary level in developing the Reagan ASAT arms control policies. I was also involved at that level in developing our approaches to the START and INF negotiations and in dealing with associated verification issues—and, when the Nuclear and Space Talks began in 1985, served with the rank of Ambassador initially as Deputy Chief Negotiator and later as Chief Negotiator in the Geneva Defense and Space Talks, with responsibilities for defending President Reagan's Strategic Defense Initiative (SDI) against Soviet efforts to undercut the viability of that important program. In all, I spent five years in these negotiations, interacting regularly with Congress, the public, our allies, and, of course, the Soviets.

In 1990, Defense Secretary Dick Cheney asked me to lead a Presidentially mandated review of the SDI program and to recommend appropriate redirection in view of the then rapidly changing geopolitical scene, as the Soviet Union was disintegrating. I concluded that, in the post-Cold War world, the primary ballistic missile problem would be associated with the then-recognized growing problem of the proliferation of weapons of mass destruction and the means to deliver them, especially ballistic missiles. Thus, I recommended that SDI be redirected away from defending the United States homeland against a massive attack by thousands of nuclear reentry vehicles to protecting the United States and our overseas troops, allies and friends against limited ballistic missile attack—up to a couple of hundred reentry vehicles—and I advocated that we work with Russia to build such a global

system. This effort was intended to integrate both "Theater Missile Defense" and "National Missile Defense" into a single global system.

I still believe this "global defense" should be the goal of our missile defense programs, and that achieving it is feasible and affordable. The one extension of my 1990 vision is that I now include among the threats of concern terrorists who might launch SCUDs—or cruise missiles—from ships off our coasts.

Secretary Cheney then asked me to serve as SDI Director to develop and implement a plan to achieve this global defense objective—and I accepted his kind offer in mid-1990 and served in that post until January of 1993. During my comprehensive 1990 review and my tour as SDI Director, I think I was privy to all the classified information related to dealing with offensive countermeasures against all potential missile defense system concepts. However, I have not been briefed on any subsequent developments that might change the appraisal I then had—which remains the guiding light for my views on how truly effective defensive systems should be designed.

On the other hand, I do not believe modifications in the underlying technology can significantly affect what we have known for 50-years to be the fundamental technical requirements for a truly effective missile defense system. I'd like to review these basic considerations because I believe they are critically important in molding the most effective future missile defense programs.

Since the circa 1960 DARPA studies of the requirements for effective ballistic missile defenses, informed investigators have understood that a layered defense is required—not only to achieve many intercept attempts, but also to stress the attempts that dedicated designers of offensive ballistic missiles can be expected to make to penetrate the defense. Consider the three phases of a ballistic missile's flight and the associated distinctive measure-countermeasure characteristics:

- The *Boost-Phase* begins with the launch of the ballistic missile and ends when its rockets burn-out. During this period of flight, the threat rocket is very vulnerable to almost any perturbation, making it an attractive target; the challenge is for the defense to reach it in time. An intercept requires that the defense be based close enough to reach the attacking rocket before it burns out—for an ICBM in a matter of a few hundred seconds. For shorter range ballistic missiles, a boost phase intercept requires even closer proximity to meet shorter time constraints. To be close enough with a "hit-to-kill" kinetic energy interceptor is challenging for ground-based interceptors—e.g., getting the defense close enough to the launch site of a hostile adversary by

placing it on a neighbor's territory can pose a significant political problem. Locating air-based defenses—whether they employ kinetic hit-to-kill technology or directed energy (like the Airborne Laser)—close enough to be effective is perhaps easier, but may still pose a difficult operational and/or political problem. Sea-based defenses may more easily be deployed close enough in international waters, but the offense can defeat their boost-phase potential if threat launch sites are sufficiently far inland. Only space-based defenses can assure a boost-phase intercept capability against essentially all threatening ballistic missiles with ranges greater than a few hundred miles.

- The *Midcourse Phase* begins at burn-out and extends to the time when the reentry vehicle(s) begin to reenter the Earth's atmosphere—for an ICBM about 20-minutes, a relatively long time for the defense in any basing mode to intercept the attacking ballistic missile/reentry vehicle. A complicating factor is that during this phase outside of the Earth's atmosphere, reentry vehicles and various other bodies—including decoys and various elements that may break away from the rocket and or reentry vehicle bus—travel at the same speed, and the resulting array of objects can create a significant discrimination problem. Defensive countermeasures include employing an array of pellets with the kill vehicle (like the pellets of a shotgun shell), or very smart miniature hit-to-kill vehicles, or eventually the use of directed energy systems like lasers to perturb light weight decoys and expose a heavier reentry vehicle in the offensive threat "cloud." Still, assuring an effective midcourse defense is perhaps the most severe of all the measure-countermeasure challenges.
- During the *Terminal Phase*, beginning with reentry into the Earth's atmosphere, atmospheric drag will strip light-weight decoys and other elements away from the heavier attacking reentry vehicle, exposing it to substantially easier discrimination and intercept opportunities. The defense challenge is then assuring that the kill vehicle's sensors can acquire and guide the interceptor to impact the descending reentry vehicle, especially if the offense develops a maneuvering reentry vehicle. Based on the work done during my SDI watch, I believe high-endo-atmospheric intercept is feasible for defenses of all basing modes deployed close enough to reach the reentry phase of the attack.

A layered defense including all three phases can frustrate an attacker attempting to maximize the offensive countermeasures for any given phase. For example, boost-phase defenses can destroy a threatening rocket before it can dispense either its warhead/reentry vehicle or associated decoys, making such countermeasures pointless. If the offense spends the effort to develop a higher acceleration booster

to defeat the boost-phase defense, it may pay a weight penalty that reduces the midcourse countermeasures suite, thereby reducing the challenge to a mid-course defense. Furthermore, a terminal, high-endo-atmospheric defense that strips away light decoys and chaff can defeat the midcourse countermeasures. If a maneuvering reentry vehicle is designed to defeat a high endo-atmospheric defense interceptor, the weight penalty will also degrade the midcourse countermeasures suite.

As noted above, an additional consideration is the possibility of directed energy defensive systems, such as lasers, which can be used to shoot down ballistic missiles early in their boost phase. The Airborne Laser is such a system, but because its beam must penetrate the atmosphere along a more or less horizontal path, it must operate within a few hundred miles of the launch area of a potential threat—and this can pose a significant operational and political problem. This problem can be solved if such a directed energy system is based in space.

Based on such considerations, my above-mentioned 1990 review, and my SDI experience, my priorities then were—and still today would be:

1. Boost-Phase Intercept;
2. High-endo-atmospheric intercept in the Terminal Phase; and
3. Midcourse Intercept, if we have an effective algorithm to identify threat reentry vehicles in the face of midcourse countermeasures.

However, I was not then permitted to pursue a program based on these priorities. For example, the most effective boost-phase defenses were not permitted under the ABM Treaty, which prohibited even the development and testing of the most effective basing modes since they could defend the United States—and the purpose of the Treaty was to keep the United States (and the Soviet Union) vulnerable to ballistic missile attack. The only ground-based site that we could deploy was at Grand Forks, ND and Congress directed that I focus on developing and deploying that "Treaty-compliant" site. At best, we could include high-endo-atmospheric terminal defenses to strip away light-weight decoys—and our program included as a follow-on development a combined endo-exo-atmospheric interceptor (E^2I).

Development of sea-based, air-based and mobile land-based defenses had to be limited to a Theater Missile Defense role. The legacy of these constraints lives on today in that sea-based defenses continue to be restricted to a Theater Missile Defense role even though they have an inherent capability against long range ICBMs, as has been shown by numerous theoretical studies and to some degree demonstrated in fact by the recent adaptation of the Aegis Standard Missile to shoot down a satellite, traveling at a higher speed than an ICBM.

Space-based defenses obviously could not be limited to a Theater Missile Defense role—still, space-based sensors were permitted, and needed, to support ground-based defenses. But research and development on space-based interceptors had to be limited to technology demonstrations, for which Congress appropriated $300 million in FY1993—before the Clinton administration killed that program and all associated technology development.

In my opinion, the technology developments for small, very smart space-based interceptors with intercept capabilities in all the above phases of flight provided the best product of the SDI years, and the only one with the prospect of meeting the so-called Nitze criteria, mandated by Congress, that effective defenses should be survivable against direct attack and cost-effective at the margin against offensive countermeasures. These facts might be born in mind when considering the $10 million requested in the President's budget to explore the feasibility of a space test bed in the context of the Committees interest in dealing with offensive countermeasures.

While the Reagan-Bush-41 SDI program actively considered all these technology alternatives within the limits of the ABM Treaty, the Clinton administration sharply curtailed all missile defense programs. All space-based defense work was cancelled, ground-based defenses were reduced by 80-percent (totally killing the E^2I system designed as a follow-on to the exo-atmospheric-only ground-based interceptor). Even the Clinton administration top priority Theater Missile Defense programs were cut back by roughly a quarter. A key loss was the Science and Technology program in which SDI was investing about $1.3 billion a year in 1993 dollars—it was cut to something like $50 million, dead-ending many important activities that were the legacy of the S&T programs derived from DARPA and the services when the SDI program was formed in 1984. To my knowledge, most of these losses have not been restored. The best technologies that resulted from $30 billion invested during the 10-year SDI era was, in my judgment, lost and have had little impact on subsequent missile defense programs, including today's.

For example, the cutting edge light-weight sensors, propulsion, computers, etc. developed to assure a viable cost-effective space-based defense became politically incorrect and to my knowledge have not been pursued for U.S. missile defense applications since 1993. The maturity of these technologies was demonstrated by the 1994 Clementine mission to the Moon, which won national acclaim among the scientific community while space qualifying almost all the technology necessary for a space-based interceptor system. (The National Academy of Science and

NASA presented the Clementine teams with awards and a replica hangs today in the Smithsonian.) When Congress sought to continue to exploit this important technology in civil space applications, President Clinton used his momentary line item veto to cancel the follow-on NASA effort, because, according to a White House aid, it used "Star Wars" technology prohibited by the ABM Treaty.

Thus was ended the technology pathway that could have long before now led to light-weight kill vehicles that, for example, would have enabled the Navy's sea-based interceptors to reach substantially higher velocities, providing greater reach to defend much larger areas, including against ICBMs.

Thankfully, President Bush withdrew from the ABM Treaty in 2002, making it possible to revisit the basic lessons, redirect the missile defense programs according to the priorities I suggested above, and reinvigorate the technology base to enable much more capable defenses in both the near and far term. In my view, this has not yet happened. Instead, most resources have been placed against the 1993 scaled-back Clinton Ground-Based Defense program, albeit expanded to include mobile components previously prohibited by the ABM Treaty and with ground-based interceptors sites other than at Grand Forks.

Returning to the basics I have reviewed above would be entirely consistent with the Missile Defense Act of 1999, which passed by an overwhelming majority in Congress, was signed into law by President Clinton in July 1999, and was recently reiterated in the Defense Authorization Act of 2008. It stated:

> *"It is the policy of the United States to deploy as soon as technologically possible an effective National Missile Defense system capable of defending the territory of the United States against limited ballistic missile attack (whether accidental, unauthorized or deliberate)."*

Given this congressionally mandated national policy, countinuing debate should not be about whether to build and sustain an effective defense—rather about how. I believe several things would result from such a return to basics, including:

- A reinvigorated technology development effort to assure viable missile defenses into the future, whether at the Missile Defense Agency, at DARPA or in the services as their respective components of a global defense architecture matures.
- A substantially increased level of funding for sea-based defenses, to fully exploit the inherent flexibility of operating freely in international waters—and to provide defensive options in all three phases of flight. In many ways,

the Navy's sea-based defenses are closest to an operational global defense capability, but they have been limited—arbitrarily I believe—to a Theater Missile Defense role. This was understandable under the constraints of the ABM Treaty, but not any longer.

- A revival of efforts to exploit the obvious benefits of space-based defenses, beginning with the President's proposed space test bed.

Finally, I want to close by emphasizing what I consider to be an urgent and largely under-appreciated threat—the possibility that terrorists could purchase SCUDs or cruise missiles and use them to launch weapons of mass destruction at our coastal cities from ships off our coasts. This is not a new threat, and it could circumvent the major expenditures now being made to prevent the smuggling of weapons of mass destruction into the Untied States from the surrounding maritime pathways.

A near-term response to this threat is to outfit the Aegis ships that normally operate in our ports and along our coasts so that they can shoot down these cruise and ballistic missiles. By the end of this year, the Navy will be operating sixteen such ships in the Pacific and two in the Atlantic. As one who lives along the east coast, I strongly urge Congress to provide the funds to increase the Aegis ballistic missile defense capabilities in the Atlantic—and to fund the extension of the East Coast Test Range to ballistic missile defense testing to help provide a deterrent as well as well as a real defense against this currently existing threat.

To further emphasize the importance of this threat, I call your attention to the report of the congressionally-mandated Commission to Assess the Threat to the United States of Electromagnetic Pulse (EMP) Attack. Terrorists that launch a single SCUD from a ship off our coast and detonates a nuclear warhead 50-100 miles above our densely populated areas could create havoc with enormous political and economic consequences. Such a threat should not be ignored, especially when there are defensive alternatives to counter it.

Thank you, Mr. Chairman, for permitting me to share my views on theses important issues. As should be clear, I am a strong advocate for building, as quickly as is possible, effective global defenses to protect the United States and our overseas troops, friends and allies—and I believe a return to basics will lead to a more cost-effective development of such a capability.

Mr. TIERNEY. Thank you, sir.

Mr. Cirincione, we would like to hear your testimony as well, please.

STATEMENT OF JOSEPH CIRINCIONE

Mr. CIRINCIONE. Mr. Chairman, members of the committee, thank you very much for bringing me back to talk about one of my favorite subjects, the antiballistic missile program.

When I became a staff member of the House Armed Services Committee in January 1985, my very first assignment was oversight over the then Strategic Defense Initiative Organization programs. Since that time, I've seen a formidable line of directors and program managers testify before Congress over—of those almost 25 years. They have constantly warned of urgent and emerging threats and have consistently promised that there was a technological solution to these threats that, with just enough money and enough time and a few less restrictions, they could deliver.

Over the 25 years, I've seen the threat diminish, actually drastically, which is fortunate because the programs that they promised have been chronically behind schedule, over budget and under performing. We do not now have and are not likely to have an effective defense against even a primitive intercontinental ballistic missile launched at the United States using the kinds of decoys and countermeasures that such a country would likely have.

The claims that we have such a capability are simply false. General Obering was a very competent representative of the program before this committee, and I sympathize with the difficulty that members have in trying to get him to elaborate on some of the problems that the program might be having. In my 25 years, I have never seen a program manager come before Congress and admit that they were having serious problems in the program or that they could do the mission with less money. If they did so, they would be fired, and another program manager would be brought up here.

So you have of a dilemma. How do you, knowing what you know, believing what you believe, forge a consensus in the Congress and in the country over the path forward on ballistic missile defenses? I believe that—and I have elaborated in my testimony some methods that you should consider that have worked in the past to forge such a consensus.

No. 1, I believe you should commission an independent assessment of the antiballistic missile technologies. In 1987, the study done by the American Physical Society forged such a consensus about the near-term value of directed-energy weapons. You may remember that to the Strategic Defense Initiative program began not with ground-based systems, which were explicitly rejected by proponents of ballistic missile defense, in favor of directed-energy weapons. We spent billions of dollars exploring the feasibility of these weapons. The deserts of America are littered with the carcasses of failed directed-energy weapons programs; none of these systems worked.

In 1987, the American Physical Society study said it would be two decades before we would know the feasibility of these systems. That helped redirect the program toward more promising near-

term solutions. I believe a similar study by the American Physical Society, perhaps the National Academy of Sciences, the American Association for the Advancement of Sciences could provide—could be sort of a technological referee here that could help give the Congress an objective assessment of what's working and what's not.

I have several other suggestions in mind. But I believe that in the long term—I'm sorry—in the near term, what the Congress and the next administration should do is disband the National Missile Defense Agency. Under various directors and under various organizational structures, this has proved to be a very ineffective development and procurement agency. I believe the way to settle some of the differences that we heard today in the first part of this hearing is to devolve these antimissile programs back to the services from whence they came. Let the Joint Chiefs and the commanders in the field wrestle with the—make a first approximation of the resources that should be allocated to antimissile defense versus the other defense priorities. I believe if you do so, then Congress will then get recommendations from the Defense Department, from the administration, that present a more complete and a more balanced representation than you will if you continue to have an agency who exists only to promote antimissile programs, an agency that now has a budget of some $10 billion a year. You've created a very formidable advocate for these programs. If you're going to try to get at the truth of what works and what's necessary, I think you have to take that advocate apart and bring—and allow the influence of the rest of the services into these decisions.

As it is now, I think the Missile Defense Agency is a self-perpetuating money machine. It exists to defend its budget, to defend its program. You're never going to get a balanced defense as long as this Missile Defense Agency exists the way it does.

I'll conclude my opening remarks with that, sir.

[The prepared statement of Mr. Cirincione follows:]

Lessons of the Past, Recommendations for the Future

Testimony of
Joseph Cirincione
President, Ploughshares Fund

United States House of Representatives
Committee on Oversight and Government Reform
Subcommittee on National Security and Foreign Affairs

April 30, 2008

The past twenty-five years have been disappointing ones for anti-ballistic missile programs. Advocates have consistently appeared before Congressional committees warning of urgent threats and promising a technological solution with rapid progress, improved capability and assured defense. The threats have not appeared, indeed, they have greatly diminished. This is fortunate. The anti-missile programs have been consistently behind schedule, over budget and under achieving.

Lessons Learned

This was predictable. In fact, it was predicted before this Committee in a series of hearings in 1991 and 1992, the last time prior to these hearings we conclude today that Congress undertook a comprehensive review of the threats, cost and benefits of anti-missile weapon systems. I was privileged to help staff those hearings.

Experts from the then-General Accounting Office testified before this committee in May 1991 on the programs of the Strategic Defense Organization (SDIO). These experts reported on the waste resulting from "the persistence of the administration and SDIO in making plans and starting project on the basis of unrealistic and overly optimistic funding requests and schedules." [1] A GAO report detailed the money lost from "this optimistic planning" including:

- $1 billion for the free electron laser
- $1 billion for the BSTS satellite system
- $720 million for the space-based chemical laser
- $700 million for the neutral particle beam
- $600 million for the STARLAB target tracking experiment
- $360 million for the airborne optical adjunct aircraft

[1] *Activities of the House Committee on Government Operations, One Hundred Second Congress, 1991-1992. Report 102-1086*, p. 173.

Another GAO study requested by the Committee found that officials of the Strategic Defense Initiative program gave exaggerated and misleading claims of success. The report detailed six incorrect statements in four separate tests during the preceding 2 years, including:

- The "Brilliant Pebbles" tests were not "90 percent successful," as claimed. Nor did they represent increasingly sophisticated tests.
- The ERIS interceptor did not discriminate between its target and decoys, as claimed. Discrimination remains a major unsolved problem.
- The test of the HEDI interceptor did not validate the design, as claimed. Parts of the missile broke into pieces, ripping off gauges and forcing costly redesign.
- The LEAP test was not a success, as claimed, failing to achieve critical altitude and accuracy requirements.[2]

Nonetheless, advocates for the programs argued that the growing threat justified rushing new, untested systems into deployment.

Keith Payne, president of the National Institute for Public Policy and later assistant secretary of defense for forces and policy, 2002-2003, warned this committee in October 1991:

> "Within the decade, the continental United States could be in the range of ballistic missiles of several Third World nations...When the ballistic missile threats of the late 1990s and the early 21st Century are considered, initiating deployments of GPALS [the Global Protection Against Limited Strikes system, a scaled-down version of the original SDI system] is not only reasonable, but essential for future U.S. allied and Soviet security." [3]

Other expert witnesses told the Committee that there was not an urgent threat. Steven Hildreth of the Congressional Research Service said, "No new, additional ICBM threat from third countries to the United States is foreseen over the next ten years or so." John Pike, then director of the space policy program at the Federation of American Scientists, said, "The prospects that an anti-missile shield might be needed in this century are so remote that there is no reason, other than political expediency, for proceeding soon with deployment of such a system."[4]

The advocates were wrong; the independent analysts were right. The threat predicted did not appear and is still unlikely to appear in the near-term. Informed by the Committee's hearings on anti-missile programs, the Congress in the Defense Authorization Act for fiscal year 1993 revised the Missile Defense Act to eliminate the specific goals of deploying a limited missile defense system in the United States by 1996. The goal of

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[2] Ibid., p. 177. GAO Report NSIAD-92-282.
[3] Ibid., pp. 175-176.
[4] Ibid., p. 175

seeking modification to the 1972 Anti-Ballistic Missile [ABM] Treaty was also repealed. These were sound judgments that withstood the test of time.

Similarly, in 1996 the Joint Requirements Oversight Councils, headed by Admiral William Owens, Vice Chairman of the Joint Chiefs, recommended that:

> "The JROC believes that with the current and projected ballistic missile threat, which shows Russia and China as the only countries able to field a threat against the US homeland, the funding level for NMD should be no more than $500 million per year and TMD [theater missile defense] should be no more than $2.3 billion per year through the FYDP. These funding levels will allow us to continue to field critical TMD/NMD systems to meet the projected threats and, at the same time, save dollars that can be given back to the Services to be used for critical recapitalization programs."

Lessons Lost

The Joint Chiefs common sense approach was correct then and is still sound today. Officials in the Bush administration choose to ignore this advice and the lessons of the past. Officials believed that breaking out of the ABM Treaty, tripling budgets and committing to deploying a system would soon provide a protective shield for the United States. They were wrong.

Steven Hadley, now National Security Advisor, wrote in 2000 that, "the U.S. NMD program is already well behind and likely to lose the race against the threat—if the race has not already been lost." He argued that North Korea, Iran and Iraq could test an ICBM capable of carrying a nuclear warhead between 2005-2010. He pushed for a crash program to deploy anti-missile systems "to counter these threats before 2005 (or more likely 2007 or 2008), when a more mature capability could be developed." He believed a "quick fix" could be deployed immediate of Aegis ships with an upgrade of the Standard Missile interceptor that would "provide a capability to intercept threatening missiles early in their flight (in the "post-boost" or "mid-course" phases)."[5]

Hadley's proposal mirrored the 1995-96 recommendations of a Heritage Foundation panel chaired by Henry Cooper that concluded:

> "For an investment of $2-3 billion, 650 defensive interceptors on 22 AEGIS cruisers could be at sea by 2001, achieving a limited global missile defense capability for the U.S. and for American forces and allies overseas....[T]hese highly mobile platforms could defend Americans in all 50 states from a limited long-range missile strike, as well as defend American troops and allies overseas."[6]

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[5] Hadley, Stephen J. "A Call to Deploy." *Washington Quarterly,* Summer 2000. 23:3 pp. 95–108.

[6] *Defending America: Ending America's Vulnerability*, An Update by the Missile Defense Study Team ("Team B"), The Heritage Foundation, March 15, 1996, "Introduction," available at: www.heritage.org/Research/MissileDefense/BG1074.cfm

This was and still is a fantasy.

Anti-missile program are now free from any treaty restraints, flush with cash, and exempt from the normal defense program checks and balances. Instead of soaring performance, we have a record unblemished by success. The administration has been forced to simplify its demonstration events and has resorted to fielding systems that have never been operationally tested. It is a placebo strategy that gives the troops and the nation the illusion of defense.

A New Approach

The officers and leaders of the anti-missile programs are hard-working patriots. But we have given them a Sisyphean task. They are rolling money up the hill, but the programs keep rolling back down. This strategy is unacceptable. It is time to change the mission, time to restructure the program. The Congress and the next administration should consider improving the programs to give the nation a better chance to field capable weapon systems against the near-term threats.

Dissolve the National Missile Defense Agency. The agency, under a variety of names and directors, has proven a deeply flawed development and procurement vehicle. The best chance of restoring balance to the programs is to devolve the various elements back to the services from whence they came. The services are in the best position to weigh the costs and benefits of the systems against other military needs.

Restore Normal Test and Procurement Procedures. All weapon systems, including anti-missile systems, must be rigorously tested under battlefield conditions before they are given to the troops or deployed in protection of the nation. The current deployment strategy of deployment without realistic tests risks commanders committing troops to battle believing they have protection when they do not, or committing the nation to a course of action believing there are defense options when there are not.

Produce an Integrated, Objective Threat Assessment. The threat from ballistic missiles should be evaluated in its entirety and in the context of all threats to the United States. Efforts to cherry-pick intelligence to support a particular point of view or to commit funding on speculation or threat exaggeration must be rebuffed.

Commission an Independent Technological Assessment. The Congress should request an independent organization review the progress and prospects of the various proposed anti-missile technologies. A 1987 report by the American Physical Society helped refocus the SDI program with its detailed assessment that the feasibility of directed energy weapons would not be know for at least two decades. A similar study by the APS on current systems could greatly inform Congressional oversight.

Restore Fiscal Discipline. Pending these recommended reviews, the budgets for anti-missile systems should be concentrated on deploying capable systems against the short- and medium-range threats confronting American troops and allies. Funding for defenses

against long-range threats should focus on research and development. No funding should be allocated to systems that have not proven their operational capability. Contractors should not be rewarded for failure.

Congress should not be guided by the mistaken belief that we have, or soon could have, technology capable of protecting us from long-range missiles. Nor should standards be relaxed and deployments rushed base on exaggerated threat estimates. Research on effective anti-missile systems should continue, and deployment of tested systems can play a role in the defense of the nation and our troops, but it will likely remain the weakest and last line of defense.

Attachment:

"The Incredibly Shrinking Ballistic Missile Threat," *Foreign Policy*, May/June 2008

ARGUMENT

The Incredible Shrinking Missile Threat

The United States is in the midst of one of the largest military buildups in history. And it is against a threat that is disappearing—fast.

By Joseph Cirincione

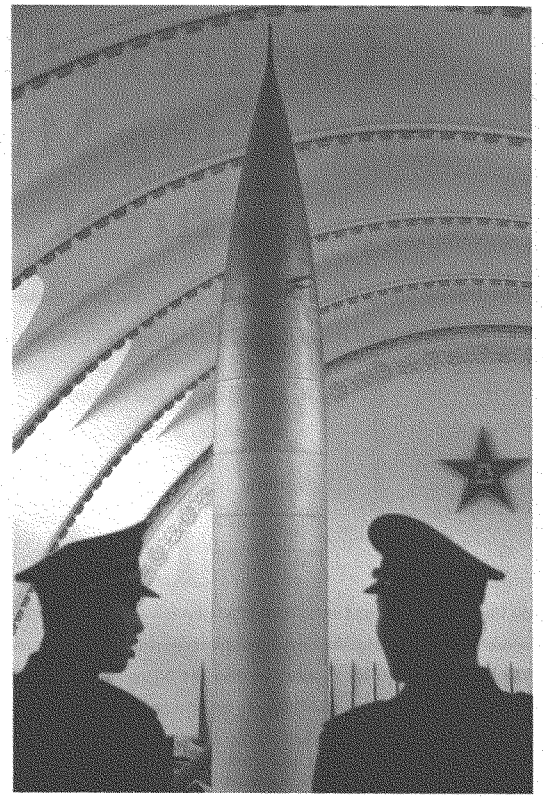
If President George W. Bush's budget requests are met, the United States will spend more this year than it ever has on antiballistic missile defense—some $12 billion, or nearly three times what the United States spent on antimissile systems during any year of the Cold War. The United States would spend more than $60 billion on missile defense in the next six years, an unprecedented sum, even for the Pentagon. But what makes this spending most remarkable is that the threat it seeks to counter is actually declining. There are far fewer missiles, missile programs, and hostile states with missiles aimed at the United States and its armed forces than there were 20 years ago. The number of long-range missiles fielded by China and Russia has decreased 71 percent since 1987. The number of medium-range ballistic missiles pointed at U.S. allies in Europe and Asia has fallen 80 percent. Most of the 28 countries that have any ballistic missiles at all have only short-range Scud missiles—which travel less than 300 miles and are growing older and less reliable each day. Even the number of countries trying to develop ballistic missiles is falling.

This is not to say that our world is without risks. Russia has more than 660 missiles capable of striking the United States. China has about 20. But these weapons are not the focus of the United States' antimissile program. In fact, U.S. officials have gone out of their way to assure Russia that the antimissile bases they seek to build in the Czech Republic and Poland are not intended to offset the Kremlin. They can't. There are countermeasures both the Russians and the Chinese can put on their missiles that would render any interceptor

Joseph Cirincione is president of the Ploughshares Fund and author of Bomb Scare: The History and Future of Nuclear Weapons *(New York: Columbia University Press, 2007).*

ineffective. Instead, the United States justifies the antiballistic missile program by the alleged threat from Iran. Of the $60 billion the United States wants to spend, $10 billion is earmarked specifically to counter a future Iranian missile.

The cost is real, but the missiles are not. Both Iran and North Korea are trying to develop long-range missiles that can strike countries far beyond their borders. So far, they have had little success. North Korea's two tests of its much-hyped Taepodong missiles, in 1998 and 2006, both ended in failure. The first went about 800 miles and failed to put a satellite into orbit; the second blew up 40 seconds after launch. In the 1980s and 90s, Iran purchased from North Korea a handful of missiles with a 600-mile range, painted them patriotic colors, and gave them the Iranian name Shahab. Tehran has been boasting that it could use these weapons to develop a new generation of long-range missiles. But the Shahab test program has had as many failures as successes. Even if they were successful, the Iranians lack a nuclear warhead to put on a missile, and they are five to 10 years away from having such a capability.



Most countries are losing interest in pointing missiles at the United States.

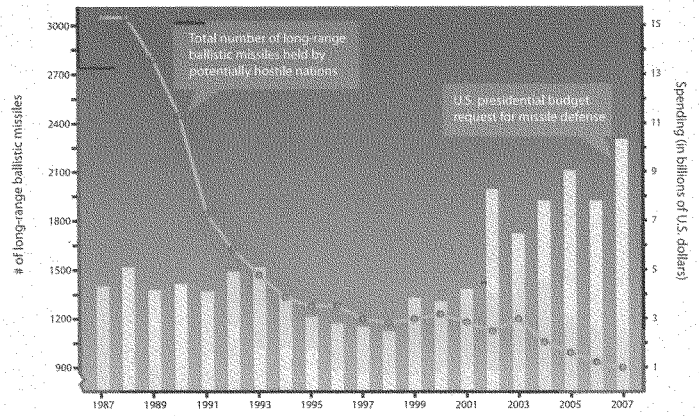
TEH ENG KOON/AFP/GETTY IMAGES

Yes, Iran's efforts to build medium-range missiles must be countered. But they represent a threat that is orders of magnitude smaller than the 5,000 nuclear warheads that former President Ronald Reagan hoped to intercept when he launched the antiballistic missile program in 1983. Those were real warheads on real missiles. They could have destroyed most life on the planet. Yet, Reagan's program had an average annual budget of just $4 billion during the 1980s. Today, the United States is spending billions more, yet the technology is no more effective now than it was 20 years ago.

The truth is that diplomacy has destroyed far more missiles than interceptors ever will. The agreements Reagan negotiated over the eight years of his presidency slashed the Soviet long-range

The Growing Missile Gap

Spending on U.S. missile defense is increasing—even as the threat declines.



missile arsenal by half—and completely eliminated all of Russia's 800 intermediate- and medium-range missiles. Follow-on agreements could cut long-range arsenals further, and a global ban on intermediate- and medium-range missiles could intercept these weapons before they are even built. In the meantime, individual deals are destroying missiles, too. Libya negotiated an end to its ballistic missile program in 2003. North Korea has suspended its long-range missile tests and could end its program completely if current talks prove successful. An agreement with Iran to contain its nuclear program to exclusively civilian ends could terminate its missile program as well.

The Pentagon's top brass have never been fans of spending billions on programs that do their troops little good. The Joint Chiefs of Staff have tolerated massive spending on the antiballistic missile program in recent years because the overall Defense Department budget has swelled alongside it. This will not be the case forever, and as the Pentagon budget eventually shrinks, the Joint Chiefs will almost certainly rather spend that money on planes, tanks, and ships. Part of this calculus will be the war in Iraq, where half of the Army's and Marine Corps' equipment has been chewed up. The last time the Joint Chiefs were asked to recommend a budget for antimissile systems, in 1993, they said to spend no more than $3 billion a year. Asked again, they would likely give similar advice.

The threat of ballistic missiles is limited and changing slowly. The only proven defense against this threat is diplomacy, deterrence, and measured military preparedness. There is every reason to believe this strategy can be as effective today as it was in the 1980s. Officials during any year of the Cold War would have gladly traded today's limited threat for the dangers they confronted then. If missile defense technologies prove feasible, particularly those designed to counter more prevalent short-range missiles, they may eventually earn their place in the military's defense strategy. But they are far from a panacea. The sooner the United States returns to a balance of realistic threat assessment, smart budgeting, and vigorous diplomacy, the sooner it will truly be prepared for the genuine threats of the 21st century. Until then, America's foes will continue to chuckle as it squanders billions to combat a threat that is growing smaller every day. FP

SOURCES: INTERNATIONAL INSTITUTE FOR STRATEGIC STUDIES; NATURAL RESOURCES DEFENSE COUNCIL; *BULLETIN OF THE ATOMIC SCIENTISTS*; U.S. DEPARTMENT OF DEFENSE; CENTER FOR DEFENSE INFORMATION

Mr. TIERNEY. Thank you.

I thank all three of you for so thoughtful remarks.

Dr. Cooper, let me start with you because I heard from the other two gentlemen a little bit before.

Do you ascribe to the notion that a country like Iran, if it had the capacity say 2015, 2020 to send one intercontinental ballistic missile here, would do so without minding the fact that they'd have retaliation against them?

Mr. COOPER. You're going to accuse me of skirting the question, but——

Mr. TIERNEY. I could do that now or after you've done it.

Mr. COOPER. But I don't know how to predict such things, sir. And I'm very uncomfortable with the idea that we would be vulnerable to the likes of—I can't even say his name—Ahmadinejad and his friends.

Mr. TIERNEY. Let me phrase it this way then, do any of you—I know, again, I'm assuming the answers from some of the gentlemen from previous testimony. It seems to me Mr. Cirincione makes a reasonable argument when he says, look, maybe you ought to take this and devolve it back to the individual branches of the services here and let them deal with their components on that; otherwise we might run the risk here of just an endless bottomless pit of money. I mean, this program is already the most expensive program that we have, and I've not seen any indication that anybody's ever concerned about measuring how much money we spend on it versus what are the other threats and risks that we have, everything from homeland security all the way to terror abroad or conventional conflicts or whatever.

Would you object to that notion, Dr. Cooper, of putting it back into the services so they could deal with the components and measure it against what other challenges they think are out there, where they want to spend their money?

Mr. COOPER. I think the combination of SDI, which was mostly about research for the first 8 years or so and began to get seriously engaged in the idea of actually building something was a really good idea because, at the time, there was no way within the Department to integrate things.

You know, when the first Gulf war came along and we saw the PATRIOT activities, I was the one who argued that we should fold in theater defenses into the Missile Defense Agency, then called SDI. And fortunately, in my judgment, Secretary Cheney went along with me. And that was to assure that our theater and strategic defenses were integrated together because of this vision of wanting a global defense.

This is a long way of saying, I think there's an important function performed by centralizing the planning, the research and development, even to the stage of developing prototypes and, to some degree, the initial operating capabilities in the field, in this integrated way, at which time I think it is an appropriate thing to transition them back to the services. And I believe that's the general intention of the department.

Mr. TIERNEY. Dr. Coyle, you've sat through, very patiently, the entire first panel on that for some time. I'd like to just know what your immediate observations are from that discussion.

Mr. COYLE. Well, General Obering is an experienced and excellent witness, but I was surprised at how many statements, including new statements, he made that were certainly incomplete, misleading or even untrue. There were quite a few of them. I don't know quite where to begin. Perhaps it would be best if I provided that for the record. But I was——

Mr. TIERNEY. Well, we'd greatly appreciate that. But if something comes to mind, that would be helpful as well.

Mr. COYLE. I was surprised that he made a couple of statements that I think are, at best, misleading.

Part of the problem is, when we talk about tests, General Obering, for example, said, we have flown countermeasures against our sensors in tests. He made that point two or three different times. But he's talking about sensor characterization tests, flight characterization tests, tests that didn't actually involve shooting down a target. So I don't deny that, indeed, they've tried to gather data about how their sensors would behave against these various countermeasures. But I think it's a little misleading to imply that they've got the matter in hand because of such tests when they don't actually involve shooting down the target. That's just one example.

Mr. TIERNEY. Thank you. We would appreciate a great deal—I don't mean to be giving you homework or anything. But, on the other hand, we do I guess. But if you have the time and the patience to do that, I think we'd benefit from knowing your analysis of what he said and what we ought to further inquire so we could get to the bottom of some of these things.

Ms. McCollum, if you don't mind, I will ask Mr. Cirincione the same question, and then we will come to you. I think I have passed my 5 minutes.

Mr. Cirincione, please.

Mr. CIRINCIONE. A lot of this boils down to what your definition of test is. And the agency uses test when they refer to computer simulations, flight tests where they're putting objects up and observing them, or actual intercept tests. And they merge them all together. So when you ask them, but you've never done a test with a realistic countermeasure, he says, yes, we have. And what he means is, they put some realistic countermeasures up into space and they've imaged them to see what they look like. But he doesn't mean—but you may have drawn that conclusion, some might have, not you, Mr. Chairman—that he meant that we'd actually done an intercept test, again with a realistic countermeasure. We have not. We have not.

And I share Dr. Coyle's concern——

Mr. TIERNEY. Are you sure it hasn't been done and classified on you?

Mr. CIRINCIONE. We have never done a realistic test against the kind of missile and the kinds of countermeasures we could expect from even an Iran or North Korea. And the reason we haven't done that is that, if we did, we would miss. It's not that we don't have the ability to hit a bullet with a bullet. We do. But we don't have the a ability to see that bullet when there are dozens of other phony bullets around it. And that's the problem. If you can't see it, you can't hit it.

Mr. TIERNEY. Ms. McCollum.

Ms. MCCOLLUM. Thank you, Mr. Chair.

Boy, I don't even know where to start. But let me thank you for talking about tests because as a former teacher, I can devise a test to measure what I want to measure. And so I think when you talk about having successful tests, you need to know what the standards were that you were trying to meet with that test.

The computer modelling that people kept being referred to, can you gentlemen tell me—I'm not a computer expert, so if I say something, and I'm using the wrong terminology, correct me. Do they have their own supercomputer? Do they use cluster computers? Are they just using, you know, something kind of souped up off the shelf? What are they using to do their testing for their computer models? Anyone know?

Mr. COYLE. Ms. McCollum, they use a variety of different kinds of approaches. Some of it's done on big computers. Some of it, with the amazing capacity of laptops these days, it could even be done on a laptop. Whether or not that simulates what would happen in real battle is another matter. But they use a variety of different kinds of computers. And with the kind of resources they have, I don't think access to big computers, supercomputers, is a problem for them. They also do what are called hardware-in-the-loop simulations where they take hardware in the laboratory and run it through small laboratory scale tests, for example. So those are a couple of ways that they do it.

Ms. MCCOLLUM. OK.

Mr. COOPER. May I add a point? The other point is that they do physics based modelling, first principle physics-based modelling. Just as the DOE laboratories are applying this approach to at least claim that they can do nuclear weapons design without testing. And so, for example, when General Obering showed you the picture up here of what they anticipated were they to hit the fuel tank on the satellite and then he showed you the picture of the actual data, there was a fair amount of detail in the two that compared—well, the modelling they did was physics-based modelling. And there is a growing confidence in our ability to do that. We fly airplanes today. I don't know that we've ever gotten to the point where we have actually put one in service without fully testing it. But once upon a time, we did lots of testing. Today we don't do as much testing because we believe these models.

Ms. MCCOLLUM. OK. My time's going to probably going to run out. Have I got time? Go ahead.

Mr. CIRINCIONE. Just two quick points. I was on staff in the 1980's and 1990's when computer simulation started to becoming an increasingly large part of Department of Defense testing. And we tried to resist the effort to have computer simulations included as operational testing data for the obvious reason that, in a computer simulation, you can program in assumptions that the customer might not be aware of. So we were very concerned that computer simulations could be manipulated to give data that might not actually be realistic, and it would, as it got down the chain, it would be more and more difficult to understand what you were actually simulating and what the assumptions were. We lost that battle. So computer simulations are now completely integrated into

not just developmental and research testing but operational testing. I personally find that very disturbing.

Second, I don't even use the word "test" when I discuss what's going on with the antiballistic missile programs. You will notice in my testimony I don't use that word. I think these are demonstrations, that these are highly scripted demonstrations of a certain capability. Do they have value in understanding how far you are toward achieving your goals? Yes. Are they actual tests of our ability to intercept a target? No, I don't think they are.

Ms. MCCOLLUM. If we're going to have another round, I'll wait and do that. But it looks like Mr. Cooper had something he wanted to add if you would be kind enough. Thank you.

Mr. Cooper.

Mr. COOPER. I just wanted to add a point of disagreement, I suppose, with my friend Joe here. And that is, he is making a universal statement, and that's not entirely an accurate thing it seems to me. I believe the Navy programs have done quite realistic operational testing in many of their experiments, if you want to use that term, including firing cruise missiles and ballistic missiles at the same time, and as General Obering spoke of, a couple of ballistic missiles at the same time where the crews of operational cruisers are actually the ones that are conducting the tests. They don't know when the rocket is going. They know they're going to be on a test range and there's a time window in which it is. But they actually come as close, I believe, as you can come to operational testing as a part of a development activity. Now, to be sure, they're not doing the midcourse countermeasures that you folk are interested in either. But that's not part of their design at this point.

Mr. CIRINCIONE. Let me quickly agree. I was talking about the midcourse intercept demonstrations. I agree that in the theater defenses, there's been more realistic testing.

Mr. TIERNEY. Thank you.

Mr. Shays, you're recognized.

Mr. SHAYS. Thank you.

Mr. Cirincione, my understanding is that you would end the program, just shut it down. Is that correct?

Mr. CIRINCIONE. Oh, no, sir.

Mr. SHAYS. OK. Then what should my understanding be?

Mr. CIRINCIONE. I would end the agency. I think we need a better, more efficient procurement and research vehicle than we've had over the last 25 years.

Mr. SHAYS. So, is your view that the missile defense program should continue, done differently, more slowly and so on?

Mr. CIRINCIONE. A refocused effort to concentrate on getting near-term capabilities into the field for our troops and allies faced with theater threats and do more focused research on long-term defensive capabilities before moving to a procurement and deployment program for those.

Mr. SHAYS. I'm happy to ask the question. Because, Mr. Coyle, would yours be somewhat similar in position? Or how would it differ?

Mr. COYLE. Mr. Shays, I support research and development on missile defense. I think it is expensive, but I think it's something that the United States can afford.

What I don't support is deploying systems that have no demonstrated operational effectiveness.

Mr. SHAYS. OK. I hear you. I want you to react to this. First off, I've always been—I had been very skeptical of the missile defense program. And I voted to continue it. But I said we shouldn't deploy until we have a system that works. But I remember during the first—well, with getting Iraq out of Kuwait and the SCUD missiles, there was some comfort that I had that there was a PATRIOT missile that somehow could maybe intercept a SCUD missile which was not all that accurate. But I thought, you know, psychologically it was good. And at times, it seemed to work. Do you think that a missile defense system is more apt to work on short-range, medium-range, or long-range? And I'll ask all three of you. Which is the easier, and which is the more difficult? I'll start with you, Mr.——

Mr. CIRINCIONE. I believe we can develop effective and reliable defenses against short-range missiles, primarily because you do not have the countermeasure problem. You are intercepting these systems in the atmosphere where countermeasures cannot operate. This is still a difficult task, and historically we've had, again, exaggerations of our capability. Mr. Shays, you remember the claims that we had intercepted 41 out of 42 SCUDs. It was only after this committee did an investigation that those claims were considerably scaled down. The Government Accountability Office estimated we hit 4 out of 44. Some independent experts don't think we hit any. My personal estimate was two as a result of our investigation.

Mr. SHAYS. But the point is, do you have a sense that——

Mr. CIRINCIONE. You could do this. You could improve the PATRIOT or improve the THAAD or develop a new system that would have a better shot at intercepting SCUDs.

Mr. SHAYS. Would it get more difficult——

Mr. CIRINCIONE. As the range of the missile increases, the difficulty of intercepting it increases.

Mr. SHAYS. Is that because of the decoy measures?

Mr. CIRINCIONE. It is because of the speed of the target and because of the countermeasures.

Mr. SHAYS. Tell me how you would agree or disagree with what I just heard, Mr. Coyle.

Mr. COYLE. Mr. Shays I was very interested in the question you asked General Obering this morning about PATRIOT. He said that—and I believe the context of your question was about PAC–3 against SCUDs. PAC–3 is still untested in battle against SCUDs because Iraq didn't fire any. And so I didn't understand his answer. And I thought it was misleading because he said all of the missiles that Iraq fired at us were destroyed or shot down. And you can go through the news accounts of how many missiles were fired by Iraq each day, of which kind, and by our count, there's a couple hundred—excuse me, a couple dozen missiles that Iraq fired, not SCUDs but shorter-range missiles of other types, including cruise missiles that were not shot down by PATRIOT or PAC–3.

Mr. COOPER. I think it's not quite as simple as it's been stated here. Countermeasures apply, as I tried to make the point in my testimony, in all of the phases of flight. The difficulty that we had in shooting down the SCUDs in the first Gulf war, for example,

had to do with the fact that Saddam Hussein took three SCUDs and he welded two together out of this to get the extended range. When they went out of the Earth's atmosphere and they were in space for some considerable amount of time, they went like this and came down hind part first and they broke up. And the warhead corkscrewed into the Earth's atmosphere, pulling, I don't remember now, but multiple Gs, and the PATRIOT couldn't keep up with it. So simply because it's a short-range missile and it's going in the atmosphere, it doesn't guarantee you that you can deal with this problem. That was my point about, if you worked that problem, you make the countermeasures a problem easier outside the Earth's atmosphere.

And now PAC–3, I believe, is an exo-atmospheric interceptor, is it not? It's hit the gill, I know, and it should have worked against the SCUD if it had been launched, but I don't know——

Mr. SHAYS. Let me ask you one last question, Dr. Cooper. Do you agree that it is easier to deal with the short range versus the intermediate or the long range?

Mr. COOPER. In principle, it is, yes. But I believe the technology is there to deal with all three. The countermeasures problem I believe is one you have to take into account. And I think it should be taken into account as a part of the design. To that degree, I'm inclined to side with Dr. Coyle. The reality is that, when you ask what is going on in the program today, you can't assume that you are starting with a clean sheet of paper.

General Obering, you know, inherited a program that was in a given direction.

Mr. SHAYS. I'll get you in the next—I mean, I'll pursue this in the next round.

Mr. TIERNEY. Thank you.

Dr. Cooper, how much would you advise Congress should spend over the next 20 years in missile defense?

Mr. CIRINCIONE. Sir, I haven't really considered that problem. I don't consider the amount of money that's being spent out of bounds. I might quibble with how it's being spent but not the amount. It is not inconsistent with the amount of money that we were spending on my watch when it was mostly—a lot of it was R&D in any case. If you take into account inflation, I think it was $4.5 billion is what I recall in 1991, 1992.

Mr. TIERNEY. Do you support the allocation of national security resources, money primarily, according to sort of what the threat likelihoods are? Do you think we ought to make an assessment of what the likelihood of the threats are and then decide how to spend our money on that?

Mr. COOPER. I do believe we should have threat-based design and development.

Mr. TIERNEY. Would you agree that the bigger threat to the United States at this point in time is actually some asymmetric threat, some terrorist sending something over in a container or on a ship or being offshore on a small boat and lobbying something in from there?

Mr. COOPER. As I indicated in my testimony, I am very worried about that. And that's how I spend most of my time these days, is worrying about nuclear smuggling out of the former Soviet Union.

That said, I think the other is a serious problem. And the problem is, you can't turn a switch. I mean the complaint that people have about the Missile Defense Agency in some sense and the programs is how long this is taking and how much money it's costing. And it's a difficult problem. And no one I think disputes that fact. But I believe we need to be working on it.

Mr. TIERNEY. I guess that's part of it, but the larger part of it is people are disputing the fact that we're buying before we're testing. I haven't heard anybody really come out and say, I don't want to spend the money on research and development. Maybe it's out there. But I hear some concern. But I think Mr. Coyle makes a point on that, that there's a lot of procurement going on. Maybe you'd like to expand on that, Dr. Coyle.

Mr. COYLE. For all other U.S. military systems, we don't go into so-called full-rate production or large quantities of production until the system is shown to be operationally effective. It's a good policy. It helps the Congress know when it's time, when a system is ready. I think the same policy ought to apply to missile defense procurements, but so far, it hasn't.

Mr. TIERNEY. Under that policy with respect to the intercontinental ballistic missile defense, the midcourse defense, what procurement is going on now would not be being made if we followed the policy?

Mr. COYLE. Well, we wouldn't be buying the hundreds of interceptors that are proposed to be bought. In my testimony, based on my research, I counted 635 new interceptors proposed to be bought between now and 2013. General Obering said it's going to be twice that, that the JROC has recommended something like 1,200 new interceptors to be bought in that period. I wouldn't go forward with that.

Mr. TIERNEY. Why not?

Mr. COYLE. Because those interceptors have yet to demonstrate their capability to deal with realistic threats under realistic operational conditions.

Mr. TIERNEY. And I think we talked about this a little bit at the last hearing. But what we're talking about demonstrating their capabilities. We're not talking about a one-off test where they hit it. I mean, each thing that you are testing, you probably need more than one successful test in order to get some level of comfortability that you have some confidence in the system. Is that correct?

Mr. COYLE. Yes. But I don't think it's affordable to do what they would call statistically based testing where you do, you know, hundreds. I don't think that's something that you would want to spend money on. But you find out in realistic operational tests very quickly whether or not you've got a problem. If the first two or three that you do under these new conditions don't work, you don't have to do hundreds of tests to get statistical confidence about that. If the first two or three don't work, you know you've got a problem.

Mr. TIERNEY. Did you hear anything in this morning's testimony that would change your mind about the statement you made in earlier testimony that it could take another 50 years before the operational realistic testing of this program is done?

Mr. COYLE. No, I didn't. And in fact, I read the responses that the Missile Defense Agency wrote to my comment about that. And they didn't refute it. They just talked about something else.

Mr. TIERNEY. OK.

Mr. CIRINCIONE. Mr. Chair, could I just add something to the test issue?

Mr. TIERNEY. Sure.

Mr. CIRINCIONE. You have to remember that we're testing these or demonstrating these very differently than we had any, even antimissile systems of the past. The first time we deployed an antiballistic missile defense system, the Sprint Safeguard System in North Dakota, we had 111 tests of those interceptors before we deployed them, and these were real tests, shooting them. And we found some problems, and we corrected them. And by the time we fielded that system, at least they were technologically capable. We're not coming close to that level of testing with this system. As I recommended last time, I don't believe we should be deploying anything until we have a realistic test to see if we can intercept a missile that is deploying decoys that look the same as the warhead. And if we can't do that, I just don't see the point of deploying a system. You have my chart up there on the screen, what I did after our last testimony was do year-by-year calculations with my staff. And we found out that over the last—well, I guess 15 years there, we've got a steady decline in the number of long-range and intermediate-range and medium-range ballistic missiles being deployed, but we're spending three times the amount on antimissile programs than we were during any period of the cold war. So, in other words, we used to spend about $4 billion a year. Now we're up to somewhere around $12 billion if everything's included. Even accounting for inflation, it's still twice as much. It just doesn't make sense.

Mr. TIERNEY. So we're spending more on that than we are on the short range and medium range?

Mr. CIRINCIONE. This is our total missile budget now. So we're spending more now on antimissile defense than we were during any year of the cold war, not just—you know by a double or three times the amount during any period of the cold war, even while the threat has drastically been reduced.

Mr. TIERNEY. Doctor, go ahead.

Mr. COOPER. I'm pleased to take credit for some of that shrinkage. I spent 5 years in Geneva in talks in the Soviet Union. And that's the reason you are seeing the decay in long-range missiles. That doesn't give me a great deal of comfort if I'm worried about North Korea and Iran. And let me say, I haven't forgotten about Russia and China either.

Mr. TIERNEY. Except we're not targeting the MDA program against them.

Mr. COOPER. Well, I understand that. But that doesn't give me a lot of confidence.

Mr. TIERNEY. I understand that.

Mr. COOPER. I'm concerned still about the accidental and unauthorized launch that I designed the system against 10 years ago. So, and I was thinking about Russian and Chinese missiles then.

So I am for more effective capability than we're designing today in part for that reason.

Mr. TIERNEY. OK. Thank you.

Ms. McCollum, do you have any other questions?

Ms. MCCOLLUM. Thank you, Mr. Chairman.

Last week in the Senate Defense Appropriations Subcommittee, General Obering said, "quite frankly, I'd like to see a missile race."

Mr. COOPER. I'm sorry?

Ms. MCCOLLUM. General Obering in the Senate Defense Appropriations Subcommittee last week, there was discussion about a missile race between the United States and an adversary such as North Korea or Iran. And he said, "frankly, I'd like to see such a missile race." I would like to know from you gentlemen if you think that would be a good thing. And that's kind of a—that's one question, but I do want to just go back and talk about some of the other things he said today in his testimony that I think goes with that.

He said, without a program such as the missile defense program, the United States weakens its negotiation position in diplomatic talks if we don't have a program going. But there's a difference between a program and encouraging or being supportive of a full-blown escalation. So I'd be interested in hearing what you gentlemen would have to say about that. And he also went on to say that if we stop funding our program, our enemies will know our vulnerabilities, and they will attack us using ICBMs. So I'd like to get your perspectives kind of on some of the General's comments. And I think, you know, to take his logic a step farther, and this is me taking it a step farther, we're currently spending $100 billion each year, and we don't have a functioning long-range system. And the General, you know, said everything was on track on time, which I think we can all agree, in my opinion, it's not. So if we can spend $10 billion and maybe thwart our enemies, then what's to stop us from just saying, OK, we'll spend $50 billion or we'll spend $500 billion? That will even make us stronger against our enemies. So I'd like your reaction on some of the things that he said today, and if you're concerned about an escalation with a missile race.

Mr. CIRINCIONE. Let me start. I think General Obering's statement was the equivalent of "bring it on." You might understand why someone would make a statement like that, "I'd like to see a missile race." But I can't believe that in hindsight he doesn't regret those remarks. It's certainly not in the U.S. national security interest to see a missile race even between two countries, let alone the many countries that might join such a race. Two, that having an antimissile capability strengthens our negotiating leverage, that might be true. I don't see any evidence that it has factored into North Korean or Iranian thinking though. So I don't know how one could prove that statement. The North Koreans have had two failed tests of a medium- or intermediate-range missile, the Taepodong series, and they have stimulated with those two tests millions of dollars in U.S. expenditures. It might be that they think that they have the advantage here, that they are distracting us, but by their demonstration shots.

The missile facility itself, even if we did continue the deployment of the Alaska system, this system is very, very vulnerable to asymmetrical responses. It's highly unlikely that a country like North

Korea would simply shoot its missile off and wait to see if the United States could intercept it. They would do what any military force does in battle. You would suppress the enemy's defenses before you launch your attack. You would go out and knock out the eyes and ears of that system. You might send frogmen to blow up the radar or sink the floating radar. There are a half of dozen things one could think of that North Korea would do that have nothing to do with missiles or interceptors that might make this system completely ineffective before they were actually to launch it.

No. 3 and finally, if the President is allowed to do what he wants to do and negotiate a deal with North Korea, I think we're going to see the North Korean missile threat disappear, the same way Ambassador Cooper helped negotiate a reduction in the Soviet missile and then Russian missile threat. I was just at a briefing last night by Sig Hecker, the former Director of Los Alamos, who came back from his fifth trip to North Korea, fairly optimistic about our possibilities of containing and eliminating both the nuclear program and the missile program. If we were able to do that, and we will know in another year or so, I don't see the point of what the Alaska deployment is. I would think, at that point, the Congress would be faced with the decision of whether they shut it down or not, and I would recommend shutting it down.

Mr. COOPER. I'd like to, I think, speak for—or in support of General Obering's comments about the importance of having a serious missile defense program going and influencing the behavior of maybe North Korea and Iran. If we have a serious program that can frustrate or deal with what they're building, I mean, it's correct to say that it's a big deal to build long-range ballistic missiles. I mean, that's a point that no one is going to dispute. On the other hand, it only took us 4½ years to do that the first time out you know 40 years ago. So you don't have a lot of time if you wait until the threat appears to build a defense. And that's no mean feat either.

Working hard on missile defenses, the SDI program I believe is the reason for that reduction up there in the 1980's. I don't think there's much doubt of that. I saw it firsthand across the table from the Russians at the time. That's what got their attention. That's what got them to the negotiations. That's what kept them serious throughout. That's why Reagan walking out of Reykjavik was a turning point. Akhromeyev, who led the Soviet military, said as much to Vernon Walters at the time. So the fact that the United States was serious in trying to work this problem, very difficult problem that we all agree was there, I think was instrumental in supporting our arms control agenda and worth every penny of the SDI investment. And I believe the same thing would be true today if it were successful in supporting whatever it is you want to say, negotiations with North Korea and Iran to hold things back, to short-range missile, short and medium-range missiles. I don't think you can imagine though that success. I think you have to have a real program. I think it has to be directed toward real capability. And it has to show progress. And I do agree that it has to involve realistic testing to deter them in doing that. But you don't get it on the cheap. I don't believe you get it on the cheap.

Mr. TIERNEY. Thank you, sir.

Mr. Shays, you're recognized.

Mr. SHAYS. Thank you. I'd like all three of you to respond to what Richard Garwin, a Democratic witness—excuse me—a witness that was opposed to the program and spoke of his fear of missiles launched from ships close to the shore. Is that a fear? And is there an antidote to it?

Mr. COOPER. I'll start. Since I put that in my testimony, I'll go first.

Mr. SHAYS. Since you what? I'm sorry.

Mr. COOPER. I put it in my testimony. I do believe that is a serious problem. And it has been recognized to be a problem for a long time. Don Rumsfeld and his commission in 1998 pointed it out. It's a little astounding to me that during his full tour and watch nothing was done about it. I believe that—well, General Obering pointed out that we've launched missiles off of ships. Actually, we first did that in the 1960's as I recall. And I believe that Paul Wolfowitz testified that the Iranians had done that. So the idea that you can launch a missile off of a vessel is not novel.

Mr. SHAYS. So, but it would strike me that—what I'm struck by, the fact—if that's the case, it makes any missile defense system seem to me even less beneficial because they pretty much get within the range of avoiding a missile defense system. So if you made that case, you are really saying—so there's two ways now that I'm thinking you can get through the system. One is with decoys, long range. And second, just bringing the ship in. That's, you know, that's in coming underneath. How would you respond to that?

Mr. COOPER. I believe there is a defense against the threat of short-range missiles. In fact, it's the same defense that we use, in fact, against SCUDs. And the sea-based, the Aegis, has already demonstrated——

Mr. SHAYS. What we would have to do in that case is we'd have to set up something off my property on Long Island Shore—I mean, on Long Island, CT. I mean, that seems unrealistic. We wouldn't know where to position those missiles.

Mr. COOPER. We have ships that are regularly, not on patrol but they're stationed in ports along both of our coasts. We have some 84 Aegis ships.

Mr. SHAYS. But we wouldn't have the time notice to——

Mr. COOPER. But they're there. My point to you is they're down at Norfolk right now, and their ships are around if they have the rounds onboard that can shoot down relatively short-range missiles, and they can. They've demonstrated that. They have a success record of whatever it is, 12 or 14——

Mr. SHAYS. I don't want to spend too much of my time on this. But I think you would agree that, you know, if you know that you have a threat and you preposition, but I can't imagine us prepositioning all along the coast of the Atlantic, the Caribbean, and the Pacific. I just can't, I can't envision——

Mr. COOPER. I've looked at the footprints of this problem, and a couple of ships is what you need. And if they're moving periodically, as they do—I'm not suggesting we establish picket ships along the coastline. That would drive my Navy friends crazy.

Mr. SHAYS. Let me hear from our other two witnesses.

Mr. COYLE. Mr. Shays, Iraq actually demonstrated the capability that you're describing in Operation Iraqi Freedom, the beginning part of Operation Iraqi Freedom when they fired cruise missiles, low-flying cruise missiles that were developed for flying across the ocean, but the desert is pretty flat. And so they work just as well in the desert as they did in the ocean. Did they fire them from ships? No. They fired them from land, and our PATRIOT system did not intercept them. It's not designed to intercept them and doesn't have that capability. So Iraq demonstrated a good part of the threat that you are describing there. The only thing they didn't demonstrate was doing it from a boat. Now, hopefully, the Coast Guard would intercept that boat or somebody else would intercept it. But I think it's a genuine concern.

Mr. CIRINCIONE. Just very quickly, this is a very real problem. I think there's broad agreement on this. And it's not just SCUDs fired from tankers. It's cruise missiles fired, which would underfly most antimissile systems, even if one could figure out an operational footprint.

We had a system called the Matador in the late-1950's early 1960's that fired from a submarine. It was a really cool cruise missile. You can see it out at the Air and Space Museum out at Dulles. So if we could do it then, it's certainly within the range of many countries' capabilities now. I don't know how you defend against something like that.

Mr. COOPER. One of the reasons I keep coming back to Aegis is the point of Aegis ballistic missile defense is to modify an air defense system that is deployed around the world. It can defend against cruise missiles and ballistic missiles. That's its forte.

Mr. SHAYS. Let me just say that I just remember when Iraq went into Kuwait, some of the weapons systems we had, I was reminded by someone in Congress who said the systems that worked were developed 10 and 20 years ago. The systems you are voting on now, Congressman—he was saying this to me as a new Congressman—will have impact to some Congress 10 years and our military and our country 10 or 20 years later.

So I do believe that we need to keep moving on this effort. But I sure as heck want to make sure we don't deploy until we know it works. And I am comforted to know that, on a short-range basis, if we can anticipate an attack, it is an important element. And I think all three of you agree that we could have some success there.

Mr. CIRINCIONE. I think we can. I think we must. And I think that makes it all the more urgent that these short-term systems get the focus of the funding and the testing.

Mr. TIERNEY. Thank you. I think those kind of questions, Mr. Shays, do help us to at least focus on what we need to focus and redirect the resources in some sense, which is, I guess, the underlying focus of these hearings to a large extent is that we don't have unlimited resources, and we do have some measure of risks and threats are more prevalent than others. And I'm not sure that we're doing a great job in the Department of Defense so far in aligning the resources that we have with the more prominent risks and accelerate them to the point that we should.

I am just about done here. I don't know, Mr. Shays, if you have any other questions. There are a million more questions we could

ask, and we could keep people here all day. I know Mr. Coyle has homework that he has taken on voluntarily.

If either of you gentlemen wish to submit anything, we will certainly be more than happy to receive it and read it. There may be some that you want to respond to.

Dr. Cooper, before we leave, you have had less time in front of us than the other two have. Is there anything else that you would like to add or contribute?

Mr. COOPER. I appreciate the opportunity to be here. And I'm happy to be responsive in any way you wish as a follow on.

Mr. TIERNEY. Thank you, sir, for that.

Mr. Coyle, anything you would like to add?

Mr. COYLE. No, thank you, Mr. Chairman.

Mr. TIERNEY. Thank you.

Mr. Cirincione.

Mr. CIRINCIONE. It's a pleasure to be back in front of my old committee. Godspeed.

Mr. TIERNEY. Thank you all very much.

Thank you, Mr. Shays.

[Whereupon, at 1:33 p.m., the subcommittee was adjourned.]

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