



July 17, 2014

Congressional Committees

Missile Defense: DOD's Report Provides Limited Insight on Improvements to Homeland Missile Defense and Acquisition Plans

The Missile Defense Agency (MDA) is developing the Ground-based Midcourse Defense System (GMD) to defend the United States against an intermediate and intercontinental ballistic missile attack.¹ As part of this system, the Department of Defense (DOD) has already deployed 30 ground-based interceptors—consisting of a booster with a kill vehicle on top—and a fire control system that uses information from sensors to formulate a battle plan. According to DOD, GMD is able to protect the United States from a limited ballistic missile attack from North Korea and Iran. However, in March 2014, a senior DOD official testified that due to test failures and the current ballistic missile threats, one of the highest priorities for the protection of the United States is to improve the reliability and effectiveness of the GMD ground-based interceptor. According to the DOD *Guide for Achieving Reliability, Availability, and Maintainability*, reliability is an essential element of mission capability and is defined as the probability that an item will perform a necessary function when required. Between December 2010 and July 2013, the program experienced three consecutive test failures: one failure with GMD's original interceptor configuration called the Capability Enhancement I (CE-I) and two failures with the upgraded version called the Capability Enhancement II (CE-II).² These test failures along with other delays and concurrent acquisition activities have raised questions about the reliability of the GMD system.³

The National Defense Authorization Act for Fiscal Year 2013, signed into law on January 2, 2013, mandated that the Secretary of Defense submit to the congressional defense committees a report on the status of efforts to improve the homeland ballistic missile defense capability of the United States that was required to include, among other things, a description of the results of two planned flight tests.⁴ While DOD was required to provide the report to the congressional defense committees no later than July 2, 2013, it did not submit that report until February 7, 2014. Additionally, GAO was required to brief the congressional defense committees on our views of DOD's report and submit a report as soon as practicable.⁵ We offered briefings to all the congressional defense committees and briefed the Senate and House Armed Services

¹ Intermediate-range ballistic missiles have a range from 1,864 to 3,418 miles and intercontinental ballistic missiles have a range greater than 3,418 miles.

² While a draft of this report was at DOD for comment, MDA conducted Flight Test GMD-06b (FTG-06b) on June 22, 2014. Initial results indicate that the CE-II EKV intercepted the target however the test analysis is ongoing.

³ Concurrency is broadly defined as the overlap between technology development and product development or between product development and production.

⁴ Pub. L. No. 112-239, § 228(b). The congressional defense committees are the Committee on Armed Services and the Committee on Appropriations of the Senate and the Committee on Armed Services and the Committee on Appropriations of the House of Representatives. 10 U.S.C. § 101(a) (16).

⁵ Pub. L. No. 112-239, § 228(c).

Committees in April 2014. We assessed: (1) the extent to which DOD's report addressed actions taken or planned to improve the reliability of the GMD system; and (2) the extent to which DOD's report described the results of two flight tests required to restart interceptor production by demonstrating the successful correction to the problem that caused the December 2010 flight test failure.

To determine the extent to which the DOD report identified actions taken or plans to improve GMD, we assessed the actions and plans described in DOD's report and compared them to GMD development efforts. We also examined past DOD reports to Congress on various Ballistic Missile Defense efforts and GMD program execution reports to identify program actions and plans. Additionally, we assessed available program plans such as their Stockpile Reliability Program Plan. We also reviewed missile defense program assessments conducted by the U.S. Strategic Command. To determine the extent to which DOD's report described the flight test results, we reviewed the report for test plans and results and then compared it to assessments in recent GAO reports, other DOD reports, and GMD program management documents. We conducted interviews with DOD officials and contractors to corroborate information found in program documentation including officials in the MDA, DOD testing agencies, the Office of the Under Secretary of Defense for Policy, U.S. Northern Command, U.S. Strategic Command, Boeing, Raytheon, and the Orbital Sciences Corporation.

We conducted this performance audit from March 2013 through July 2014 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our objectives.

DOD's Report Described Actions Taken and Plans but Not their Effect, If Any, or Risks

On February 7, 2014, DOD submitted to Congress a report titled *Status of Efforts to Improve the Homeland Ballistic Missile Defense Capability of the United States*. On the basis of our analysis of DOD's report, we found that it described actions to improve homeland missile defense and was generally responsive to the mandate, but it did not detail the effect of these actions, if any, on the GMD system. Without an understanding of the effectiveness of these actions and plans, Congress may not have the information it needs when making difficult choices on where to spend limited funds. For example, the report stated that MDA has upgraded the software of the entire fleet of CE-I and CE-II interceptors to improve their operational performance, but it did not describe the effectiveness of these improvements or whether these improvements have been confirmed to work as intended in flight tests. Specific details on the GMD program, such as improvements made as a result of software upgrades, are classified. DOD could have provided such information in a classified annex, which was specifically allowed by the mandate language, but it chose not to do so. A DOD policy official stated that the unclassified report met the intent of the mandate without the classified annex. In our view, a classified annex with a detailed description of the effect of the actions taken would have provided a more comprehensive picture of the accomplishments achieved to date, if any, and the benefits of those improvements to homeland defense.

The report also described MDA's plans to improve GMD reliability, but again without significant details. For example, the report mentions that MDA is developing an improved methodology to estimate the interceptors' reliability, the effect of which could provide more confidence in the estimates. However, it does not mention how the new methodology will be implemented, or that MDA has changed its methodology several times since 2008. According to DOD, these changes

could ultimately improve DOD's ability to assess reliability, but in the near term frequent changes to the methodology have made it difficult to compare reliability estimates to see if any progress occurred. Until GMD has fully implemented this methodology and gathered data to assess its effectiveness, it is unclear whether the changes are an improvement.

Moreover, several of MDA's reported reliability improvement plans are not yet final and therefore we could not assess their effect on program activities or their potential for improving GMD. According to MDA officials, they were not certain when the plans would be finalized. For example, DOD's report stated the following:

- MDA is developing an acquisition strategy for an interceptor with new components to bolster defenses against missile threats to the United States. According to GMD officials, the acquisition strategy has not been finalized and they do not have an expected completion date. However, these interceptors are expected to be delivered in fiscal year 2018.
- MDA is conducting trade studies to determine the most cost-effective approach for upgrading existing sensors and adding new types of sensors. The report does not provide an expected time frame for completion of this effort.
- MDA's reliability testing programs include an ongoing effort to identify components that require development, procurement, testing, and replacement to improve interceptor reliability.

Although the report described MDA's reliability testing programs, which are intended to identify potential interceptor component changes that could improve the interceptor's reliability, it did not describe the expected effects of these testing programs. In addition, the report did not note that these programs have existed for several years, but their progress has been hindered by flight test failures, which in turn have prolonged the time it will take to gain a full understanding of GMD capabilities and limitations.⁶ According to GMD program officials, they also delayed component testing to determine estimated service life, in part due to MDA's redirection of resources from reliability testing to flight test failure investigations and mitigations.

Additionally, the report discusses CE-I retrofits but did not explain that the completed retrofits do not fix all known issues and that the effect of these fixes has not been demonstrated through flight testing, as we have previously reported.⁷ Nor did it explain the connection between the July 2013 flight test failure—which was intended to demonstrate some of those fixes—and delayed understanding of retrofit performance.

The need for these retrofits arose in part due to the concurrent activities GMD used to develop, produce, and field the CE-I. In 2012, we reported that the GMD program concurrently matured technology, designed the system, tested the design, and produced and fielded a system, resulting in developmental challenges. The CE-I interceptors were fielded before flight testing confirmed the design was reliable. Design problems uncovered during testing led to design changes and the ongoing retrofit program to improve the reliability of delivered CE-I

⁶ In 2013, we reported that CE-I upgrades were deferred through 2017. See GAO, *Missile Defense: Opportunity to Refocus on Strengthening Acquisition Management*, [GAO-13-432](#) (Washington, D.C.: Apr. 26, 2013).

⁷ See GAO, *Missile Defense: Mixed Progress in Achieving Acquisition Goals and Improving Accountability*, [GAO-14-351](#) (Washington, D.C.: Apr. 1, 2014). Additionally, see GAO, *Missile Defense: Opportunity Exists to Strengthen Acquisitions by Reducing Concurrency*, [GAO-12-486](#) (Washington, D.C.: Apr. 20, 2012).

interceptors. As a result, confidence in the interceptors' current reliability continues to be affected by past GMD concurrent production, fielding, and testing.

Acquisition Strategy for New Interceptors Overlaps Manufacturing and Testing Leading to Increased Acquisition Risk

The DOD report also described plans to develop and deliver 11 interceptors with the same design as the initial CE-II exoatmospheric kill vehicle (EKV), but with changes to certain components to address its reliability.⁸ MDA has given this interceptor configuration its own name, the CE-II Block I. We assessed these acquisition plans and determined that they include concurrent manufacturing and testing, which puts DOD at high risk for cost growth, schedule delays, and performance shortfalls if it discovers issues after manufacture of interceptors begins.⁹ Specifically, we found the following:

1. In the near term, MDA is planning to confirm the performance of new components for the CE-II Block I in a third quarter fiscal year 2016 flight test—the same year the program plans to deliver interceptors with these new components for operational use. However, because production must begin at least 2 years before delivery, the program must begin manufacturing before that developmental flight test in order to deliver the interceptors for operational use beginning in the fourth quarter of fiscal year 2016. This developmental flight test determines if the new EKV and booster components work as intended and, according to acquisition best practices, should be conducted before production for operational use. As we previously found, GMD intercept tests conducted to date have already led to major hardware or software changes to the interceptor. In April 2014, we found that the discovery of design issues has increased the cost to demonstrate as well as fix the already produced CE-IIs from \$236 million to \$1.309 billion.¹⁰ Consequently, in our view this approach is high risk because any issues discovered through the 2016 test could disrupt ongoing manufacturing and require costly post-manufacture retrofits.
2. In the long term, MDA plans to reach an operational fleet of 44 interceptors by 2017 and to deliver a robust defense capability in 2019, 3 years before GMD developmental testing would be complete. To realize these plans, many concurrent efforts must be completed including successful testing, restarting CE-II production, and developing and acquiring interceptors with new components. In addition, MDA's developmental test plan for GMD calls for increasing the complexity of the flight testing in order to explore new areas of performance. In our view, this approach is high risk because any issues discovered in these increasingly complex developmental tests after 2017 could significantly affect the fleet and the delivery of additional system capabilities scheduled in fiscal year 2019.

In our view, if MDA continues its past practice of concurrent manufacturing and testing, it risks repeating the performance shortfalls, delays, and cost increases it has experienced with the deployed interceptor fleet. We have previously made recommendations to the Secretary of Defense to reduce concurrency and strengthen MDA's near- and long-term acquisitions. For example, in March 2009, we recommended that MDA synchronize the development, manufacturing, and fielding schedules of Ballistic Missile Defense System assets with the

⁸ This is a similar approach to the one MDA took to initially replace obsolete components on the CE-I EKV resulting in the CE-II EKV.

⁹ The mandate did not require the DOD report to discuss concurrent activities.

¹⁰ See GAO, *Missile Defense: DOD's Report Provides Limited Insight on Testing Options for the Ground-based Midcourse Defense System*, [GAO-14-350R](#) (Washington, D.C.: Apr. 30, 2014).

testing and validation schedules to ensure that items are not manufactured for fielding before their performance has been validated through testing.¹¹ While DOD partially concurred with this recommendation, we concluded that it has not yet been fully implemented.

DOD's Report Is Limited Because It did not Explain That a Key Flight Test was Delayed or Provide the Reasons for that Delay

DOD did not explain in its report that a key flight test had been delayed nor did it provide the reasons for that delay. DOD was required to describe in its report the test results of two flight tests intended to demonstrate the successful correction to the problem that caused a prior flight test failure. In December 2010, a CE-II intercept test failed due to a fault in the EKV's guidance system. In response, MDA halted deliveries of new CE-II interceptors, identified the cause of the failure, and, over several years, worked to redesign the guidance system component that caused it. MDA planned two CE-II flight tests with the redesigned component—a non-intercept, diagnostic flight test called Controlled Test Vehicle (CTV)-01 and an intercept flight test called Flight Test GMD (FTG)-06b—to show it had resolved the cause of the December 2010 failure and to allow interceptor deliveries to resume.

DOD's report described test results for CTV-01 but only described plans for FTG-06b because MDA had not conducted that test.¹² DOD's report said that in January 2013, CTV-01 was successfully completed and that the test had gathered critical flight test data to verify the redesigned component. DOD's report also briefly described plans for FTG-06b and stated the test was scheduled for the second or third quarter of fiscal year 2014.

DOD's report was of limited use to congressional decision makers because it did not explain that FTG-06b had been delayed, nor did it discuss the reasons for the test delay. MDA previously planned to conduct FTG-06b in the third quarter of fiscal year 2012 but we found in April 2014 that MDA has experienced at least 2 years of delays in conducting FTG-06b because resolving the 2010 test failure has proven more difficult than initially expected.¹³ For example, although MDA successfully achieved all test objectives for CTV-01, we found that subsequent ground testing revealed further corrections to the redesigned component were needed. We also found that the program experienced further delays in this test while it implemented changes based on assessments from an ongoing failure review of a July 2013 flight test. In our view, this context would have been beneficial for Congress for oversight of this critical program.

Agency Comments

We provided a draft of this report to DOD for review and comment. Although DOD provided technical comments for our report and we incorporated them as appropriate, DOD did not provide written comments to include in this report.

¹¹ See GAO, *Defense Acquisitions: Production and Fielding of Missile Defense Components Continue with Less Testing and Validation Than Planned*, [GAO-09-338](#) (Washington, D.C.: Mar. 13, 2009).

¹² While this report was at DOD for comment, MDA conducted FTG-06b on June 22, 2014. To conduct the test, MDA launched a CE-II interceptor from Vandenberg Air Force Base, California. Initial test reports indicate that the CE-II interceptor intercepted the target, however, MDA is still analyzing the test data.

¹³ See [GAO-14-351](#).

We are sending copies of this report to the appropriate congressional committees and to the Secretary of Defense. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-4841 or chaplainc@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are: David Best, Assistant Director; Desirée Cunningham; Steven Stern; Robert Swierczek; Jay Tallon, Brian Tittle; Hai V. Tran; and Alyssa Weir.

A handwritten signature in black ink, appearing to read 'Cristina Chaplain', with a long horizontal line extending from the end of the signature.

Cristina Chaplain, Director
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