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The Honorable Robert Wittman
Chairman
The Honorable Madeleine Z. Bordallo
Ranking Member
Subcommittee on Readiness
Committee on Armed Services
House of Representatives

The Honorable J. Randy Forbes
House of Representatives

Subject: Homeland Defense: DOD's Aerospace Control Alert Basing Decision Was Informed by Various Analyses

Since the September 11, 2001, terrorist attacks, the federal government has undertaken extensive efforts to protect U.S. airspace. As a part of the federal government's overall efforts to protect U.S. airspace, the Department of Defense (DOD) performs Operation Noble Eagle, which consists of several missions, including aerospace control alert (ACA).¹ The ACA mission includes aerospace control forces arrayed in a rapid response posture to conduct both air sovereignty and air defense operations against airborne threats.² Among other things, this includes fighter aircraft and trained personnel on alert 24-hours a day, 365 days a year, at 16 alert basing locations across the contiguous United States and one each in Alaska and Hawaii to deter, respond to, and if necessary defeat airborne threats over the United States and Canada. These fighter aircraft and trained personnel can be the last line of multiple layers of the air defense of the United States.

Our prior work has highlighted improvements and challenges in the planning and management of the ACA operation, including challenges related to the North American Aerospace Defense Command's (NORAD) and DOD's ability to balance risks, costs, and benefits when making decisions about the ACA operation. Specifically, in January 2009 we

¹DOD formerly referred to the ACA operation as "air sovereignty alert (ASA)."

²Air sovereignty refers to a nation's inherent right to exercise absolute control and authority over the airspace above its territory. Air defense refers to defensive measures designed to destroy attacking enemy aircraft or missiles in the atmosphere, or to nullify or reduce the effectiveness of such attack. See Joint Chiefs of Staff, Joint Pub. 1-02, *Department of Defense Dictionary of Military and Associated Terms* (Nov. 8, 2010; as amended through Nov. 15, 2012).

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reported on shortcomings in DOD's management approach to the ACA operation.³ Among other things, we reported that NORAD faced difficulty determining the appropriate levels and types of units, personnel, and aircraft for the ACA operation. We made five recommendations to DOD to improve management of the ACA operation, including conducting routine risk assessments as part of a risk-based management approach. DOD fully or partially agreed with all our recommendations. In January 2012, we reported that the Air Force had taken steps to implement one recommendation and partially implement the other four recommendations.⁴ We also reported on strengths and limitations of the computer model NORAD used for assessing domestic air defense operations, and we reported that NORAD had not considered cost in its analysis of the ACA basing strategy. NORAD and DOD had taken some action to improve their risk-based management approach; however, we made seven additional recommendations in January 2012 for NORAD and DOD to implement a more complete risk-based management approach that balances risk and cost for the ACA operation. DOD agreed with one recommendation, partially agreed with the other six, and highlighted actions it would take to implement the intent of the recommendations.

In 2012, based on the desire to find savings in the ACA operation that did not impede operational effectiveness, DOD determined that two ACA basing locations could be taken off 24-hour alert. The two locations are Duluth, Minnesota and Langley, Virginia.

You asked us to review DOD's analyses regarding its decision to change the alert status for those two ACA locations. This report assesses (1) the analyses NORAD and DOD conducted in support of the decision to change the alert status at two NORAD ACA basing locations, and (2) the extent to which DOD estimated costs or cost savings resulting from its decision.

Scope and Methodology

To assess NORAD's and DOD's analyses used in their decision to change the alert status at two NORAD ACA basing locations, we reviewed and analyzed applicable documentation and interviewed relevant officials at NORAD, the Office of the Assistant Secretary of Homeland Defense and Americas' Security Affairs, the Office of the Secretary of Defense Office of Cost Assessment and Program Evaluation (CAPE), the U.S. Air Force, the National Guard Bureau, and the Air National Guard. We also reviewed prior GAO reports that recommended NORAD and DOD use a risk-based management approach to the ACA operation.⁵ Drawing from our previous assessments to understand NORAD's ACA model, we interviewed NORAD officials who were familiar with the model to update our understanding of the model's current assumptions and structure and reviewed its results under various scenarios. We reviewed changes or improvements to the model and risk assessment and compared NORAD's and DOD's risk assessment methodologies to GAO and federal government best practices and DOD criteria for risk-based management, all of

³GAO, *Homeland Defense: Actions Needed to Improve Management of Air Sovereignty Alert Operations to Protect U.S. Airspace*, [GAO-09-184](#) (Washington, D.C.: Jan. 27, 2009).

⁴GAO, *Homeland Defense: Continued Actions Needed to Improve Management of Air Sovereignty Alert Operations*, [GAO-12-311](#) (Washington, D.C.: Jan. 31, 2012).

⁵[GAO-09-184](#) and [GAO-12-311](#).

which remain relevant and are described in our previous reports.⁶ In addition, we assessed the assumptions and structure of another computer simulation model created by CAPE to assess the risk of various ACA basing strategies. We observed a demonstration of the model using multiple assumptions, reviewed its results under the various assumptions, and interviewed the CAPE official who developed it. This allowed us to understand how CAPE's model assessed risk in its analyses of ACA basing locations. On the basis of our understanding of both computer models, the results of NORAD's and DOD's analyses, and discussions with relevant officials, we assessed the reasonableness and reliability of the analyses that NORAD and DOD performed to change the alert status at two ACA basing locations.

To assess the extent to which DOD estimated the costs or cost savings as part of its decision to reduce two ACA basing locations from 24-hour alert status, we reviewed documents such as the Air Force's budget exhibit and cost-savings estimate and interviewed NORAD, the Air Force, and other DOD officials. To assess the Air Force's cost-savings estimate, we used key principles we derived from cost estimating, budgeting, and related guidance.⁷ We reviewed the Air Force's estimate and discussed with Air Force officials the detailed documentation; significant cost assumptions and other key assumptions; reliability of the data; and the accuracy, Air Force review of, and Air Force validation of its cost-saving estimate.

We conducted this performance audit from August 2012 through February 2013 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit and 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 audit objectives.

Results in Brief

DOD's decision to change the alert status at two ACA basing locations was informed by various analyses, which assessed the impact on operational effectiveness to the ACA operation. DOD's analyses were based on a NORAD assessment—which included a computer model—a CAPE computer model, and an analysis by NORAD's Continental U.S. NORAD Region. NORAD's analyses, informed by a model developed in response to a recommendation in our 2009 report and bolstered by additional NORAD analysis, identified two basing locations that could be removed from 24-hour alert status with little impact on ACA capabilities overall. In our January 2012 report, we noted limitations to NORAD's

⁶[GAO-09-184](#) and [GAO-12-311](#).

⁷We reviewed federal guidance documents related to cost estimating, accounting standards, economic analysis, and budgeting and identified broad themes that we believe can be applied to evaluating cost analyses and estimates, including those of cost savings. The guidance documents we reviewed include: *GAO Cost Estimating and Assessment Guide*, [GAO-09-3SP](#); Office of Management and Budget Circular No. A-11, Preparation, Submission and Execution of the Budget (Aug. 2011, superseded by an August 2012 issuance); Federal Accounting Standards Advisory Board, Statement of Federal Financial Accounting Standards 4 (June 2011); Department of Defense Instruction 7041.3, *Economic Analysis for Decisionmaking* (Nov. 7, 1995); and Department of Defense Financial Management Regulation 7000.14-R, Volume 4, Chapter 22, Cost Funding (May 2010). Although each of these documents may not apply to these circumstances as a legal matter, we believe that these documents collectively contain broad themes that can be applied to evaluating cost analyses.

computer model. For example, we found that it did not include a prioritized list of metropolitan areas and critical infrastructure locations that NORAD should protect and that it did not incorporate assumptions associated with all three elements of risk: threat, vulnerability, and consequence. Since our January 2012 report, NORAD has strengthened its risk-based management approach of the ACA operation by improving its risk analyses, including to change some of the assumptions used to address vulnerability and consequence in its model. With regard to the CAPE model, the CAPE office separately identified a point below which the number of ACA basing locations on 24-hour alert could not be further reduced without materially increasing risk. Both NORAD's and CAPE's analyses identified the Duluth, Minnesota and Langley, Virginia ACA locations as the best candidates to take off 24-hour alert status. In addition to these two models, the Continental U.S. NORAD Region convened a panel of subject matter experts to discuss and analyze the ACA basing strategy. These experts' analysis and conclusions were consistent with the results of the analysis using NORAD's model. The Deputy's Management Action Group—which includes DOD senior leaders who monitor DOD's efforts to improve its defense business operations—approved the decision to change the ACA alert status at the two basing locations.

The Air Force estimated cost savings from reducing the alert status at the two ACA basing locations of about \$73 million over fiscal years 2013 through 2017. In our January 2012 report, we noted that NORAD had not identified potential cost savings that could result from eliminating a given number of ACA basing locations on 24-hour alert. After DOD made the decision to remove the Duluth and Langley ACA basing locations from 24-hour alert, the Air Force calculated estimated cost savings. Air Force officials told us that the estimated cost savings are mostly from personnel who will no longer be required to fully maintain 24-hour alert status—by shifting from full-time to part-time status. We did not independently verify the Air Force's estimated cost savings. However, we discussed with Air Force officials their level of review and validation of the cost-savings estimate and determined that the Air Force's categories of savings were consistent with key principles of cost-savings estimates. GAO is not making recommendations in this report.

Background

As a component of Operation Noble Eagle,⁸ the ACA operation is conducted by several DOD components under the command of NORAD for the airspace over North America, which includes Alaska and the contiguous United States, and under the command of U.S. Pacific Command for the airspace over the state of Hawaii and U.S. territories in the Pacific. The Joint Chiefs of Staff have directed the Air Force (among other services) to provide support for the ACA operation. Generally, Air National Guard aircraft and personnel are used for alert, consistent with the Air National Guard's homeland defense mission. Both the Air Force's Air Combat Command and the National Guard Bureau believe that Air National Guard units can conduct alert duty with less effect on overseas missions and at a lower cost

⁸Operation Noble Eagle, which was initiated after the terrorist attacks of September 11, 2001, is DOD's umbrella homeland defense mission for North America and Hawaii. There are a variety of operations that could be conducted underneath this umbrella mission. For example, NORAD could conduct irregular air patrols above major metropolitan areas and critical infrastructure facilities (as opposed to more regular—and predictable—patrols) as well as maintain an alert force of fighter, tanker, and command & control aircraft. Aircraft and alert commitments are based on a tiered response system. As threat levels intensify, the number of aircraft on alert and on patrol increases.

than active-duty Air Force units.⁹ The units at all ACA locations (i.e., both Air National Guard and active-duty personnel) are dual-tasked to conduct expeditionary missions, such as Operation Enduring Freedom in Afghanistan, as well as the ACA operation.

The ACA operation consists of ground operations that take place before fighter aircraft take off, including such activities as maintaining the fighter aircraft. This operation also includes those activities that may take place after a unit receives an alert from NORAD but before the aircraft are airborne. For example, pilots and maintenance personnel may rush from their nearby lodging facility to the alert aircraft facility, where maintenance personnel conduct final preparations while the pilots sit in their aircraft awaiting further instruction (battle stations). Alternatively, pilots may taxi the aircraft to the end of the runway and await further instruction (runway alert) or take off in response to the alert (scramble). Once aircraft take off, Air National Guard pilots in Title 32 status under the command and control of the state governor, automatically convert to federal Title 10 status under the command and control of NORAD.¹⁰ Within limits, NORAD can increase personnel, aircraft, and the number of ACA basing locations on the basis of changes in the threat conditions.

In response to one of the recommendations in our 2009 report—to conduct routine risk assessments to determine ACA requirements, including the appropriate numbers of ACA basing locations, personnel, and aircraft to support the ACA operation—NORAD officials developed a quantitative computer simulation model to study basing locations that were part of the ACA operation.¹¹ NORAD's computer model provides DOD with data to assess risk of the ACA operation, which helps decision makers identify and evaluate potential risks associated with various allocations of resources. The model allows NORAD to analyze how changing the number and location of ACA basing locations would affect its ability to defend the homeland from commercial aviation attacks. The model uses real-world data on the opportunity for attacks from within the commercial aviation system and on NORAD's operational capabilities, along with assumptions about the randomness of these factors in practice, to generate numerous simulated Operation Noble Eagle-related events and assess NORAD's capability to defeat them.¹² By assessing ACA operational capabilities for various combinations of basing locations, the model helps NORAD quantify how risk would change if certain locations were removed from 24-hour alert status.

In 2010, NORAD used the model to analyze the pre-existing 16 ACA basing locations in the contiguous United States, in order to identify the potential operational performance and efficiencies of alternative ACA basing locations. According to NORAD officials, the results of

⁹The National Guard Bureau is a joint function within DOD that, among other things, participates with staff from the Department of the Army and the Department of the Air Force in the formulation, development, and coordination of all programs, policies, concepts, and plans pertaining to or affecting the National Guard, the Army National Guard of the United States, and the Air National Guard of the United States. The Air National Guard of the United States is a reserve component of the U.S. Air Force.

¹⁰According to Air National Guard Instruction 10-203: *Air National Guard (ANG) Alert Resource Management* (February 22, 2012), provisions will be made to ensure members automatically convert to Title 10, if a specific Title 10 trigger is included in higher headquarters guidance. Title 32 and Title 10 refer to sections of the United States Code.

¹¹Referred to in NORAD documents as the Operation Noble Eagle Fighter Basing Location Model.

¹²The algorithms that calculate different scenarios or events to determine probability of certain outcomes are referred to as Monte Carlo simulations.

this analysis led DOD officials to direct NORAD to determine which locations, if any, might be removed from 24-hour alert. In 2011, after DOD began to plan for the reduction of ACA basing locations on 24-hour alert, NORAD performed additional analyses, using both the NORAD model and a less complex calculation, to determine the specific ACA basing locations that could be taken off 24-hour alert. The analyses sought to identify the two locations where alert status could be reduced with the smallest impact on NORAD's ACA capabilities.

In our prior reports,¹³ we stated that, as part of an overall risk-based management framework, routine risk assessments—which the NORAD model and related analyses help to address—should contain three key elements: an analysis of threat, an estimation of vulnerability, and identification of consequences. In our 2012 report, we noted that NORAD's model was limited because it was designed to assess the ability of its aircraft to respond to a single type of threat regardless of its location in the United States and that it did not include a prioritized list of metropolitan areas and critical infrastructure NORAD should protect.

DOD's ACA Decision Was Informed by Various Analyses that Produced Similar Conclusions

DOD's decision to change the alert status at two ACA basing locations was informed by various analyses that assessed the impact on operational effectiveness to the ACA operation. These DOD analyses were based on a NORAD assessment—which included a computer model—a CAPE computer model, and a Continental U.S. NORAD Region¹⁴ assessment. We assessed the analytical and methodological basis for the NORAD and CAPE computer simulation models and found them to be reasonable based on our understanding of the structure, algorithms, and outputs of these models. Although the methodology used in the three analyses differed, they reached similar conclusions. Based on the analytical conclusions, the Deputy's Management Action Group—which includes DOD senior leaders who monitor DOD's efforts to improve its defense business operations—approved the decision to change the ACA alert status at the two basing locations.

DOD used the various analyses by NORAD, CAPE, and the Continental U.S. NORAD Region, which produced similar results, to inform its decision to reduce the alert status at Duluth, Minnesota and Langley, Virginia. NORAD's analysis used criteria, such as historical data on the number of actual responses by each ACA basing location, and was informed by NORAD's computer model. NORAD officials told us that its model's assumptions about threat had not changed since our last report and that the model could not be used to consider some types of airborne threats. Therefore, NORAD used additional calculations of such things as basic fighter response times to help inform its broader analysis. We found that NORAD improved its risk-based management approach of the ACA operation by improving its risk analyses, specifically by changing some of the assumptions used to address vulnerability and consequence. For example, NORAD officials stated that, although the list of metropolitan areas and critical infrastructure had not been updated since DOD

¹³[GAO-12-311](#) and [GAO-09-184](#).

¹⁴A component of NORAD, the Continental U.S. NORAD Region provides airspace surveillance and control and directs aerospace control activities for the contiguous United States.

developed it after the September 11, 2001, attacks, NORAD prioritized the assets to protect, and its model used those priorities in its current analyses of ACA basing locations. NORAD's analysis indicated that two basing locations could be removed from 24-hour alert status with little impact on ACA capabilities overall.

We found that DOD's CAPE office developed its own computer model that could analyze the basing locations of Operation Noble Eagle, specifically, the ACA operation. CAPE's model calculated population and infrastructure coverage for all combinations of ACA basing locations. The model used various assumptions about NORAD's operational capabilities—such as flight times and aircraft velocity—with a goal of optimizing the number and placement of the ACA basing locations that existed in the United States. In contrast to NORAD's model, CAPE's analyses made no assumptions about where threats would emerge and calculated NORAD's ACA capabilities at any geographic point. CAPE's results identified a point below which the number of ACA basing locations on 24-hour alert could not be further reduced without materially increasing risk. CAPE officials stated that their model could analyze numerous alternative ACA basing location scenarios more quickly than NORAD's model. Although CAPE's model was developed independently of NORAD, both CAPE and NORAD officials told us that they discussed the CAPE model's assumptions with one another to ensure their accuracy in such areas as realistic fighter scramble times and operational range.

In addition to its quantitative analysis, NORAD asked its Continental U.S. NORAD Region to conduct a separate analysis regarding the operational efficiencies and capabilities of the ACA operation. This analysis relied on Continental U.S. NORAD Region subject matter experts on strategy, planning, logistics, and tactics for the ACA operation, rather than a computer simulation model. According to these experts, they used criteria such as time, distance, major population areas, and proximity to international flight routes in measuring the overlapping coverage of select ACA basing locations, considering various terrorist threat scenarios. These experts' analysis and conclusion were consistent with the results of NORAD headquarters' analysis. NORAD officials told us that the results of the NORAD and Continental U.S. NORAD Region analyses were approved by the NORAD Commander and provided in a briefing to congressional staff.

Although the specific methods used in the various analyses of the ACA operation differed, we found that NORAD's and DOD's use of various analytical methods comprised a reasonable approach to evaluating changes in ACA basing locations. The NORAD model and response time analysis, the Continental U.S. NORAD Region analysis, and the CAPE's model used different methods to evaluate the ACA operation and the risk of various ACA basing options. For example, the model that contributed to NORAD's analysis uses real-world data on the opportunity for attacks from within the commercial aviation system and on NORAD's operational capabilities, along with assumptions about the randomness of these factors in practice, and it estimated how response times would change if various ACA basing locations were taken off 24-hour alert. NORAD used various criteria, including historical data on ACA basing location responses, to determine which ACA locations could be taken off 24-hour alert. The Continental U.S. NORAD Region convened a panel of subject matter experts to analyze the ACA operation. In contrast to NORAD's model, CAPE's model made no assumptions about where threats would emerge, and calculated NORAD's ACA capabilities to reach maximal populations at any geographic point. Each analysis concluded that taking the Duluth, Minnesota, and Langley, Virginia, ACA locations

off 24-hour alert status would result in the smallest impact on ACA capabilities and not materially increase risk.

The results of CAPE's independent model-driven analyses regarding the reduction of ACA basing locations on 24-hour alert was brought to the Deputy's Management Action Group, which includes DOD senior leaders, led by the Deputy Secretary of Defense, who monitor DOD's efforts to improve its defense business operations. CAPE officials stated that after discussing the ACA basing location options, the Deputy's Management Action Group approved the decision to change the ACA alert status at the two ACA basing locations—Duluth, Minnesota and Langley, Virginia.

The Air Force Estimated Cost Savings to the ACA Operation

NORAD and Air Force officials told us that the Air Force estimated cost savings of \$73 million over five years after DOD made the final decision to reduce the alert status at the two ACA basing locations, as part of the Secretary of Defense's efficiency initiative,¹⁵ not as an effort to conduct a complete cost-benefit assessment of ACA basing options. In our January 2012 report, we noted that NORAD's 2010 analysis did not identify potential cost savings that could result from eliminating a given number of ACA basing locations. As noted in that report, an analysis that balances both risk and costs would enable NORAD, DOD, and Congress to make more fully-informed decisions about the number and location of ACA bases. According to Air Force officials, the cost-savings estimate was calculated for the fiscal year 2013 budget submission and included annual cost-savings estimates that ranged from about \$9.2 million to \$16.6 million for fiscal years 2013 through 2017, as shown in Table 1.

Table 1: Estimated Cost Savings of the ACA Operation for Fiscal Years 2013 – 2017

(in millions)	
Fiscal Year	Savings
2013	\$9.2
2014	15.4
2015	15.8
2016	16.1
2017	16.6
Total	\$73.1

Source: GAO analysis of DOD data.

Air Force officials told us that the majority of the cost savings were from personnel who would shift from full-time to part-time status. Other areas from which the Air Force identified savings included decreases to operations and maintenance costs at the basing locations.

¹⁵In May 2010, the Secretary of Defense publicly announced that DOD was to undertake a department-wide initiative to assess how the department is staffed, organized, and operated with the goal of reducing costs and modernizing, among others, its weapons portfolio. The Secretary's initiative targeted both short- and long-term improvements and set specific goals and targets for achieving cost savings and efficiencies, which are expected to be achieved between fiscal years 2012 and 2016.

We did not independently verify the Air Force's estimated cost savings. However, we compared the Air Force's estimate to key principles we derived from cost estimating, budgeting, and related guidance. For example, a cost-savings estimate should have an appropriate level of detailed documentation, all significant costs and key assumptions should be included, the reliability of the data to develop the estimate should be assessed, and the accuracy of the calculations should be verified or validated. According to Air Force officials, the cost-savings estimate was reviewed and verified by knowledgeable high-level Air Force, National Guard Bureau, and CAPE officials to ensure that costs were valid, key assumptions were included, and the calculations were accurate and reliable. Therefore, we determined that the Air Force's categories of savings were consistent with the key principles of preparing cost-savings estimates.

Agency Comments

NORAD and DOD reviewed a draft of this report and provided technical comments, which we incorporated as appropriate.

We are sending copies of this report to appropriate congressional committees, the Secretary of Defense, the Commander of NORAD, the Secretary of the Air Force, and the Chief of the National Guard Bureau. This report also is available at no charge on our Web site at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-6912 or gablerr@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 major contributions to this report are listed in the enclosure.



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Enclosure

Enclosure: GAO Contact and Staff Acknowledgments

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