



December 2014

# GROUND RADAR AND GUIDED MUNITIONS

Increased Oversight  
and Cooperation Can  
Help Avoid  
Duplication among the  
Services' Programs

| Report Documentation Page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    |                                     |                                                           | Form Approved<br>OMB No. 0704-0188                  |                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------------------------------------|-----------------------------------------------------------|-----------------------------------------------------|---------------------------------|
| Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. |                                    |                                     |                                                           |                                                     |                                 |
| 1. REPORT DATE<br><b>DEC 2014</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                    | 2. REPORT TYPE                      |                                                           | 3. DATES COVERED<br><b>00-00-2014 to 00-00-2014</b> |                                 |
| 4. TITLE AND SUBTITLE<br><b>Ground Radar and Guided Munitions: Increased Oversight and Cooperation Can Help Avoid Duplication among the Services' Programs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                    |                                     |                                                           | 5a. CONTRACT NUMBER                                 |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                           | 5b. GRANT NUMBER                                    |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                           | 5c. PROGRAM ELEMENT NUMBER                          |                                 |
| 6. AUTHOR(S)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                    |                                     |                                                           | 5d. PROJECT NUMBER                                  |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                           | 5e. TASK NUMBER                                     |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                           | 5f. WORK UNIT NUMBER                                |                                 |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)<br><b>U.S. Government Accountability Office, 441 G Street NW, Washington, DC, 20548</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                    |                                     |                                                           | 8. PERFORMING ORGANIZATION REPORT NUMBER            |                                 |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    |                                     |                                                           | 10. SPONSOR/MONITOR'S ACRONYM(S)                    |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                           | 11. SPONSOR/MONITOR'S REPORT NUMBER(S)              |                                 |
| 12. DISTRIBUTION/AVAILABILITY STATEMENT<br><b>Approved for public release; distribution unlimited</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                    |                                     |                                                           |                                                     |                                 |
| 13. SUPPLEMENTARY NOTES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    |                                     |                                                           |                                                     |                                 |
| 14. ABSTRACT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                    |                                     |                                                           |                                                     |                                 |
| 15. SUBJECT TERMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                    |                                     |                                                           |                                                     |                                 |
| 16. SECURITY CLASSIFICATION OF:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     | 17. LIMITATION OF ABSTRACT<br><b>Same as Report (SAR)</b> | 18. NUMBER OF PAGES<br><b>32</b>                    | 19a. NAME OF RESPONSIBLE PERSON |
| a. REPORT<br><b>unclassified</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | b. ABSTRACT<br><b>unclassified</b> | c. THIS PAGE<br><b>unclassified</b> |                                                           |                                                     |                                 |

## Why GAO Did This Study

Over the past five years, GAO has found potential overlap or duplication in DOD weapon system investments. Overlap occurs when multiple agencies or programs are engaged in similar activities. Duplication occurs when two or more agencies or programs are engaged in the same activities. Senate Report 113-44 accompanying the fiscal year 2014 National Defense Authorization Act mandated that GAO examine the military services' ground radar and air-to-ground precision guided munitions programs for potential duplication. Ground radars are sensors used to detect and track targets, and precision guided munitions are weapons intended to accurately engage and destroy enemy targets.

This report examines the extent to which potential overlap or duplication exists across the military services' (1) ground radar and (2) air-to-ground precision guided munitions programs. GAO analyzed program documentation on system performance requirements and capabilities and interviewed DOD officials about potential duplication.

## What GAO Recommends

To address potential duplication, GAO recommends that DOD ensure that new ground radar acquisitions are reviewed by the JROC and CAPE and require the Army and Navy to jointly assess the possibility of using a single solution and a cooperative, preferably competitive, contracting strategy to meet their guided rocket needs. DOD partially agreed with GAO's first recommendation, but stated it should not be mandatory. GAO believes the recommendation remains valid as discussed in its report. DOD agreed with the second recommendation.

View [GAO-15-103](#). For more information contact Michael J. Sullivan, (202) 512-4841 or [sullivanm@gao.gov](mailto:sullivanm@gao.gov).

# GROUND RADAR AND GUIDED MUNITIONS

## Increased Oversight and Cooperation Can Help Avoid Duplication among the Services' Programs

### What GAO Found

Several of the Department of Defense's (DOD) active ground radar programs have overlapping performance requirements and two are potentially duplicative. In these instances, the military service pursued separate acquisition programs because other programs did not fully meet their performance requirements, among other reasons. Specifically, GAO found:

- The Marine Corps' Ground/Air Task Oriented Radar (G/ATOR) Block I and the Air Force's Three-Dimensional Expeditionary Long-Range Radar (3DELRR) have some overlapping key requirements, such as range, and are potentially duplicative. The Joint Requirements Oversight Council (JROC), which validates requirements for DOD's largest acquisition programs, did not find unnecessary redundancy, and Air Force officials stated that G/ATOR could not meet all of the 3DELRR's requirements.
- The Army's AN/TPQ-53 Counterfire Radar and the Marine Corps' G/ATOR Block II have some overlapping requirements, but the AN/TPQ-53 does not meet certain key G/ATOR Block II requirements, therefore reducing the risk that the programs are duplicative. In this case, urgent operational needs and different acquisition approaches also led the Army and Marine Corps to establish separate acquisition programs.

As a result of reviews conducted by the JROC and DOD's Office of Cost Assessment and Program Evaluation (CAPE), which develops guidance for analyzing alternative ways to fulfill capability needs, the Air Force made positive changes to the 3DELRR program, such as reducing some requirements to improve program affordability. CAPE also expanded the alternatives considered on acquisition programs to minimize potential duplication. DOD missed an opportunity to assess whether the capabilities of the AN/TPQ-53 and G/ATOR Block II were unnecessarily redundant. The JROC did not review the AN/TPQ-53 requirements because it was initially fielded to meet an urgent need and did not meet the dollar threshold to automatically trigger a review. However, the AN/TPQ-53 transitioned to the traditional, non-urgent needs acquisition process at which point the JROC could have reviewed it. Ensuring that the JROC and CAPE review new ground radar acquisitions could help DOD avoid duplication.

DOD's active air-to-ground precision guided munitions programs are not duplicative, but potential for duplication exists in the future. The active programs share some capabilities, but characteristics such as the aircraft that can launch them distinguish them from one another. To the extent that overlapping capabilities exist, DOD officials said these capabilities provided needed flexibility for military operations. Cooperation among the military services contributed to the current lack of duplication. GAO found one example of potential future duplication. Both the Army and the Navy plan to buy the Advanced Precision Kill Weapon System through fiscal year 2015 to meet their guided rocket needs, but starting in fiscal year 2016, they may pursue separate, potentially duplicative, efforts. There are costs and benefits associated with both the Army and Navy's acquisition approaches; however, if the Army and Navy fulfill their guided rocket needs separately instead of cooperatively, it could result in the inefficient use of weapon system investment dollars and a loss of buying power.

---

# Contents

---

|              |                                                                                                                                                             |    |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Letter       |                                                                                                                                                             | 1  |
|              | Background                                                                                                                                                  | 2  |
|              | Overlapping Performance Requirements and Potential Duplication<br>Exist across Ground Radar Programs, but DOD Has<br>Determined Any Redundancy Is Necessary | 7  |
|              | Air-To-Ground Precision Guided Munitions Programs Are Not<br>Duplicative, but Potential for Duplication in the Future Exists                                | 12 |
|              | Conclusions                                                                                                                                                 | 15 |
|              | Recommendations for Executive Action                                                                                                                        | 17 |
|              | Agency Comments and Our Evaluation                                                                                                                          | 17 |
| Appendix I   | Scope and Methodology                                                                                                                                       | 21 |
| Appendix II  | Description of Active Ground Radar Programs                                                                                                                 | 23 |
| Appendix III | Comparison of Select Active Air-to-Ground Precision Guided<br>Munitions Capabilities                                                                        | 24 |
| Appendix IV  | Comments from the Department of Defense                                                                                                                     | 25 |
| Appendix V   | GAO Contact and Staff Acknowledgments                                                                                                                       | 27 |
| Tables       |                                                                                                                                                             |    |
|              | Table 1: Military Services' Active Ground Radar Programs                                                                                                    | 4  |
|              | Table 2: Select Active Air-to-Ground Precision Guided Munitions<br>Programs                                                                                 | 5  |
| Figure       |                                                                                                                                                             |    |
|              | Figure 1: Notional Depictions of Ground Radars Performing<br>Various Missions                                                                               | 3  |

---

## Abbreviations

|        |                                                       |
|--------|-------------------------------------------------------|
| 3DELRR | Three-Dimensional Expeditionary Long-Range Radar      |
| AOA    | analysis of alternatives                              |
| APKWS  | Advanced Precision Kill Weapon System II              |
| CAPE   | Cost Assessment and Program Evaluation                |
| DOD    | Department of Defense                                 |
| G/ATOR | Ground/Air Task Oriented Radar                        |
| GPS    | Global Positioning System                             |
| JAGM   | Joint Air-to-Ground Missile                           |
| JCIDS  | Joint Capabilities Integration and Development System |
| JROC   | Joint Requirements Oversight Council                  |
| JSOW   | Joint Standoff Weapon                                 |
| KPP    | Key Performance Parameter                             |
| KSA    | Key System Attribute                                  |

This is a work of the U.S. government and is not subject to copyright protection in the United States. The published product may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.



December 19, 2014

## Congressional Committees

The Department of Defense (DOD) and the military services spend over \$150 billion each year on the development and procurement of weapons and other defense systems to fulfill their roles and missions. These investment dollars are not always spent in the most efficient and effective way. We have previously found potential overlap or duplication in DOD's electronic warfare, tactical wheeled vehicles, and unmanned aircraft system investments, in which the military services pursued multiple acquisition efforts to develop similar or the same capabilities.<sup>1</sup> Several factors contributed to the overlap or duplication, including the military services generating unique system requirements that justify multiple acquisitions to meet similar needs, the military services' authority to independently make resource allocation decisions that support their respective requirements, and the department's urgent needs processes—activities aimed at rapidly developing, equipping, and fielding solutions and critical capabilities to the warfighter—which have led to multiple entities responding to requests for similar capabilities.

In the Senate report 113-44 accompanying the National Defense Authorization Act for Fiscal Year 2014, the Senate Armed Services Committee raised questions about potential duplication within DOD's ground radar and air-to-ground precision guided munitions programs and directed DOD to provide briefings on each area. The report mandated that we examine these programs for potential duplication. This report

---

<sup>1</sup>Overlap occurs when multiple agencies or programs have similar goals, engage in similar activities or strategies to achieve them, or target similar beneficiaries. Duplication occurs when two or more agencies or programs are engaged in the same activities or provide the same services to the same beneficiaries. See GAO, *Next Generation Jammer: DOD Should Continue to Assess Potential Duplication and Overlap As Program Moves Forward*, [GAO-13-642](#) (Washington, D.C.: Aug. 20, 2013); *Airborne Electronic Attack: Achieving Mission Objectives Depends on Overcoming Acquisition Challenges*, [GAO-12-175](#) (Washington, D.C.: Mar. 29, 2012); *2012 Annual Report: Opportunities to Reduce Duplication, Overlap and Fragmentation, Achieve Savings, and Enhance Revenue*, [GAO-12-342SP](#) (Washington, D.C.: Feb. 28, 2012); *Warfighter Support: DOD's Urgent Needs Processes Need a More Comprehensive Approach and Evaluation for Potential Consolidation*, [GAO-11-273](#) (Washington, D.C.: Mar. 1, 2011); and *Defense Acquisitions: Opportunities Exist to Achieve Greater Commonality and Efficiencies among Unmanned Aircraft Systems*, [GAO-09-520](#) (Washington, D.C.: July 30, 2009).

---

examines the extent to which potential overlap or duplication exists across the military services' (1) ground radar and (2) air-to-ground precision guided munitions programs.

To determine the extent of potential overlap or duplication across ground radar and air-to-ground precision guided munitions programs, we reviewed acquisition programs currently in development or production, which we also refer to in this report as active programs. We reviewed and analyzed documentation on system requirements, capabilities, and other distinguishing factors to determine if potential overlap or duplication exists. We interviewed DOD officials regarding any instances where we identified potential overlap or duplication. We also reviewed DOD analysis and interviewed DOD officials to identify instances in which DOD found potential overlap or duplication during acquisition and requirements reviews and what actions DOD took in response. Appendix I includes additional details on our scope and methodology.

We conducted this performance audit from June 2014 to December 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 audit objectives.

---

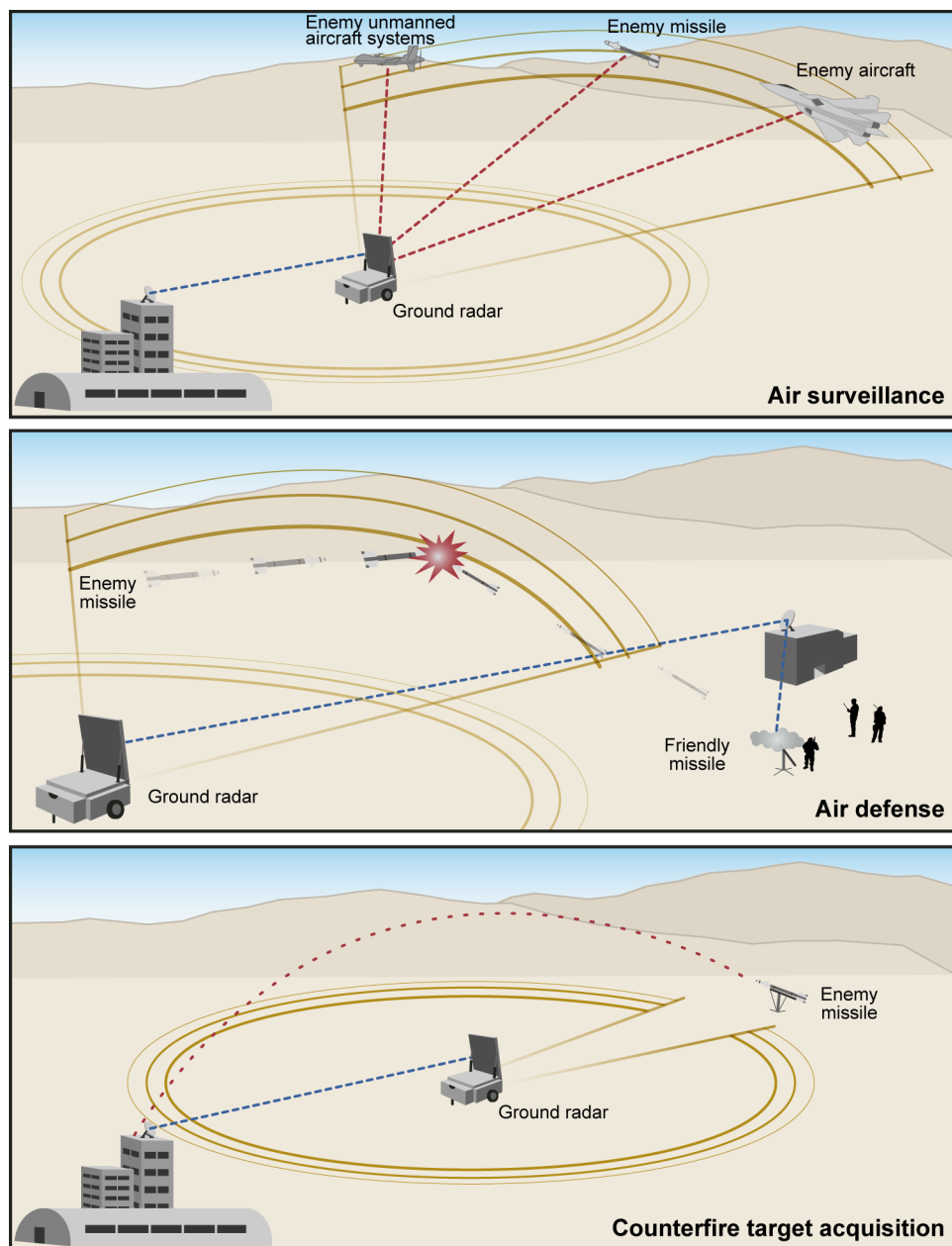
## Background

DOD and the military services invest in ground radars and air-to-ground precision guided munitions. Ground radars are ground-based sensor systems used by the Army, Air Force, and Marine Corps to detect and track a variety of targets. These radars perform missions such as air surveillance, air defense, and counterfire target acquisition, among others. Ground radars that can perform multiple missions one at a time are called multi-role radars, and radars that can perform multiple missions simultaneously are called multi-mission radars. We focused on ground radars that perform the following missions, which are notionally depicted in figure 1:

- Air surveillance—search, detect, and track cruise missiles, fixed and rotary wing aircraft, and unmanned aircraft systems.
- Air defense—provide radar data that enables other weapon systems, such as air and missile defense or aircraft, to take offensive or defense actions against enemy cruise missiles, fixed and rotary wing aircraft, and unmanned aircraft systems.

- Counterfire target acquisition—detect and track enemy rockets, artillery, and mortars to determine enemy firing positions and impact areas for incoming fire.

**Figure 1: Notional Depictions of Ground Radars Performing Various Missions**



Source: GAO analysis of DOD documents. | GAO-15-103



The military services have several active ground radar acquisition programs performing air surveillance, air defense, and counterfire target acquisition missions. These programs and their missions are presented in table 1. Appendix II provides additional information on the capabilities of these radar programs.

**Table 1: Military Services' Active Ground Radar Programs**

| Lead service              | System name                                                                                | Primary radar mission          | Program status |
|---------------------------|--------------------------------------------------------------------------------------------|--------------------------------|----------------|
| Army                      | AN/TPQ-53 Counterfire Target Acquisition Radar System                                      | Counterfire target acquisition | In production  |
| Air Force                 | Three-Dimensional Expeditionary Long-Range Radar (3DELRR)                                  | Air surveillance, air defense  | In development |
| Marine Corps <sup>a</sup> | AN/TPS-80 Ground/Air Task Oriented Radar (G/ATOR) Block I: Air Defense/ Surveillance Radar | Air surveillance, air defense  | In production  |
|                           | AN/TPS-80 G/ATOR Block II: Ground Weapons Locating Radar                                   | Counterfire target acquisition | In development |

Source: GAO analysis of program documents. | GAO-15-103

Notes: We reviewed active ground radar programs used in land operations with primarily air surveillance, air defense, and counterfire target acquisition missions. Active programs are defined as those currently in development or production. It does not include systems only being developed or produced for foreign military sales.

<sup>a</sup>The Marine Corps' G/ATOR is a multi-role radar. The Marine Corps is using an incremental approach to fielding G/ATOR capabilities. G/ATOR Block I will develop the basic hardware for the radar in all of its potential roles. G/ATOR Block II will be a software upgrade to provide counterfire target acquisition capabilities.

The House Armed Services Committee has previously raised questions about potential overlap in the ground radar area. For example, in 2012, House report 112-479 accompanying the National Defense Authorization Act for Fiscal Year 2013 noted overlap with the Army and Marine Corps ground radar programs' missions and encouraged the Army and Marine Corps to collaborate and identify overlapping requirements and determine if they could procure a single system rather than having each service procuring and maintaining separate systems.

Air-to-ground precision guided munitions are weapons launched from Army, Navy, Air Force, and Marine Corps aircraft that are intended to accurately engage and destroy enemy targets on the ground. These

munitions include missiles, guided rockets, and laser guided bombs.<sup>2</sup> Precision guided munitions contain a seeker, warhead, and fuze.<sup>3</sup> The seeker detects electromagnetic energy reflected from a target and provides commands to a control system that guides the weapon to the target. Different seekers provide targeting capabilities for different environments, such as for clear weather only or all weather. Some precision-guided munitions are made up of a guidance kit attached to an unguided or “dumb” munition. Munitions are also made up of varying warheads with different capabilities and weights that make them optimized for different types of targets. The military services’ active air-to-ground precision guided munitions are presented in table 2.

**Table 2: Select Active Air-to-Ground Precision Guided Munitions Programs**

| Lead service | System name                                      | Type                                      | Program status |
|--------------|--------------------------------------------------|-------------------------------------------|----------------|
| Army         | Hellfire II Romeo variant                        | Missile                                   | In production  |
|              | Joint Air-to-Ground Missile (JAGM)               | Missile                                   | In development |
| Navy         | Advanced Precision Kill Weapon System II (APKWS) | Rocket with Guidance Kit                  | In production  |
|              | Direct Attack Moving Target Capability           | Bomb with Laser Guidance Kit <sup>a</sup> | In production  |
|              | Joint Standoff Weapon (JSOW) C-1 variant         | Missile                                   | In production  |
| Air Force    | Maverick Laser variant                           | Missile                                   | In production  |
|              | Small Diameter Bomb Increment II                 | Guided Bomb                               | In development |

Source: DOD data | GAO-15-103

Notes: Active systems are defined as those currently in development or production. They do not include systems only being developed or produced for foreign military sales. This table does not include precision guided munitions in certain specialized categories, such as anti-ship, anti-radiation, ballistic, and cruise missiles. It also does not include GPS-only guided munitions because these are not considered to be precision guided munitions by the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, Strategic and Tactical Systems.

<sup>a</sup>Direct Attack Moving Target Capability is a laser guidance kit attached to a Joint Direct Attack Munition, which is a bomb guided by a Global Positioning System (GPS) – Inertial Navigation System.

<sup>2</sup>According to the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, Strategic and Tactical Systems, precision guided munitions do not include those weapons with only Global Positioning System (GPS) enabled guidance systems. As a result, we did not include munitions, such as the Joint Direct Attack Munition, even though the Air Force and Navy consider GPS-only systems to be precision guided munitions.

<sup>3</sup>A fuze provides safe, reliable detonation of a munition at the desired time and place. It ensures safe separation of the munition from the delivery platform and triggers its detonation.

---

DOD's requirements and acquisition policies contain provisions to help avoid redundancy and consider existing alternatives before starting new acquisition programs. DOD's Joint Capabilities Integration and Development System (JCIDS) guidance states that when validating key requirements documents, the chair of the group responsible for that capability area is also certifying that the proposed requirements and capabilities are not unnecessarily redundant to existing capabilities in the joint force.<sup>4</sup> In some cases, redundancy may be advisable for operational reasons. The validation authority for a requirements document depends on factors such as the potential dollar value of a program, and determines the level of oversight a requirement document receives.<sup>5</sup> The Joint Requirements Oversight Council (JROC) is the validation authority for documents with a "JROC Interest" designation. A military service can be the validation authority for lower level designations.

DOD's Instruction 5000.02, which establishes policies for the management of all acquisition programs, requires the military services to complete an analysis of alternatives (AOA) to assess potential materiel solutions, including existing and planned programs, which could satisfy validated capability requirements. DOD's Office of Cost Assessment and Program Evaluation (CAPE) approves study guidance, which provides direction on what the AOA must include, for acquisition category I programs. Under DOD's Interim Instruction 5000.02, which was effective as of November 2013, CAPE also develops and approves study guidance for programs for which the JROC is the validation authority, regardless of the acquisition category of the program.<sup>6</sup> It also states that the Milestone

---

<sup>4</sup>JCIDS is the process used by the Joint Requirements Oversight Council (JROC) to fulfill its advisory responsibilities to the Chairman of the Joint Chiefs of Staff in identifying, assessing, validating, and prioritizing joint military capability gaps and the requirements for the systems that are planned to address them. The JROC is chaired by the Vice Chairman of the Joint Chiefs of Staff and includes one senior leader from each of the military services, among others.

<sup>5</sup>The JROC is the validation authority for all acquisition category I programs. Acquisition category I programs are major defense acquisition programs. Major defense acquisition programs are generally those identified by DOD with a dollar value for all increments estimated to require eventual total expenditure for research, development, test, and evaluation of more than \$480 million, or for procurement of more than \$2.79 billion, in fiscal year 2014 constant dollars. The Milestone Decision Authority is the designated individual with overall responsibility for a program and approves entry of a program into the next phase of the acquisition process.

<sup>6</sup>DOD Interim Instruction 5000.02, *Operation of the Defense Acquisition System* (Nov. 25, 2013).

---

Decision Authority can designate non-major defense acquisition programs as “special interest.” A “special interest” program is a program that meets certain criteria, such as being a potential joint acquisition program, and as a result, receives higher level oversight.<sup>7</sup> The Under Secretary of Defense for Acquisition, Logistics, and Technology serves as Milestone Decision Authority for “special interest” programs.

---

## Overlapping Performance Requirements and Potential Duplication Exist across Ground Radar Programs, but DOD Has Determined Any Redundancy Is Necessary

Our analysis of DOD’s active ground radar programs found evidence of overlapping performance requirements and potential duplication in certain mission areas. However, the JROC and Joint Staff have determined that any redundancies across the programs they reviewed were necessary. The JROC did not review one of the programs in our analysis. The military services pursued separate ground radar acquisition programs for several reasons: other programs did not fully meet their performance requirements; the timelines for other programs did not align with their needs; and they made different decisions on whether to pursue multi-role or single role radars. DOD has taken steps to encourage collaboration in the ground radar area by asking the services to consider joint acquisition programs, developing joint requirements, and requiring the services to include existing radar programs in their AOAs, with mixed success.

---

<sup>7</sup>A joint acquisition program is any acquisition program with a strategy that includes funding by more than one DOD component during any phase of a system’s life cycle.

---

## Ground Radar Programs for Air Surveillance and Air Defense Have Some Key Overlapping Requirements and Are Potentially Duplicative

Based on our analysis of program requirements documents, we found that the Marine Corps' Ground/Air Task Oriented Radar (G/ATOR) Block I and Air Force's Three-Dimensional Expeditionary Long-Range Radar (3DELRR) acquisition programs have some key overlapping requirements and provide similar capabilities in their air surveillance and air defense roles.<sup>8</sup> However, the JROC ultimately determined that any redundancy between requirements was necessary. During the JROC validation process, the proposed performance requirements for the 3DELRR program were reduced in several areas, including range. These reductions brought the 3DELRR requirements closer to the G/ATOR Block I requirements, thus increasing the extent of overlap across the programs' requirements and the risk of potential duplication. In other areas, 3DELRR requirements still exceeded those for G/ATOR Block I. The JROC validated the 3DELRR requirements document in 2013. The JROC approved the latest G/ATOR Block I requirements document in 2012.

Due to the Marine Corps and Air Force pursuing different radar systems with overlapping key performance requirements, the G/ATOR Block I and 3DELRR acquisition programs are potentially duplicative. The Marine Corps' G/ATOR program, which is further along in the acquisition process and has recently entered initial production, is based on Northrop Grumman's AN/TPS-80 radar. The Air Force's 3DELRR program recently entered system development, and the Air Force awarded a contract to Raytheon on October 6, 2014, to develop and produce a separate radar.<sup>9</sup> Prior to entering system development, the Air Force conducted two studies as a result of DOD inquiries on whether G/ATOR could meet the

---

<sup>8</sup>The details of our analysis are not presented here because it was based on classified or For Official Use Only documents. To conduct our analysis, we compared common Key Performance Parameters (KPP) and Key System Attributes (KSA) in the programs' requirements documents, including range, probability of detection, search volume, reliability, availability, maintainability, and transportability/mobility, as appropriate. KPPs are the performance attributes of a system considered critical to the development of an effective military capability. KSAs are the attributes or characteristics considered to be essential to achieving a balanced solution or approach to a system, but not critical enough to be designated a KPP.

<sup>9</sup>Lockheed Martin and Northrop Grumman also competed for this contract.

---

Air Force's long-range radar requirements.<sup>10</sup> According to Air Force officials, each of these studies confirmed that no other existing radar could meet all of the 3DELRR requirements, and supported the decision to start a new development program. One of these studies was an AOA update that considered reductions in the 3DELRR range requirements and both studies considered the introduction of a more capable gallium nitride semiconductor technology into the G/ATOR program.<sup>11</sup> Our review of these studies and a related CAPE analysis showed that G/ATOR could be capable of meeting some key 3DELRR performance requirements. In addition, a CAPE official, who reviews radar programs, stated the Air Force could use about 90 percent of the work the Marine Corps has already done to develop G/ATOR for 3DELRR and that additional research and development would primarily be required to develop software for the system.

---

Ground Radar Programs for Counterfire Target Acquisition Have Some Overlapping Requirements, but Other Factors Justified Separate Programs

Based on our analysis of program requirements documents, we found that the Army's AN/TPQ-53 Counterfire Radar and the Marine Corps' G/ATOR Block II have some overlapping requirements.<sup>12</sup> Both radar systems detect, track, classify, and locate the origin of enemy projectiles, including mortar, artillery, and rocket systems and are to replace existing Army and Marine Corps Firefinder radars that perform counterfire target acquisition missions.<sup>13</sup> However, while many of the requirements overlap, the AN/TPQ-53 does not meet the G/ATOR Block II detection range requirements for multiple target types.

---

<sup>10</sup>Headquarters, Air Combat Command, Directorate for Requirements, Command and Control, Intelligence, Surveillance, and Reconnaissance Division, *Deployable, Tactical, Radar Replacement Analysis of Alternatives Update (DTR2AU) Final Report, Executive Summary Revision* (Langley Air Force Base, Va.: Apr. 18, 2014) and MIT Lincoln Laboratory, *3DELRR Comparison to G/ATOR LRIP v2* (Lexington, Mass.: Dec. 22, 2010).

<sup>11</sup>Gallium nitride semiconductor technology is used in radar transmit-receive modules—the individual radiating elements key to transmitting and receiving electromagnetic signals. Gallium nitride has the potential to provide higher efficiency with smaller power and cooling demands than legacy semiconductor technology.

<sup>12</sup>The details of this analysis are not presented here because it was based on For Official Use Only documents. To conduct our analysis, we compared common KPPs and KSAs in the programs' requirements documents, including range, probability of detection, search volume, reliability, availability, maintainability, and transportability/mobility, as appropriate.

<sup>13</sup>The Firefinder family of radars includes the Army's AN/TPQ-36, AN/TPQ-37, and Enhanced AN/TPQ-36, and the Marine Corps' TPQ-46.

---

In addition to some unique requirements, urgent operational needs and different acquisition approaches led the Army and Marine Corps to establish separate acquisition programs for counterfire target acquisition radars. The Army's AN/TPQ-53 started in 2006 as an upgrade program to increase the capabilities of existing radar to meet urgent needs that had been identified in overseas operations. According to Army and Marine Corps officials, the Army's timeframes required it to field its new capability before the G/ATOR development program would transition to production. After the Army met its urgent needs with an initial procurement of upgraded radars, the program continued through the traditional or non-urgent needs acquisition process and held a new production decision review in 2012. However, by this point, the Army and the Marine Corps had adopted different acquisition approaches for meeting their ground radar needs. The Army moved from a strategy of developing one multi-mission radar for air surveillance, air defense, and counterfire target acquisition to a strategy of buying the AN/TPQ-53 and upgrading other radars as needed. The Marine Corps, on the other hand, is developing G/ATOR as a multi-role and potentially a multi-mission radar. Despite these different approaches, the Army and Marine Corps have cooperated in certain areas related to these acquisitions. For example, according to Army and Marine Corps officials, the Army and Marine Corps have discussed using common software for the AN/TPQ-53 and G/ATOR Block II counterfire target acquisition capabilities.

The JROC did not review whether the capabilities of the Army's AN/TPQ-53 and the Marine Corps' G/ATOR Block II were unnecessarily redundant or duplicative as part of the requirements validation process. The JROC did not validate the Army's AN/TPQ-53 performance requirements because it was initially an urgent wartime need and did not meet acquisition category I dollar thresholds. However, at the point the JROC could have reviewed the AN/TPQ-53 requirements, the program had transitioned to the more traditional acquisition process. Instead, the Joint Staff delegated the validation authority for the AN/TPQ-53 requirements to the Army, which validated them in 2010. The JROC had previously validated the G/ATOR Block II requirements documents in 2005, prior to the Army starting the AN/TPQ-53 program. Because the Joint Staff delegated the validation authority for the AN/TPQ-53 to the Army, the JROC may have missed an opportunity to review whether the capabilities of the AN/TPQ-53 and G/ATOR Block II were unnecessarily redundant or duplicative, or to encourage additional areas of cooperation between the Army and the Marine Corps.

---

## DOD Has Encouraged Collaboration on Ground Radars with Mixed Success

The Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics and CAPE has taken steps to encourage the military services to collaborate on ground radar programs with mixed success. None of the efforts resulted in a joint acquisition program, primarily due to service funding decisions, but they have led to the development of joint requirements and broader analyses of acquisition alternatives. For example:

- In 2009, the Under Secretary of Defense for Acquisition, Technology, and Logistics designated the Air Force's 3DELRR program and the TPS-59 Product Improvement Program for the Marine Corps' long-range air surveillance radar as special interest programs and encouraged both services to collaborate on a single system that addressed their long-range radar requirements. According to Air Force officials, this resulted in a 3DELRR requirements document that was developed jointly, and which still shares many of the Marine Corps' requirements. The Marine Corps decided to discontinue the TPS-59 Product Improvement Program due to budget constraints, but DOD officials said that 3DELRR may still be able to meet the Marine Corps' needs when it eventually decides to replace the TPS-59 ground radar.
- In 2009, the Under Secretary of Defense for Acquisition, Technology, and Logistics designated G/ATOR as a special interest program, and directed the Marine Corps to collaborate with the Joint Staff and Army to work towards a joint capability to meet the services' multi-mission radar requirements. The Army later decided not to fund the Multi-Mission Radar and has instead pursued the AN/TPQ-53 radar and other radar upgrades to meet its needs.
- In 2011, CAPE issued AOA study guidance that required the Air Force to update a prior 3DELRR AOA and consider a broader range of alternatives, including other ground radar systems, such as G/ATOR. Because 3DELRR was proposed to address Air Force and Marine Corps long-range radar requirements, the study guidance required Marine Corps participation in the development and review of the AOA. The AOA concluded that a new radar program was the optimum solution to meet 3DELRR requirements.
- The Army is looking to upgrade the radar system that supports the Patriot missile system. A CAPE official responsible for reviewing radar programs said that CAPE is working with the Army to develop its AOA study guidance for the radar upgrade effort and asked the Army to include systems, such as 3DELRR and G/ATOR in the analysis.



---

## Air-To-Ground Precision Guided Munitions Programs Are Not Duplicative, but Potential for Duplication in the Future Exists

Our analysis of DOD's active air-to-ground precision guided munitions found some munitions shared some capabilities, but after taking into consideration characteristics such as the aircraft that can launch them, we found the systems were not duplicative. To the extent overlapping capabilities exist, DOD officials said these capabilities provided needed flexibility for different military operations. However, there is potential for future duplication in the Army's and Navy's air-to-ground guided rocket acquisitions. While the Army and Navy have similar needs, the services' potential procurement strategies could lead to them procuring the same or very similar systems using different programs and contracts.

---

## Air-to-Ground Munitions Are Not Duplicative and Any Overlapping Capabilities Provide Flexibility for Military Operations

Based on our analysis of the target sets of DOD's air-to-ground precision guided munitions, the seeker capabilities, the aircraft platforms that can launch them, and cost, we did not find evidence that DOD's capabilities in this area were duplicative. Additionally, none of the DOD or military service requirements and acquisition organizations we spoke to identified unnecessary redundancy or duplication within air-to-ground precision guided munitions. In general, DOD officials described the air-to-ground precision guided munitions area as efficient in terms of the investments DOD has made. Appendix III provides a comparison of air-to-ground precision guided munition air platforms, seeker capabilities, and target sets.

Our analysis of DOD's active air-to-ground precision guided munitions found evidence of overlapping target sets among the munitions, but unique factors such as what type of aircraft a munition can be launched from, the munition's seeker capability in varying weather conditions, and the cost of the munition for the desired effect clearly distinguish them from one another.<sup>14</sup> In addition, where some overlap was found, DOD officials explained the overlap was necessary to provide flexibility for military operations. We found three illustrative examples of how platform, seeker capability, and the cost of the munition weigh into how air-to-ground precision guided munitions are used and how their capabilities complement one another:

---

<sup>14</sup>Another important distinction is the lethality of the munitions, but this information is classified.

- 
- Air-to-ground precision guided munitions are suitable for different types of aircraft platforms, or behave differently when fired from different types of platforms; therefore, the method of delivery, such as from a fixed wing fighter aircraft versus a rotary wing helicopter platform, can be critical to the operation. For example, the Joint Air-to-Ground Missile (JAGM) and the Joint Standoff Weapon (JSOW) are both missiles optimized to hit moving and stationary targets.<sup>15</sup> When JAGM replaces the Hellfire missile, it will, like Hellfire, be capable of launching from rotary helicopters and unmanned aircraft systems, whereas JSOW is a glide weapon with no motor, that must be launched from bomber and fighter aircraft. The JSOW also has a penetrating warhead that allows it to target deeply buried targets.
  - Differing seeker capabilities allow for flexibility in different operating environments. An all weather seeker capability allows a munition to reach its target regardless of weather conditions or other obscurants, such as smoke. For example, the Direct Attack Moving Target Capability was developed to hit moving targets, but it does not have the all weather seeker capability that would allow it to hit all moving targets in all weather conditions. The JAGM and the Small Diameter Bomb II munitions will have the capability to address moving targets in all weather conditions. This all-weather capability requires a more expensive seeker technology.
  - The unit cost of precision guided munitions varies and may be a determining factor in when they are used. For example, the Hellfire II Romeo missile and Advanced Precision Kill Weapon System II (APKWS), which is a guided rocket, both have the ability to hit unarmored and unhardened targets. However, the Hellfire II Romeo costs approximately \$93,000 per unit and is optimized to hit armored and hardened targets, whereas the APKWS costs approximately \$31,000 per unit and is only optimized for unarmored and unhardened targets. According to DOD officials, while the Hellfire II missile is effective against both armored and unarmored targets, it could be more optimal, depending on the range of the target, to use the smaller and less expensive APKWS system against unarmored targets.

---

<sup>15</sup>The JSOW C-1 variant is optimized to hit maritime targets such as ships.

---

One of the reasons for the lack of duplication in air-to-ground precision guided munitions programs is that the military services cooperated on multiple systems and leveraged each other's investments. Three of the seven munitions programs we reviewed are joint development programs between at least two of the military services. In other cases, the military services procured each other's munitions systems. For example, all of the military services procure Hellfire missiles from the Army.

---

### Duplication in Guided Rockets Procurements Could Occur in the Future

There is potential for future overlap or duplication in the Army's and Navy's procurement of air-to-ground guided rockets, which could result in DOD not fully leveraging its buying power. Specifically, both the Army and Navy have validated requirements for air-to-ground guided rockets.<sup>16</sup> The general requirement is for a guidance kit that attaches to the existing family of unguided Hydra-70 rockets.<sup>17</sup> While the Army and Navy have similar needs, the services' current procurement strategies could lead to them procuring the same or very similar systems using different programs and contracts. APKWS is currently the only guided rocket system that has been integrated and fully qualified for use on a DOD platform.<sup>18</sup> Defense contractors have developed other guided rocket systems, and there is at least one other system that the Army is considering to meet its future guided rocket needs.

Both the Army and the Navy plan to buy APKWS through fiscal year 2015 to meet their guided rocket needs, but starting in fiscal year 2016, they may pursue separate, potentially duplicative, efforts to meet their requirements. The Army plans to introduce competition for its Hydra-70 rocket guidance kit and consider other qualified systems besides APKWS. DOD acquisition policy and Better Buying Power initiatives to increase the efficiency of defense spending both emphasize the importance of sustaining a competitive environment at every stage in the

---

<sup>16</sup>The Army re-validated its requirement for a guided rocket capability in 2014.

<sup>17</sup>Hydra-70 rockets are a family of unguided, modular rockets made up of a motor and a variety of warheads, including high explosive, illumination, and smoke, which are selected for use based on the warfighter's situational requirements and desired effects.

<sup>18</sup>APKWS has been fully integrated and qualified by the Navy on the Marine Corps' H-1 helicopters. The Army has completed integration and airworthiness qualification testing of APKWS on their AH-64 helicopters and is in the process of fully qualifying the system.

---

acquisition process as a means to control and reduce cost.<sup>19</sup> To do so, the Army is exploring various options to introduce competition for guided rockets to include an option that requires the Hydra-70 rocket prime contractor to competitively procure guidance kits and fully integrate them with Hydra-70 before delivering complete systems to the Army, which is different than the Navy's current approach. Alternatively, the Army could still jointly buy APKWS with the Navy. The Navy procures APKWS and Hydra-70 separately and integrates the components themselves in order to, among other things, allow for the flexibility to use the different combinations of rocket components based on mission needs.

The Navy's current contract for APKWS, which was awarded on a sole source basis, expires in 2016. At that point, the Navy plans to negotiate another sole source contract because it does not believe that introducing competition to APKWS would be worth the investment of integrating and qualifying another Hydra-70 guided rocket on Marine Corps' H-1 helicopters.<sup>20</sup> Navy officials stated that DOD invested \$71 million to fully develop, integrate, and qualify APKWS on the H-1. According to the Army program officials, introducing competition for the Hydra guidance kit could reduce its current cost by as much as one-third. There are costs and benefits associated with both the Army and Navy's acquisition approaches; however, if the Army and Navy fulfill their guided rocket needs separately instead of through a single solution with a cooperative contracting strategy, it could result in the inefficient use of weapon system investment dollars and a loss of buying power.

---

## Conclusions

DOD will likely be at some risk for overlap and duplication in its weapon system acquisition programs, given the breadth and magnitude of its investments. While some overlap and duplication may provide necessary

---

<sup>19</sup>Interim DODI 5000.02, *Operation of the Defense Acquisition System* (Nov. 25, 2013); Office of the Under Secretary of Defense, Acquisition, Technology, and Logistics Memorandums: "Better Buying Power 2.0: Continuing the Pursuit for Greater Efficiency and Productivity in Defense Spending" (Nov. 13, 2012); "Implementation Directive for Better Buying Power - Obtaining Greater Efficiency and Productivity in Defense Spending" (Nov. 3, 2010); "Better Buying Power: Guidance for Obtaining Greater Efficiency and Productivity in Defense Spending" (Sept. 14, 2010); and "Better Buying Power: Mandate for Restoring Affordability and Productivity in Defense Spending" (June 28, 2010).

<sup>20</sup>The Navy's June 2013 Justification and Approval for awarding a sole source contract for APKWS states that BAE Systems is the only responsible source and no other type of supplies or services will satisfy the agency requirements. 10 U.S.C. §2304(c)(1).

---

redundancy for military operations, in other cases, it is driven by the military services generating unique system requirements that meet similar needs, their authority to independently make resource allocation decisions, and the timing of acquisition programs. The 3DELRR program appears to be a case where the Air Force was focused on what made its requirements unique, instead of looking for ways to leverage the Marine Corps' development program for G/ATOR. We found these programs to be potentially duplicative.

DOD currently relies on its requirements and acquisition processes and decision makers to ensure that capabilities and programs are not unnecessarily redundant or duplicative. Its experiences with ground radar programs suggest ways to make these processes more effective in the future. For example, DOD may have missed an opportunity to review whether the capabilities of the Army's AN/TPQ-53 Counterfire Radar and the Marine Corps' G/ATOR Block II were unnecessarily redundant or duplicative because the requirements document for the AN/TPQ-53 was validated by the Army, rather than the JROC, which has a broader perspective on DOD's capability needs. In another case, DOD was better positioned to encourage cooperation for Patriot radar upgrades. Because CAPE had visibility into the program, it was able to shape the Army's AOA to make sure existing radars, such as 3DELRR and G/ATOR, were considered.

There may be other opportunities for increased service cooperation to meet future ground radar needs, but, in order for key decision makers such as the JROC, CAPE, and the Under Secretary of Defense for Acquisition, Technology, and Logistics to take advantage of them, it is important for them to have insight into ground radar programs, including upgrade programs and programs that do not meet the dollar thresholds that trigger a "JROC Interest" designation and automatic review. A "JROC Interest" designation provides the JROC the opportunity to review ground radar performance requirements and capabilities for potential duplication and CAPE with the opportunity to develop broad AOA guidance. This type of visibility would put DOD in a better position to take the actions necessary to make the most efficient use of its resources.

Unlike the ground radar programs we examined, most of the air-to-ground precision guided munitions programs were already being developed and procured jointly. This cooperation has helped DOD leverage its buying power. As new areas of potential cooperation emerge, the services should look to leverage those opportunities. Specifically, when the Army revalidated its air-to-ground guided rocket requirement, it opened up the

---

possibility of cooperating with the Navy on jointly buying APKWS or holding a competition to find a system that can meet both services' needs when the Navy's current sole source contract expires in 2016. Either option seems preferable to the Army and Navy potentially procuring the same or similar systems to fill the same requirement under different program and contracts, which could lead to duplicative procurement activities in both services and a degradation in buying power.

---

## Recommendations for Executive Action

We recommend that DOD take the following two actions:

- To provide the JROC the opportunity to review all ground radar programs for potential duplication and CAPE with the opportunity to develop broad analysis of alternative guidance, the Vice Chairman of the Joint Chiefs of Staff should direct the Joint Staff to assign all new ground radar capability requirement documents with a Joint Staff designation of "JROC Interest."
- To address potential overlap or duplication in the acquisition of Hydra-70 rocket guidance kits, the Under Secretary of Defense for Acquisition, Technology, and Logistics should require the Army and Navy to assess whether a single solution and cooperative, preferably competitive, contracting strategy offers the most cost effective way to meet both services' needs.

---

## Agency Comments and Our Evaluation

We provided a draft of this report to DOD for review and comment. In its written comments, which are reprinted in full in appendix IV, DOD partially concurred with our first recommendation and concurred with our second recommendation. DOD also provided technical comments that were incorporated as appropriate.

DOD partially concurred with our recommendation to assign all new ground radar capability requirement documents with a Joint Staff designation of "JROC Interest." DOD responded that although it is likely that new ground radar capability would be given the Joint Staff Designator of "JROC Interest," the "JROC Interest" designation should not be a required designation because it ignores the tiered Joint Staff designation system process. DOD also noted that it would lessen the impact and importance of the Functional Capabilities Boards and their role to ensure minimization of duplication across the portfolio.

We acknowledge that the Joint Staff has a process for determining Joint Staff designations and for minimizing duplication across portfolios.

---

However, as we point out in our report, DOD missed an opportunity to review whether the capabilities of the Army's AN/TPQ-53 Counterfire Radar and the Marine Corps' G/ATOR Block II were unnecessarily redundant or duplicative because the requirements document for the AN/TPQ-53 was given a lower-level designation. The way to ensure this does not occur in the future is to make the "JROC Interest" designation mandatory for all new ground radar programs. Hence, we still believe without this designation for all new ground radar programs, the JROC and CAPE may not have the opportunity to review programs that do not meet the dollar threshold for an automatic "JROC Interest" designation and may miss additional opportunities to encourage collaboration across the military services.

DOD concurred with our second recommendation to require the Army and Navy to assess whether a single solution and cooperative, preferably competitive, contracting strategy offers the most cost effective way to meet both services' needs if both services continue to pursue the acquisition of Hydra-70 rocket guidance kits. DOD noted that it has a process to consider redundancies across the services' programs, but it was unclear what actions it planned to take to assess if the services could use a single contracting strategy to meet its guided rocket needs. We continue to believe that DOD should assess this option as part of its consideration of potential redundancies.

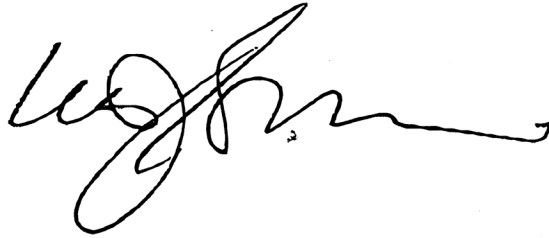
---

We are sending copies of this report to appropriate congressional committees; the Secretary of Defense; the Under Secretary of Defense for Acquisition, Technology, and Logistics; the Vice Chairman of the Joint Chiefs of Staff; and the Secretaries of the Army, Navy, and Air Force, and the Commandant of the Marine Corps. In addition, this report also is available at no charge on GAO's 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 [sullivanm@gao.gov](mailto:sullivanm@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 appendix V.

A handwritten signature in black ink, appearing to read 'Michael J. Sullivan', with a large, stylized initial 'M'.

Michael J. Sullivan  
Director  
Acquisition and Sourcing Management



---

### *List of Committees*

The Honorable Carl Levin  
Chairman  
The Honorable James Inhofe  
Ranking Member  
Committee on Armed Services  
United States Senate

The Honorable Richard J. Durbin  
Chairman  
The Honorable Thad Cochran  
Ranking Member  
Subcommittee on Defense  
Committee on Appropriations  
United States Senate

The Honorable Howard P. "Buck" McKeon  
Chairman  
The Honorable Adam Smith  
Ranking Member  
Committee on Armed Services  
House of Representatives

The Honorable Rodney Frelinghuysen  
Chairman  
The Honorable Pete Visclosky  
Ranking Member  
Subcommittee on Defense  
Committee on Appropriations  
House of Representatives

---

# Appendix I: Scope and Methodology

---

To determine the extent of potential overlap or duplication across (1) ground radar and (2) air-to-ground precision guided munitions programs, we reviewed acquisition programs currently in development or production, which does not include systems only being developed or produced for foreign military sales. We reviewed and analyzed documentation on system requirements, capabilities, and other distinguishing factors to determine if potential overlap or duplication exists. We interviewed Department of Defense (DOD) officials in the Joint Staff; Offices of the Under Secretary of Defense for Acquisition Technology, and Logistics and Director, Cost Assessment and Program Evaluation; and the Army, Navy, Air Force, and Marine Corps to discuss ground radar and air-to-ground precision guided munition programs as appropriate. We also reviewed DOD analysis and interviewed DOD officials to identify instances in which DOD found potential overlap or duplication during acquisition and requirements reviews and what actions DOD took, if any, in response to any identified potential overlap or duplication.

For ground radar programs, we reviewed the mission, acquisition life cycle, and basic system characteristics of the military services' active ground radar programs, to determine which programs may have overlapping or duplicative requirements and capabilities. We focused on ground radar programs used in land operations with primarily air surveillance, air defense, and counterfire target acquisition missions. Our scope included two air surveillance and air defense ground radar systems—the Air Force's Three-Dimensional Expeditionary Long-Range Radar (3DELRR) and the Marine Corps' AN/TPS-80 Ground/Air Task Oriented Radar (G/ATOR) Block I Radar—and two counterfire target acquisition ground radar programs—the Army's AN/TPQ-53 Counterfire Radar and the Marine Corps' AN/TPS-80 G/ATOR Block II. We excluded the Army's AN/TPQ-50, which is in production, from our analysis because unlike the other radar system we reviewed, it is a lightweight, man portable radar. We also excluded Sentinel and Patriot from our analysis because these programs are fielded systems undergoing modification. Within our scope, we compared the common Key Performance Parameters (KPP) and Key System Attributes (KSA) found in the program requirements documents across the radars primarily performing air surveillance and air defense and counterfire target acquisition missions. KPPs are the performance attributes of a system considered critical to the development of an effective military capability. KSAs are the attributes or characteristics considered to be essential, but not critical enough to be designated a KPP. The KPPs and KSAs included range, probability of detection, search volume, reliability, availability, maintainability, and transportability/mobility, as appropriate.

---

For air-to-ground precision guided munitions, we reviewed the type, acquisition life cycle, and select system characteristics of the military services' active air-to-ground precision guided munitions programs, to determine which programs may have overlapping or duplicative requirements and capabilities. We did not review munitions in certain specialized categories, such as anti-ship, anti-radiation, ballistic, or cruise missiles. Our scope included Advanced Precision Kill Weapon System II (APKWS), Direct Attack Moving Target Capability, Hellfire II Romeo variant, Joint Air-to-Ground Missile (JAGM), Joint Standoff Weapon (JSOW) C-1 variant, Maverick Laser variant, and Small Diameter Bomb II. Within our scope, we conducted an analysis comparing the precision guided munitions characteristics that we determined, in consultation with DOD subject matter experts, were most critical to assessing the system's capabilities. Based on information we gathered and corroborated with the military services, we compared munitions' air platforms, unit cost, all weather capability, and target sets: moving and stationary; armored and unarmored; hardened and unhardened.

We conducted this performance audit from June 2014 to December 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 audit objectives.

# Appendix II: Description of Active Ground Radar Programs

| Service      | Radar                                                          | Description of capabilities                                                                                                                                                                                                                                                                                                                                     |
|--------------|----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Army         | AN/TPQ-53 Counterfire Target Acquisition Radar System          | Highly mobile ground based radar set that automatically detects, classifies, tracks, and locates the point of origin of projectiles fired from rocket, artillery and mortar systems. The radar provides increased range and accuracy throughout a 90 degree search sector (stare mode) as well as 360 degree coverage (rotating) for locating firing positions. |
| Air Force    | Three-Dimensional Expeditionary Long-Range Radar (3DELRR)      | Long-range, three-dimensional, ground-based radar for detecting, identifying, tracking, and reporting aerial targets. Responds to operational need to detect and report highly maneuverable, small radar cross section targets to enable battlefield awareness.                                                                                                 |
| Marine Corps | AN/TPS-80 Ground/Air Task Oriented Radar (G/ATOR) <sup>a</sup> | Expeditionary, three-dimensional, high-mobility, short/medium range multi-role radar designed to detect cruise missiles, air breathing targets, rockets, mortars, and artillery.                                                                                                                                                                                |
|              | G/ATOR Air Defense/ Surveillance Radar – Block I               | <ul style="list-style-type: none"> <li>Provides expeditionary, day/night, adverse weather radar coverage and tracks aerial objects. Provides the baseline system for the Marine Corps short and medium range radar requirement.</li> </ul>                                                                                                                      |
|              | G/ATOR Ground Weapons Locating Radar – Block II                | <ul style="list-style-type: none"> <li>Detects indirect fire from rockets, artillery, and mortar systems at greater range and provides greater accuracy, classification and deployability to support counterfire and counter battery missions.</li> </ul>                                                                                                       |

Source: Fiscal Year 2015 budget and program documents. | GAO-15-103

Notes: We reviewed active ground radar programs used in land operations with primarily air surveillance, air defense, and counter target acquisition missions. Active programs are defined as those currently in development or production.

<sup>a</sup>The Marine Corps' G/ATOR is a multi-role radar. The Marine Corps is using an incremental approach to fielding G/ATOR capabilities. G/ATOR Block I is to develop the basic hardware for the radar in all of its potential roles. G/ATOR Block II is to be a software upgrade to provide counterfire target acquisition capabilities.

# Appendix III: Comparison of Select Active Air-to-Ground Precision Guided Munitions Capabilities

| System                                   | Platforms <sup>a</sup>            | Seeker capabilities | Moving targets <sup>b</sup> |           | Stationary targets <sup>c</sup> |            |
|------------------------------------------|-----------------------------------|---------------------|-----------------------------|-----------|---------------------------------|------------|
|                                          |                                   | All weather         | Armored                     | Unarmored | Hardened                        | Unhardened |
| Advanced Precision Kill Weapon System II | Rotary, Unmanned Aircraft Systems |                     |                             | X         |                                 | X          |
| Direct Attack Moving Target Capability   | Attack/Fighter                    |                     | X                           | X         | X                               | X          |
| Hellfire II Romeo variant                | Rotary, Unmanned Aircraft Systems |                     | X                           | X         | X                               | X          |
| Joint Air-to-Ground Missile (JAGM)       | Rotary <sup>d</sup>               | X                   | X                           | X         | X                               | X          |
| Joint Standoff Weapon C-1 variant        | Attack/Fighter, Bomber            |                     | X                           | X         | X                               | X          |
| Maverick Laser variant                   | Attack/Fighter                    |                     | X                           | X         | X                               | X          |
| Small Diameter Bomb II                   | Attack/Fighter                    | X                   | X                           | X         |                                 | X          |

Source: DOD data and GAO analysis. | GAO-15-103

Notes: Active systems are defined as those currently in development or production. It does not include systems only being developed or produced for foreign military sales. This table does not include precision guided munitions in certain specialized categories, such as anti-ship, anti-radiation, ballistic, and cruise missiles. It also does not include Global Positioning System-only guided munitions because these are not considered to be precision guided munitions by the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, Strategic and Tactical Systems.

<sup>a</sup>Platforms that meet the system's threshold requirements or are being used with the system.

<sup>b</sup>Targets for which the system was optimized.

<sup>c</sup>Targets for which the system was optimized.

<sup>d</sup>JAGM is also expected to be used on unmanned aircraft systems, but this is not a threshold requirement.

# Appendix IV: Comments from the Department of Defense



THE JOINT STAFF  
WASHINGTON, DC

05 December 2014

Reply ZIP Code:  
20318-0300

Mr. Michael J. Sullivan  
Director, Acquisition, and Sourcing Management  
U.S. Government Accountability Office  
441 G Street, NW  
Washington DC 20548

Dear Mr. Sullivan:

This is the Department of Defense (DoD) response to the GAO Draft Report GA0-15-103, "GROUND RADAR AND GUIDED MUNITIONS: Increased Oversight and Cooperation Can Help Avoid Duplication among the Services' Programs," dated 5 November 2014 (GAO Code 121230).

The Department is providing the enclosed official written comments for inclusion in the report.

Sincerely,

A handwritten signature in black ink, reading "David L. Goldfein", is positioned above the printed name and title.

DAVID L. GOLDFEIN, Lt Gen, USAF  
Director, Joint Staff

Enclosure:  
As stated



The Joint Staff  
WASHINGTON, D.C. 20318-8000

GAO DRAFT REPORT DATED NOVEMBER 5, 2014  
GAO-15-103 (GAO CODE 121230)

**"GROUND RADAR AND GUIDED MUNITIONS: Increased Oversight and  
Cooperation Can Help Avoid Duplication among the Services' Programs"**

**DEPARTMENT OF DEFENSE COMMENTS  
TO THE GAO RECOMMENDATIONS**

**RECOMMENDATION # 1:** To provide the JROC the opportunity to review all ground radar programs for potential duplication and CAPE with the opportunity to develop broad analysis of alternative guidance, the Vice Chairman of the Joint Chiefs of Staff should direct the Joint Staff to assign all new ground radar capability to requirement documents with a Joint Staff designation of "JROC Interest."

**DoD RESPONSE:** Partially Concur - While it is likely new ground radar capability would be given the Joint Staffing Designator (JSD) of "JROC Interest", this should not be a required designation. When a sponsor submits a requirements document for Joint review, the Joint Staff Gatekeeper actions include the assignment of the JSD based on actual/potential Acquisition Category (ACAT) and Joint Staff equities which include necessity of specific certifications and endorsements, leadership guidance, and predecessor document JSD. Regardless of the JSD, the Functional Capabilities Board (FCB) is directly involved in the process, and serves to ensure minimization of duplication across the portfolio. Mandating that ground radar systems always receive a designation of "JROC Interest" defeats the purpose of a tiered JSD system and lessens the impact and importance of the Functional Capabilities Boards.

**RECOMMENDATION # 2:** To address potential overlap or duplication in the acquisition of Hydra-70 rocket guidance kits, the Under Secretary of Defense for Acquisition, Technology, and Logistics should require the Army and Navy to assess whether a single solution and cooperative, preferably competitive, contracting strategy offers the most cost effective way to meet both services' needs.

**DoD RESPONSE:** Concur. Under the Better Buying Power (BBP) initiative, there is a process to consider redundancies across the Services for Acquisition Category II & III programs. The Advanced Precision Kill Weapon System II, a HYDRA-70 rocket guidance kit falls under this process and will be reviewed when the Army commits to procuring a Hydra-70 rocket guidance kit. The Army currently has no definitive plans to procure guidance kits for Hydra-70 rockets beyond Fiscal Year 2015.

---

# Appendix V: GAO Contact and Staff Acknowledgments

---

## GAO Contact

Michael J. Sullivan, (202) 512-4841 or [sullivanm@gao.gov](mailto:sullivanm@gao.gov).

---

## Acknowledgments

In addition to the contact named above, the following individuals made key contributions to this report: Ronald E. Schwenn, Assistant Director; Danielle Greene; Laura Holliday; Heather Krause; John Krump; Zina Merritt; Paige Muegenburg; Erin Preston; Sylvia Schatz; Roxanna Sun; Hai Tran; and Oziel Trevino.



---

## GAO's Mission

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

---

## Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's website (<http://www.gao.gov>). Each weekday afternoon, GAO posts on its website newly released reports, testimony, and correspondence. To have GAO e-mail you a list of newly posted products, go to <http://www.gao.gov> and select "E-mail Updates."

---

## Order by Phone

The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, <http://www.gao.gov/ordering.htm>.

Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.

Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.

---

## Connect with GAO

Connect with GAO on [Facebook](#), [Flickr](#), [Twitter](#), and [YouTube](#). Subscribe to our [RSS Feeds](#) or [E-mail Updates](#). Listen to our [Podcasts](#). Visit GAO on the web at [www.gao.gov](http://www.gao.gov).

---

## To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Website: <http://www.gao.gov/fraudnet/fraudnet.htm>

E-mail: [fraudnet@gao.gov](mailto:fraudnet@gao.gov)

Automated answering system: (800) 424-5454 or (202) 512-7470

---

## Congressional Relations

Katherine Siggerud, Managing Director, [siggerudk@gao.gov](mailto:siggerudk@gao.gov), (202) 512-4400, U.S. Government Accountability Office, 441 G Street NW, Room 7125, Washington, DC 20548

---

## Public Affairs

Chuck Young, Managing Director, [youngc1@gao.gov](mailto:youngc1@gao.gov), (202) 512-4800, U.S. Government Accountability Office, 441 G Street NW, Room 7149, Washington, DC 20548

