



# INSPECTOR GENERAL

*U.S. Department of Defense*

AUGUST 6, 2015



## **Marine Corps Ground/Air Task Oriented Radar Program Management Met Acquisition Guidelines Intent, but Risks Remain**

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# Results in Brief

## *Marine Corps Ground/Air Task Oriented Radar Program Management Met Acquisition Guidelines Intent, but Risks Remain*

August 6, 2015

### Objective

Our audit objective was to determine if the Marine Corps was effectively managing the Ground/Air Task Oriented Radar (G/ATOR) during the low-rate initial production (initial production) phase. We evaluated the production plan for initial production units and planned developmental testing.

### Finding

The Marine Corps generally managed the G/ATOR program in accordance with Defense acquisition guidelines. G/ATOR Program Management Office (PMO) officials implemented reliability improvements, planned new semiconductor technology that should reduce costs and improve performance, and obtained the milestone decision authority approval for increased initial production quantities.

However, on March 10, 2014, the milestone decision authority approved the G/ATOR system to begin initial production without an approved Test and Evaluation Master Plan (TEMP). Officials from G/ATOR PMO and the test community stated that they were coordinating to include the test strategy for new semiconductor technology and a clarified operational reliability requirement in the TEMP.

### Finding (cont'd)

G/ATOR PMO officials plan to complete the TEMP before developmental testing begins in the second quarter FY 2017. Until the TEMP is updated to include the test strategy for new semiconductor technology and a clarified operational reliability requirement, the G/ATOR program is not ready for additional testing.







**INSPECTOR GENERAL  
DEPARTMENT OF DEFENSE  
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August 6, 2015

MEMORANDUM FOR DIRECTOR, OPERATIONAL TEST AND EVALUATION ASSISTANT  
SECRETARY OF THE NAVY (RESEARCH, DEVELOPMENT,  
AND ACQUISITION)

SUBJECT: Marine Corps Ground/Air Task Oriented Radar Program Management  
Met Acquisition Guidelines Intent, but Risks Remain  
(Report No. DODIG-2015-158)

We are providing the enclosed charts for your information and use. Our objective was to determine if the Marine Corps was effectively managing the G/ATOR during the low rate initial production (initial production) phase. We evaluated the production plan for initial production units and planned developmental testing. In addition, we reviewed program planning and reporting documents against DoD policies and guidance.

We determined that the Marine Corps generally managed the G/ATOR program in accordance with Defense acquisition guidelines after the program entered the initial production phase in March 2014. However, G/ATOR program management officials are at risk of not being ready for initial production testing planned for the second quarter FY 2017. The G/ATOR Program Management Office and the DoD test community continue to negotiate how much to test the new semiconductor technology. We will not make a recommendation in the enclosed charts; however, we will continue to monitor G/ATOR progress. We conducted this audit in accordance with generally accepted government audit standards.

We considered Navy and Marine Corps comments on a draft of the enclosed charts. No further action is necessary. We appreciate the courtesies extended to the staff. Please direct questions to me at (703) 604-8905 (DSN 664-8905).

A handwritten signature in black ink, reading "Amy J. Frontz", is positioned above the typed name.

Amy J. Frontz  
Acting Deputy Inspector General  
for Auditing

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## BACKGROUND

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- The Marine Corps Ground/Air Task Oriented Radar (G/ATOR) program is an acquisition category IC major defense acquisition program with total life-cycle costs of \$5.1 billion. The Marine Corps received full funding for 45 G/ATOR systems, consisting of 1 engineering development model and 44 operational systems. The Marine Corps will include an additional 12 systems in a future funding initiative.
- The Assistant Secretary of the Navy, Research, Development, & Acquisition (ASN[RD&A]) is the milestone decision authority (MDA). Program Executive Office—Land Systems reports directly to the ASN(RD&A) and oversees the G/ATOR Program Management Office (PMO), which manages the G/ATOR program.
- The Marine Corps Capabilities Development Directorate developed G/ATOR operational requirements in 2004.
- In March 2014, the G/ATOR program entered the initial production phase in which the Marine Corps planned to produce 14 initial production systems and refurbish the engineering development model.



## BACKGROUND (CONT'D)

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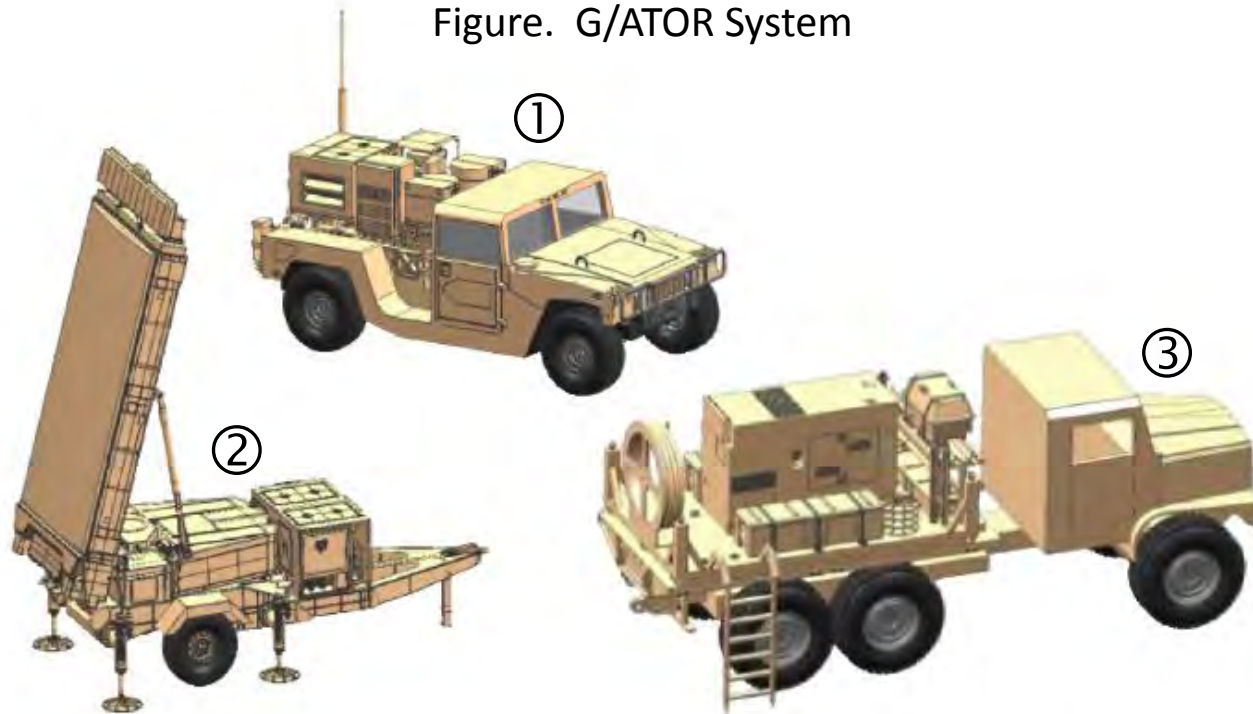
- The Marine Corps G/ATOR is a short to medium range radar designed to detect cruise missiles, manned aircraft, and unmanned aerial systems as well as rockets and artillery fire. The G/ATOR will replace five legacy radar systems.
- The G/ATOR will perform three different types of missions. Each G/ATOR will share basic hardware and software and will be differentiated through upgrades depending on its mission. Of the 57 G/ATORS,
  - 17 will perform air defense/air surveillance;
  - 28 will perform ground weapons locating; and
  - 12 (unfunded) will perform expeditionary airport surveillance.
- The G/ATOR system consists of three equipment groups: communications, radar, and power. The G/ATOR system is shown on the next page.





## BACKGROUND (CONT'D)

Figure. G/ATOR System



1. Communications Equipment Group
2. Radar Equipment Group
3. Power Equipment Group on Medium Tactical Vehicle Replacement pallet



Source: G/ATOR PMO

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## BACKGROUND (CONT'D)

- Marine Corps officials planned initial production orders as summarized in the Table below.

Table. Planned Initial Production Orders

	Order 1	Order 2	Order 3	Order 4	Order 5
Quantity	4	2	3	3	3*
Order Year	FY 2015	FY 2015	FY 2016	FY 2017	FY 2018
Delivery Year	FY 2017	FY 2017	FY 2018	FY 2019	FY 2020

\* Marine Corps officials planned to refurbish the engineering development model in FY 2018.

Source: G/ATOR PMO

- Marine Corps officials estimated each G/ATOR system will cost an average of \$39.7 million to produce.



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## RELIABILITY UNDERPERFORMANCE AND INCOMPLETE TEST STRATEGY FOR NEW SEMICONDUCTOR TECHNOLOGY

- In October 2013, Marine Corps officials concluded system development phase testing and reported the G/ATOR system met all primary operational requirements. However, the G/ATOR tested lower than expected for average time between operational mission failure, a reliability requirement. G/ATOR reliability is a secondary operational requirement.
- In November 2013, the Office of the Director, Operational Test & Evaluation (DOT&E) assessed the G/ATOR test and evaluation master plan (TEMP) and concluded the TEMP was aggressive and lacked details for reliability improvement and new semiconductor technology test strategy.
- DOT&E memorandum, “Ground/Air Task Oriented Radar (G/ATOR) Milestone C Decision,” January 23, 2014, stated the G/ATOR TEMP was not ready for the DOT&E signature. G/ATOR PMO officials needed to include a complete test strategy for new semiconductor technology in the TEMP.
- In addition, DOT&E memorandum, “Ground/Air Task Oriented Radar (G/ATOR) Reliability,” February 3, 2014, stated the DOT&E did not approve the G/ATOR TEMP for the initial production decision because G/ATOR PMO officials’ plan to improve reliability was unrealistic. The DOT&E recommended G/ATOR PMO officials reassess its reliability requirements and improvement plan.



## G/ATOR PROGRAM MANAGEMENT MET ACQUISITION GUIDELINES INTENT, BUT RISKS REMAIN

- The Marine Corps generally managed the G/ATOR program in accordance with Defense acquisition guidelines. G/ATOR PMO officials implemented reliability improvements, planned new semiconductor technology that should reduce costs and improve performance, and obtained MDA approval for increased initial production quantities.
- However, on March 10, 2014, the MDA approved the G/ATOR system to begin initial production without an approved TEMP. Officials from G/ATOR PMO and the test community stated that they were coordinating to include the test strategy for new semiconductor technology and a clarified operational reliability requirement in the TEMP.
- G/ATOR PMO officials plan to complete the TEMP before developmental testing begins in the second quarter FY 2017. Until the TEMP is updated to include the test strategy for new semiconductor technology and a clarified operational reliability requirement, the G/ATOR program is not ready for additional developmental testing.



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## G/ATOR RELIABILITY IMPROVEMENT

- During initial production, G/ATOR PMO officials implemented reliability improvements and obtained clarification on the reliability requirements from the Marine Corps Capabilities Development Directorate for test purposes.
  - G/ATOR PMO implemented a phased reliability improvement plan:
    - Phase 1 began in December 2013 and was completed in August 2014.
    - Phase 2 began in March 2015 and is planned to be completed by December 2016.
  - On June 3, 2014, the MDA chartered a reliability panel chaired by the Executive Director, Marine Corps Systems Command. The panel consisted of DoD experts, including DOT&E, to assess G/ATOR reliability underperformance.
  - On September 26, 2014, the reliability panel concluded the Marine Corps based the average time between operational mission failure requirement on a decades-old radar system. This requirement did not align with the intended mission. The reliability panel recommended the Marine Corps Capabilities Development Directorate reevaluate the requirement and base it on intended mission duration and probability of success. This recommendation was consistent with operational test needs and the Joint Requirements Oversight Council, “Manual for the Operation of the Joint Capabilities Integration and Development System,” February 12, 2015.



## G/ATOR RELIABILITY IMPROVEMENT *(CONT'D)*

- On February 23, 2015, the G/ATOR Program Manager requested the Marine Corps Capabilities Development Directorate clarify the G/ATOR system average time between operational mission failure requirement to better align with the Marine Corps' intended radar use and operational test needs.
- On March 30, 2015, the Marine Corps Capabilities Development Directorate clarified mission duration and probability of success for more efficient operational testing. As a result of the clarification, the G/ATOR system has two requirements for average time between operational mission failure:
  - the Marine Corps will test the G/ATOR system against the clarified operational test requirement; and
  - the contractor will build the system to meet the inherent design reliability requirement.



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## NEW SEMICONDUCTOR SHOULD REDUCE COST AND IMPROVE PERFORMANCE

- The Office of the Secretary of Defense memorandum, “Joint Memorandum on Savings Related to ‘Should Cost,’” April 22, 2011, advises DoD program officials to identify alternative technologies that can reduce life-cycle costs.
- On January 24, 2014, G/ATOR PMO officials briefed the MDA about their plan to transition to a new semiconductor technology—from gallium arsenide (GaAs) to gallium nitride (GaN).<sup>1</sup> G/ATOR PMO officials stated the transition should reduce costs and improve G/ATOR reliability.
- Marine Corps officials estimated \$40 million in procurement cost savings when they transition to GaN technology.
- GaN-based G/ATOR systems should achieve greater efficiency by reducing the number of system components.
  - GaN-based G/ATOR has 76 less transmit/receive components than GaAs-based G/ATOR.
  - Fewer components:
    - cost less to maintain and sustain; and
    - reduce chances of failure.
- G/ATOR PMO officials are updating the TEMP to include the GaN test strategy

<sup>1</sup> GaAs and GaN are chemical compounds that G/ATOR PMO officials use to produce the semiconductor.



## INITIAL PRODUCTION QUANTITIES INCREASED

- G/ATOR PMO officials obtained approval to increase initial production quantities from 8 to 14.
  - DoD Instruction 5000.02, “Operation of the Defense Acquisition System,” January 7, 2015, states that:
    - initial production quantities will be the minimum needed to provide production representative test articles for operational test and evaluation, to establish an initial production base for the system and provide efficient ramp up to full-rate production, and to maintain continuity in production pending completion of operational testing.
    - program offices should document rationale for quantities exceeding 10 percent of the total production quantity in the Acquisition Strategy and include the final initial production quantity in the first Selected Acquisition Report to Congress after quantity determination.
  - G/ATOR PMO officials planned to produce 14 initial production systems, about 31 percent of the total production quantities of 45. The MDA required G/ATOR PMO officials to submit a justification and approval for the increase to 14 systems by March 2015.
    - In May 2014, the MDA approved the G/ATOR Milestone C Acquisition Strategy that stated the initial production quantities increased from 8 to 14 to support the GaN semiconductor technology transition and development. Of the 14 initial production systems, the first 6 will be GaAs and the later 8 will be GaN.
    - In December 2014, G/ATOR PMO officials included the 14 initial production quantities in the Selected Acquisition Report to Congress.
    - In April 2015, the MDA signed a justification and approval for the increased initial production quantities.



## G/ATOR TEMP MAY NOT BE READY FOR FY 2017 DEVELOPMENTAL TESTING

- G/ATOR PMO officials are at risk of not having an approved TEMP before developmental testing begins in the second quarter FY 2017.
  - DoD Instruction 5000.02 states program managers use developmental testing and evaluation activities to manage and mitigate risks; and notify Congress when a lead developmental test organization plans to conduct testing without an approved TEMP.
  - In March 2014, when the MDA approved initial production, he required G/ATOR PMO officials to submit the TEMP for his signature by September 2014. DOT&E disagreed with the G/ATOR PMO GaAs to GaN test strategy and reliability improvement plan. G/ATOR PMO and DOT&E are negotiating details of the TEMP.
  - On February 19, 2015, the MDA extended the TEMP due date by 1 year until September 30, 2015. This provided G/ATOR PMO and DOT&E an opportunity to resolve disagreements with test requirements.



## G/ATOR TEMP MAY NOT BE READY FOR FY 2017 DEVELOPMENTAL TESTING (*CONT'D*)

- G/ATOR PMO officials are updating the TEMP to include GaAs to GaN semiconductor technology transition, plus a clarified reliability requirement and improvement plan.
  - An ASN(RD&A) official indicated that coordination and review of the TEMP can take up to 6 months.
  - In May 2015, the G/ATOR PMO and DoD test community, including DOT&E, discussed and agreed to implement the clarified reliability requirement.
  - G/ATOR PMO and DOT&E officials are negotiating how much testing is acceptable for the GaN-based systems for Initial Operational Test and Evaluation (IOT&E). G/ATOR PMO officials originally planned to use GaAs-based systems for IOT&E. However, DOT&E required G/ATOR PMO officials to use GaN-based systems for IOT&E because it represented the majority of the G/ATOR production quantity. As of July 2015, about 1 ½ years after the initial production review, G/ATOR PMO officials continue to update the semiconductor test strategy.



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## SCOPE AND METHODOLOGY

- We conducted this performance audit from February 2015 through July 2015 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.
- We interviewed personnel from the following offices responsible for or participating in the G/ATOR program.
  - Under Secretary of Defense for Acquisition, Technology, & Logistics
    - Assistant Secretary of Defense for Acquisition
    - Assistant Secretary of Defense for Research & Engineering
  - DOT&E
  - ASN(RD&A)
  - Marine Corps Program Executive Office—Land Systems
  - G/ATOR PMO
  - Marine Corps Systems Command
  - Marine Corps Operational Test and Evaluation Activity
  - Marine Corps Requirements Oversight Council
  - Marine Corps Capabilities Development Directorate



## SCOPE AND METHODOLOGY *(CONT'D)*

- We obtained and reviewed the following documents that G/ATOR PMO officials used during the initial production phase.
  - Marine Corps Systems Command, Justification and Approval No. 15, 077, April 20, 2015
  - U.S. Marine Corps Headquarters Memorandum, "Clarification of Ground/Air Task Oriented Radar (G/ATOR) Requirements," March 30, 2015
  - ASN(RD&A) Memorandum, "Ground/Air Task Oriented Radar Test and Evaluation Master Plan Relief and Low Rate Initial Production Lot 2 Gate Review Relief Acquisition Decision Memorandum," February 19, 2015
  - G/ATOR Reliability Blue Ribbon Panel Findings and Recommendations, September 26, 2014
  - Reliability Test Report: G/ATOR Phase 1 Reliability Improvement, August 28, 2014
  - Acquisition Strategy for the AN/TPS -80 Ground/Air Task Oriented Radar (G/ATOR), May 12, 2014
  - Ground/Air Task Oriented Radar (G/ATOR) Systems Engineering Plan (SEP), May 9, 2014
  - ASN(RD&A) Memorandum, "Ground/Air Task Oriented Radar Milestone C Acquisition Decision Memorandum," March 10, 2014
  - DOT&E Memorandum, "Ground/Air Task Oriented Radar (G/ATOR) Reliability," February 3, 2014
  - DOT&E memorandum, "Ground/Air Task Oriented Radar (G/ATOR) Milestone C Decision," January 23, 2014
  - Reliability Program Plan for the Ground/Air Task Oriented Radar (G/ATOR), January 8, 2014
  - Test and Evaluation Master Plan for the Ground/Air Task Oriented Radar, August 20, 2012





## SCOPE AND METHODOLOGY *(CONT'D)*

- To determine whether the Marine Corps effectively managed the G/ATOR program during the initial production phase, we reviewed program planning and reporting documents against policies and guidance in the following DoD issuances.
  - Joint Requirements Oversight Council, “Manual for the Operation of the Joint Capabilities Integration and Development System (JCIDS),” February 12, 2015
  - DoD Instruction 5000.02, “Operation of the Defense Acquisition System,” January 7, 2015
  - DoD Instruction 5134.17, “Deputy Assistant Secretary of Defense for Developmental Test and Evaluation (DASD(DT&E)),” October 25, 2011
  - Office of the Secretary of Defense memorandum, “Joint Memorandum on Savings Related to ‘Should Cost’,” April 22, 2011
  - DoD Directive 5141.02, “Director of Operational Test and Evaluation (DOT&E),” February 2, 2009



## SCOPE AND METHODOLOGY *(CONT'D)*

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- We did not use computer-processed data or technical assistance to perform this audit.
- The Government Accountability Office (GAO) issued three reports discussing the G/ATOR program during the last 5 years. Unrestricted GAO reports can be accessed at <http://www.gao.gov>.
  - GAO-15-342SP, “DEFENSE ACQUISITIONS: Assessments of Selected Weapon Programs,” March 2015
  - GAO-14-340SP, “DEFENSE ACQUISITIONS: Assessments of Selected Weapon Programs,” March 2014
  - GAO-13-294SP, “DEFENSE ACQUISITIONS: Assessments of Selected Weapon Programs,” March 2013



## Acronyms and Abbreviations

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<b>ASN(RD&amp;A)</b>	Assistant Secretary of the Navy (Research, Development, & Acquisition)
<b>DOT&amp;E</b>	Director, Operational Test and Evaluation
<b>GaAs</b>	Gallium Arsenide
<b>GaN</b>	Gallium Nitride
<b>GAO</b>	Government Accountability Office
<b>G/ATOR</b>	Ground/Air Task Oriented Radar
<b>IOT&amp;E</b>	Initial Operational Test and Evaluation
<b>MDA</b>	Milestone Decision Authority
<b>PMO</b>	Program Management Office
<b>TEMP</b>	Test and Evaluation Master Plan



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