



June 2018

MILITARY READINESS

Analysis of Maintenance Delays Needed to Improve Availability of Patriot Equipment for Training

GAO Highlights

Highlights of [GAO-18-447](#), a report to congressional committees

Why GAO Did This Study

Patriot is a mobile Army surface-to-air missile system deployed worldwide to defend critical assets and forces. The Army plans to extend the life of Patriot equipment until at least 2048 through maintaining and modernizing the system. To achieve this, the Army performs two maintenance processes, restoring equipment returning from combat back to pre-deployment conditions ("reset") and comprehensively overhauling ("recapitalizing") a portion of its equipment annually.

The conference report accompanying a bill for the National Defense Authorization Act for Fiscal Year 2017 included a provision that GAO assess the Army's Patriot maintenance and recapitalization plans to ensure that operational needs are met. This report (1) evaluates the extent to which the Army's reset process supports the timely delivery of Patriot equipment back to units; and (2) describes the Army's plans for supporting the long-term viability of the Patriot system through recapitalization and any challenges associated with its plans. GAO analyzed Army guidance and equipment and maintenance data; interviewed Army officials; and assessed the Army's recapitalization plans.

What GAO Recommends

GAO recommends that the Army conduct an analysis of the primary factors affecting the Patriot program's reset timeliness to identify their relative importance and develop and implement appropriate corrective actions. The Department of the Army concurred with GAO's recommendation.

View [GAO-18-447](#). For more information, contact John Pendleton at (202) 512-3489 or pendletonj@gao.gov.

June 2018

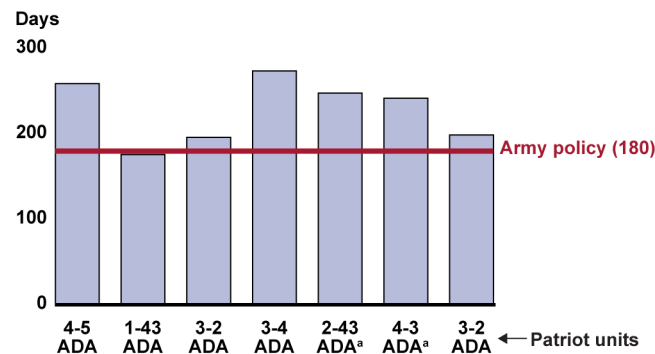
MILITARY READINESS

Analysis of Maintenance Delays Needed to Improve Availability of Patriot Equipment for Training

What GAO Found

The Army uses reset and recapitalization to extend the life of its Patriot surface-to-air missile system. The reset process—which is intended to repair recently-deployed equipment—has often returned equipment to Patriot units late, which has affected unit training. GAO found that of the seven Patriot battalions that underwent reset from fiscal years 2014 through 2017, only one received its equipment within 180 days, in accordance with Army policy (see figure). Patriot unit officials told GAO that such delays reduced the time available for unit training, creating challenges in meeting training requirements as units prepare for their next mission. The Army has identified and analyzed several factors affecting reset timeliness, ranging from supply chain issues to transportation. However, the Army has not comprehensively analyzed the relative importance of these factors. Such an analysis would better position the Army to target its efforts effectively to ensure units receive equipment back in a timely manner.

Patriot Equipment Reset Timeliness for Units, Fiscal Years 2014-2017



Source: GAO analysis of Army information. | GAO-18-447

Notes: Air Defense Artillery (ADA) is used as a designator in the names of Patriot units.

*Reset of the 2-43 ADA and 4-3 ADA in fiscal years 2016-2017 included concurrent upgrades of equipment that added, according to officials, 60 days to their reset periods.

With respect to recapitalization, the Army has decided to recapitalize each battalion set of Patriot equipment once every 15 years to support the system's long-term viability through 2048, while recognizing that this approach introduces some challenges. The Army would prefer to recapitalize Patriot equipment every 10 years, but Army officials stated this is not feasible for the following reasons:

- Reducing the amount of equipment for ongoing operational commitments to increase the pace of recapitalization is not feasible given current commitments and the projected security environment.
- Buying extra equipment to provide to additional units undergoing recapitalization is not feasible because the Army has prioritized replacing the Patriot radar to improve its capability to defend against advanced threats.

Army officials told GAO that the current pace of recapitalization is not optimal and could introduce challenges, such as the possibility of equipment failure and increased maintenance costs. However, the Army has concluded that the current pace is the best path forward.

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Abbreviations

ADA Air Defense Artillery

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June 20, 2018

Congressional Committees

The Army's Patriot surface-to-air missile system was first fielded in the early 1980s and has been in high demand, with more than half of the Patriot force currently deployed, forward stationed, or prepared to deploy on short notice. While there have been upgrades to the system, the age of the equipment and high pace of operations create risks that the Army attempts to mitigate through maintenance. This maintenance, designed to extend the life of the system until at least 2048, includes restoring equipment returning from combat back to pre-deployment condition ("reset") and comprehensively overhauling ("recapitalization") a portion of the equipment annually. However, the current global threat environment has the potential to further increase demands for the Patriot system and result in additional maintenance requirements. The Department of Defense's 2018 National Defense Strategy, for instance, notes the Democratic People's Republic of Korea's growing ballistic missile capability.¹ As we have previously found, with a limited fleet of 15 battalions, the Army has struggled to keep up with demands, so increased operations could be unsustainable.²

We have also previously reported that the Army's current maintenance schedule for the Patriot system presents an elevated risk of equipment failure due to the pace of recapitalization and the Army's fielding plan for system upgrades.³ Congress has expressed additional concerns that potential delays in modernizing Patriot systems, components, and software will amplify these risks as units continue to train, deploy, and operate legacy Patriot equipment at a high pace over an extended period. The conference report accompanying a bill for the National Defense Authorization Act for Fiscal Year 2017 included a provision that we assess the Army's Patriot maintenance and recapitalization plans to

¹Department of Defense, *Summary of the 2018 National Defense Strategy of the United States of America* (2018).

²GAO, *Military Readiness: Personnel Shortfalls and Persistent Operational Demands Strain Army Missile Defense Units and Personnel*, GAO-18-168SU (Washington, D.C.: Oct. 5, 2017).

³GAO, *Patriot Modernization: Oversight Mechanism Needed to Track Progress and Provide Accountability*, [GAO-16-488](#) (Washington, D.C.: Aug. 25, 2016).

ensure that operational needs are met.⁴ This report (1) evaluates the extent to which the Army's reset process supports the timely delivery of Patriot equipment back to units; and (2) describes the Army's plans for supporting the long-term viability of the Patriot system through recapitalization and any challenges associated with its plans.

For our first objective, we analyzed Army reset and recapitalization processes and collected and analyzed data on the timeliness and quality of Army Patriot reset and recapitalization activities from fiscal years 2014 through 2017. We selected these years to identify any trends in the timeliness and quality of the maintenance activities and because this was the most recent data available. We assessed the reliability of these data by reviewing available documentation and interviewing officials, among other things. We found the data to be sufficiently reliable for our purposes, to include reporting on battalion-specific reset timeliness and the time spent by the depot on correcting quality defects identified during internal inspections. We compared the data on reset timeliness against Army policy.⁵ We also interviewed cognizant Army personnel involved in the planning and conduct of Patriot reset and recapitalization, as well as officials from two Patriot battalions and their higher headquarters that recently underwent reset to identify challenges, if any, with respect to reset timeliness, such as equipment transfer delays and any effects on training. We also evaluated the Army's processes to identify and correct factors causing any reset delays against Army guidance on program performance improvement.⁶

For our second objective, we identified and analyzed—via a review of recapitalization schedules, briefings, and other documentation—the Army's current processes and planning for future Patriot recapitalization activities, including Army assessments of the feasibility of adjusting the pace of recapitalization. We also interviewed, among others, cognizant officials from operational units, the Patriot program office, and Letterkenny Army Depot (Letterkenny), which conducts Patriot reset and recapitalization, to obtain their views on considerations influencing the Army's recapitalization planning and the current and optimal paces of

⁴H. R. Rep. No. 114-840, at 1261 (2016).

⁵Army Regulation 525-29, *Army Force Generation* (Mar. 14, 2011).

⁶Army Regulation 702-11, *Army Quality Program* (Feb. 25, 2014).

recapitalizing Patriot equipment. For more information on our scope and methodology, see appendix I.

We conducted this performance audit from June 2017 to June 2018 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

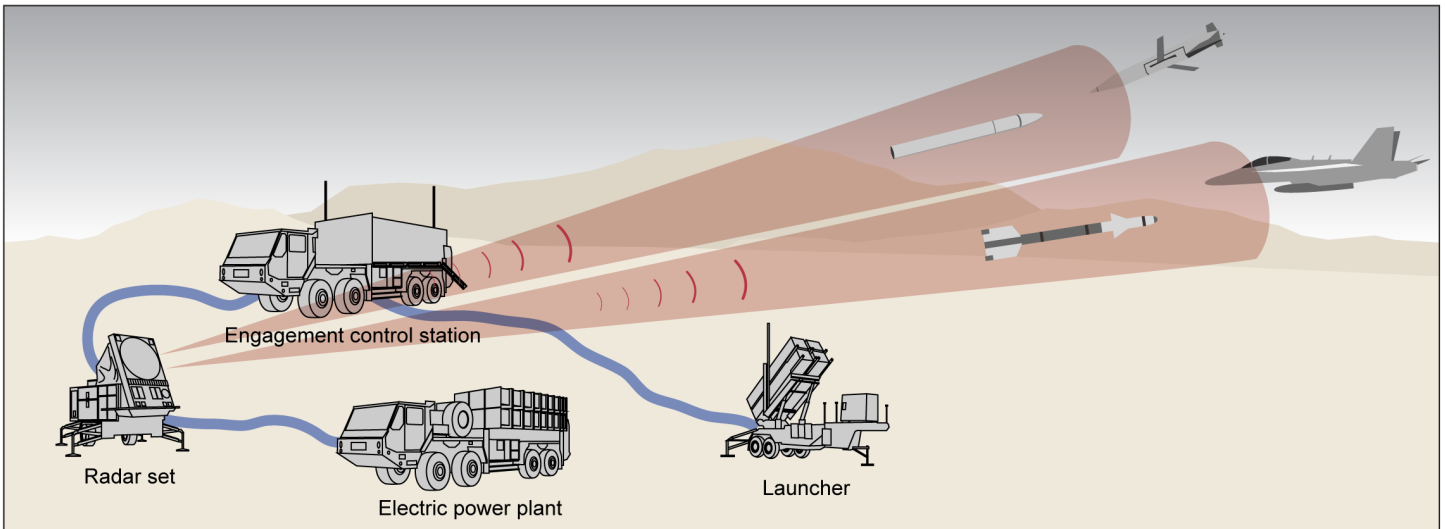
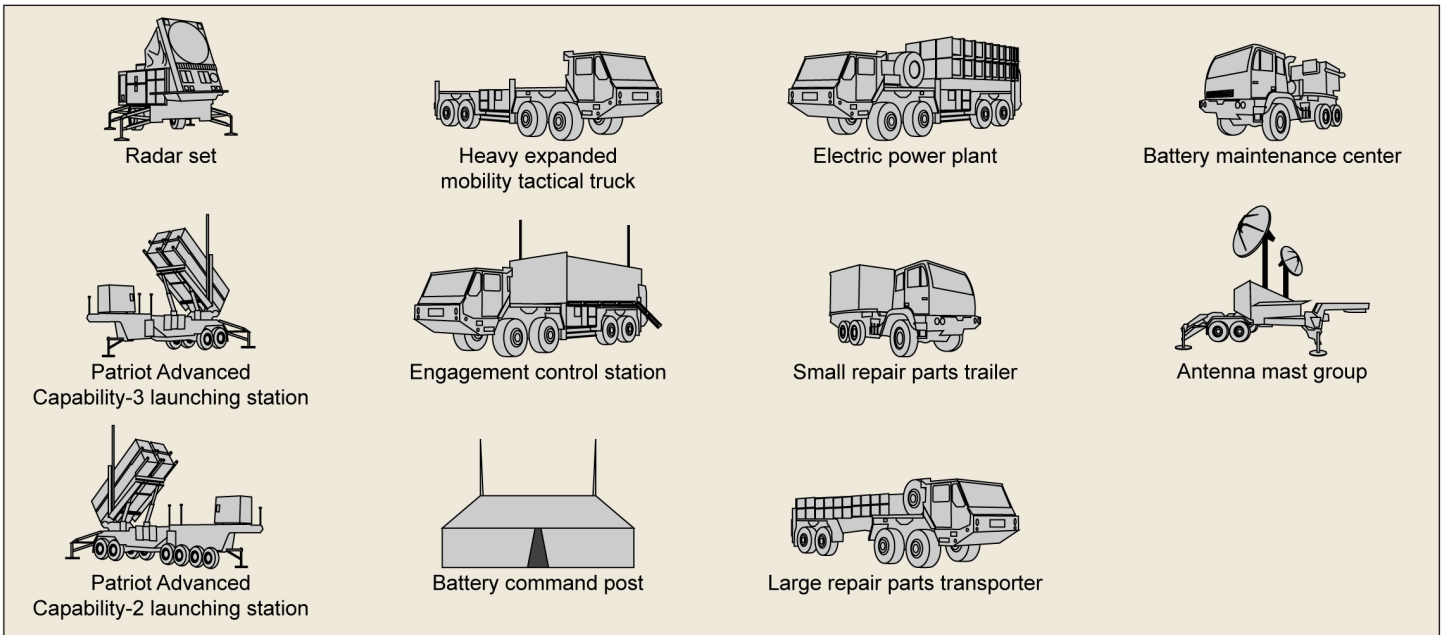
Patriot Weapon System and Equipment

The Patriot weapon system is a mobile Army surface-to-air missile system designed to counter tactical ballistic missiles; cruise missiles; and other threats such as airplanes, helicopters, and unmanned aerial vehicles. The Patriot system was first deployed in the early 1980s; since that time, it has received a number of substantial updates to keep pace with growing threats. Patriot units are deployed worldwide—in Germany and South Korea, for example—in defense of the United States' and its allies' key national interests, ground forces, and critical assets.

The Army currently has 15 Patriot battalions, all in its active component. Each battalion is organized into groups known as fire units, along with a headquarters and headquarters battery. Each battalion is controlled by its own command and control station and can manage up to six fire units, although a battalion is typically deployed with four. A fire unit is made up of four basic components: (1) a ground-based radar to detect and track targets; (2) launchers; (3) interceptor missiles; and (4) a command, control, and communication station. Overall, a fire unit's equipment includes eleven unique major end items, including the radar, the launchers, and an electric power plant, among other items.⁷ Figure 1 provides a listing of the major end items in a Patriot fire unit (top) along with the notional employment of some of these items (bottom).

⁷This report only discusses the maintenance of ground support equipment. As such, interceptor missiles are excluded from this report's scope.

Figure 1: Patriot System Major End Items and Their Notional Employment



Source: GAO analysis of Army information. | GAO-18-447

Reset and Recapitalization Processes

Two of the primary processes the Army utilizes to maintain the Patriot system are reset and recapitalization, summarized in Table 1.

Table 1: Summary of the Army's Reset and Recapitalization Processes for the Patriot System

	Reset	Recapitalization
Level of work performed	Returns equipment to pre-deployment condition	Comprehensive rebuild
Timeliness policy for completing work (per equipment set)	180 days	365 days
Does a unit generally receive a set of equipment to use when turning in equipment for maintenance?	No	Yes
Units eligible for process	Only Patriot units returning from deployment to U.S. Central Command	All Patriot units

Source: GAO analysis of Army information. | GAO-18-447

The Army's reset program seeks to bring Patriot equipment returning from the U.S. Central Command area of responsibility back to Army standards. The reset process seeks to return Patriot equipment to a pre-deployment condition in order to prevent Patriot units from having to spend home station training funds to keep their equipment functional after returning from operations in austere environments for extended periods.⁸

The Army also relies heavily on recapitalization to restore Patriot equipment. A longer and more intensive process than reset, recapitalization seeks to restore equipment to what the Army considers a "like-new" condition, and according to Army guidance is a "near zero time or zero mile" maintenance process.⁹ The recapitalization process seeks to add life to the system, and it provides an opportunity for the Army to make incremental modernization upgrades, such as the insertion of new software, technology insertions, or replacing obsolete parts. For example,

⁸Army Regulation 750-1 defines reset as consisting of activities to restore the Army's personnel and equipment to a desired level of combat capability commensurate with future missions.

⁹According to Army regulation, recapitalization includes, among other things, replacing all expendable components, all aged components, reconditioning of structural components, and restoring the item to a configuration that allows for technology insertions. See Army Regulation 750-1, *Army Materiel Maintenance Policy* (Aug. 3, 2017).

the Army is upgrading the Patriot system to prepare for its integration into the Integrated Air and Missile Defense Battle Command System.¹⁰

As the Army fields this modernized command and control system, the Patriot equipment undergoing recapitalization will also change, but the Army plans to continue recapitalization to support the Patriot system's mission through 2048. Specifically, the Army expects that the transition to the Integrated Air and Missile Defense Battle Command System will allow it to replace current command and control elements. However, remaining end items, such as launchers, would continue to require recapitalization through the full life of the system to 2048. If the Integrated Air and Missile Defense Battle Command System, which is currently planned for initial fielding in 2022, is delayed, program and depot officials expect that they can continue to recapitalize current Patriot equipment as long as needed to support the Army's long-term goal. However, Army officials noted that delays could require mitigation actions, such as the need to continue repairing parts that the Army would otherwise have replaced.

Aside from the degree of work performed, the recapitalization and reset processes differ in several other key ways. For instance, the Army generally provides units undergoing recapitalization with another set of Patriot equipment in a one-for-one exchange. In contrast, units undergoing reset receive the same set of equipment back after work is completed and are not provided other equipment while the unit's equipment undergoes reset at the depot. Additionally, the target length for each process differs; the Army aims to recapitalize one battalion's worth of equipment each year, while reset work is expected to be completed in 180 days to meet the timelines of the Army's process to prepare units for potential deployment. Letterkenny Army Depot primarily conducts the maintenance work for both of these efforts under the management of

¹⁰The Integrated Air and Missile Defense Battle Command System is the Army's modernized battle command and control system. This system will integrate Patriot radar and launchers into a command and control framework that will also control other ballistic missile defense assets. We previously reported on Patriot modernization to prepare for this modern battle command and control system, finding that the Army recognizes it is incurring some added risk of equipment failure given its recapitalization pace. See GAO, *Patriot Modernization: Oversight Mechanism Needed to Track Progress and Provide Accountability*, [GAO-16-488](#) (Washington, D.C.: Aug. 25, 2016).

Army Materiel Command and via coordination with the Patriot program office.¹¹

Patriot Demands and Equipment Mission Capable Rates

Patriot units are in high demand. As we found in October 2017, the Army believes its Patriot force is operating at capacity given a consistently high pace of operations, and Army studies have found that any additional operational demands and potential wartime demands would exceed current capacity.¹² We also found that the Army was planning to increase the capacity of its Patriot force in two ways: first, by fielding five small detachments in fiscal year 2018 that would provide the ability to deploy a Patriot battery without a full battalion-level command and control element, and second, by increasing the size of an existing test detachment in order to relieve the Patriot battalion currently assigned to conduct testing for Patriot modernization efforts of that mission.¹³ The Army intends for the test detachment to begin supporting Patriot modernization test events starting in the second quarter of fiscal year 2019.

From fiscal years 2014 through 2017, Patriot equipment across the force was reported to be fully mission capable at least 90 percent of the time on average, in accordance with the Army's goal, as established in Army regulation.¹⁴ These fully mission capable rates continue an overall trend since 2009, which a 2014 Army assessment of Patriot readiness

¹¹Some Patriot equipment maintenance, such as for trucks, is managed by U.S. Army Tank-automotive and Armaments Command. This review focused on the equipment items maintained by Letterkenny Army Depot for Army Aviation and Missile Command because this is where the majority of maintenance for the system takes place.

¹²GAO-18-168SU.

¹³As of May 2018, Army officials stated that these detachments have not yet added capacity as intended because the additional personnel needed to fill the positions have not yet arrived to these detachments. Army officials also told us that the test battalion will be used to support modernization efforts for Patriot, as well as other air defense capabilities.

¹⁴The Army defines Fully Mission Capable as a status condition where fully operational equipment or systems are safe and correctly configured as designated by the U.S. Army. Equipment is fully mission capable when it can perform all of its combat missions without endangering the lives of crew or operators. For the Army's readiness goal, see Army Regulation 700-138, *Army Logistics Readiness and Sustainability* (Feb. 26, 2004).

attributed to the recapitalization program.¹⁵ Specifically, this assessment noted that the worldwide average for Patriot unit fully mission capable levels was above 90 percent, and that units that underwent recapitalization consistently experienced positive spikes in readiness. Further, this assessment highlighted the importance of the Army's reset program, noting that it must be sustained because deployed Patriot units are subjected to the highest pace of operations in the Patriot force.

Reset Equipment Is Often Returned Late to Units, and the Army Has Not Analyzed the Relative Importance of Factors Contributing to the Delays

During the period we reviewed, the Army often did not return reset equipment to units in accordance with the timelines established in Army regulation, which affected unit training. Although the Army has identified several factors that caused delays in returning equipment to units and monitors these factors, it has not assessed their relative importance.

The Army Often Returns Reset Equipment to Patriot Units Late, Which Affects Training

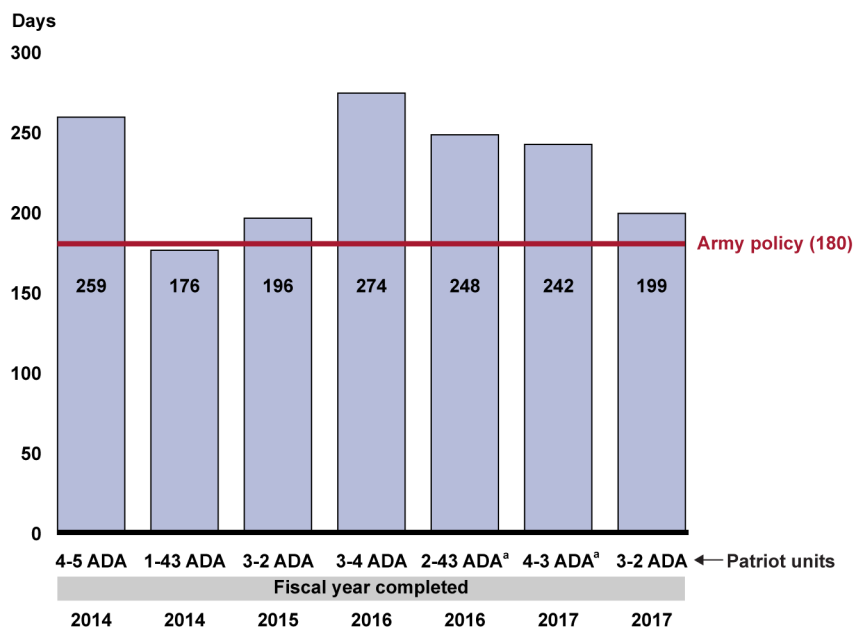
From fiscal years 2014 through 2017, the Army often did not return reset equipment to units in accordance with the timelines established in the Army's keystone regulation governing its process to build ready forces.¹⁶ This regulation establishes phases through which a unit passes as it prepares for a potential deployment. The first of these, the reset phase, begins when a majority of the unit's personnel have returned from deployment and must last a minimum of 180 days. At the conclusion of the 180 days, the unit enters the train/ready phase, at which point it may be deployed again, and needs to have its equipment back in order to do so. Because of this standard, the Army must return a unit's equipment from reset within 180 days from the start of the unit's reset phase. From fiscal years 2014 through 2017, the Army reset seven battalions and for

¹⁵The Army conducted an assessment of Patriot readiness in 2014, which found that from 2009 to 2014 the overall Patriot system maintained fully mission capable rates above the Army's established goal, with an average across the force of 92.8 percent during that five-year period. See Army Fires Center of Excellence and Fort Sill Capability Development and Integration Directorate Memorandum, *Worldwide Assessment of Patriot Radar Operational Readiness* (Nov. 25, 2014).

¹⁶Army Regulation 525-29.

six of these battalions the Army did not return all of the units' equipment within 180 days. Two of these battalions—the 2-43 Air Defense Artillery and 4-3 Air Defense Artillery—experienced delays that were deliberately planned. Specifically, Army officials told us that the installation of system upgrades for these battalions extended the overall reset timeline by 60 days. One official stated that this was requested and approved, and explained that if the upgrades had been installed separately after equipment had been reset, it would have taken 4 months to conduct the work.¹⁷ However, as shown in figure 2, of the remaining five Patriot units that completed reset during the period we reviewed, only one received all of its returned equipment within 180 days.

Figure 2: Patriot Equipment Reset Timeliness for Units Completed in Fiscal Years 2014 through 2017



Source: GAO analysis of Army information. | GAO-18-447

Notes: Air Defense Artillery (ADA) is used as a designator in the names of Patriot units.

^aReset of the 2-43 ADA and 4-3 ADA in fiscal years 2016-2017 included concurrent upgrades of equipment that added, according to officials, 60 days to their reset periods.

¹⁷Modernization upgrades include obsolete parts replacement as well as installation of touch-enabled flat-screen panels to replace old Cathode Ray Tube displays.

Patriot battalion officials we interviewed told us that delays in the receipt of reset equipment forced them to modify their scheduling and execution of required collective training. For example, one battalion commander we spoke with said that without equipment his battalion could not effectively train for some collective tasks, such as exercises that require moving the system. Additionally, leadership from two battalions we spoke with told us that the late return of reset equipment compressed the training time available for them to conduct field exercises. This can create unnecessary challenges in meeting Army training requirements as units progress through the Army's process for building ready units. Specifically, according to the Army's force generation guidance, a unit is expected to be ready to redeploy on day 181 after returning from its last deployment to its home station.¹⁸ As one battalion commander described, the collective-level training that units conduct during these shortened windows is "sufficient, but not optimal."

Patriot units have utilized a series of actions to mitigate the impact of delays in equipment receipt after maintenance, but such mitigation actions are sometimes not feasible or optimal. For example, Patriot unit officials told us that the Army shares equipment between battalions that are collocated on the same installation, but at different points in the readiness building timeline. Specifically, when one battalion turns in equipment for reset, certain pieces of equipment from another battalion on the same installation, if available, might be borrowed to conduct training. Battalion officials noted, however, that this measure may not always be feasible. Leadership from two Patriot battalions, for example, cited instances where their units were unable to train during their reset periods and could not borrow equipment from other battalions located on the same installation because those battalions were deployed. In addition, units use simulators to conduct individual-level training to give personnel experience with new system upgrades, though Patriot brigade officials noted this is a stopgap measure while units are without equipment and does not allow for collective training. Lastly, Patriot units can—once delayed equipment arrives or via borrowing equipment—conduct some collective training for extended hours (i.e. during evenings) each day while at their home station, but a battalion official noted that doing so is also not optimal for unit morale.

¹⁸Army Regulation 525-29.

Battalion commanders we spoke with told us that their units were sufficiently trained and ready to deploy, despite the delays in the return of the equipment to the units. However, a memorandum from a brigade commander noted that given the high pace of operations, it is important that units receive their equipment in a timely manner to enable them to complete training for their next deployment, as delays can create a notable impact on crew and collective training.¹⁹ The late return of reset equipment could therefore have a detrimental impact on units' ability to conduct training to meet assigned missions.

The Army Has Identified Factors Affecting Maintenance Timeliness

The Army has identified several factors affecting the timeliness of Patriot maintenance as shown in table 2.

Table 2: Factors Affecting Timeliness of Patriot Equipment Reset

Factor	Description
Preventive maintenance	Lack of unit leadership emphasis on preventive maintenance can result in additional depot work
Unexpected damage	Unreported damage to equipment results in unexpected depot work tasks
Supply chain challenges	Depot experiences challenges in obtaining needed repair parts
Depot quality controls	Internal depot quality controls identify depot work or parts deficiencies that require additional time to correct
Equipment transportation	Time equipment spends in transportation to and from the depot reduces available time for depot work

Source: GAO analysis of Army information. | GAO-18-447

Some of the factors affecting timeliness, as identified by Army officials, are directly within the control of Letterkenny, where reset is conducted, and some are not. Specifically, Army officials stated that U.S. Transportation Command and the Defense Logistics Agency also have responsibilities related to some of the factors that can affect timeliness, such as the transport of equipment and availability of parts, respectively. These factors are discussed in more detail below.

¹⁹In a previous report on Department of Defense readiness issues, we noted that, according to the Army, one of the greatest challenges inhibiting readiness recovery is difficulty maintaining collective training proficiency in its core competencies due to a lack of personnel depth and experience. See [GAO-16-841](#).

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- *Preventive maintenance.* According to Army officials and Army documentation, the unit leadership of some deployed Patriot battalions do not emphasize preventive maintenance. As a result, equipment may not be properly maintained to Army standards and can create additional work tasks for depot personnel when they receive it, such as conducting additional or more detailed inspections.
 - *Unexpected damage.* Army officials cited some instances where equipment sent to the depot arrives in worse than expected condition, either due to damage incurred during transport or because unit personnel did not accurately report the condition of the equipment prior to turning it in. For example, in December 2017 Letterkenny officials documented that a battalion's missile launcher was returned to the depot with unexpected severe corrosion on power cables, and certain equipment items, such as generators, were completely inoperable. Officials cited another instance where a radar was pressure-washed prior to its return to the depot, causing extensive damage. These kinds of unexpected conditions result in greater repair work than anticipated for depot employees.
 - *Supply chain challenges.* Officials at Letterkenny told us that their forecasts for parts orders have not been consistently met via Army and Department of Defense supply chain processes, but that the depot was taking steps to improve its own forecasting.²⁰ An official also noted that problems can arise if sole-source suppliers for critical parts go out of business, or if they have to order parts that are no longer regularly produced by vendors due to obsolescence.²¹ Patriot program office officials provided an example of a radio that is part of the Patriot system and is no longer in production, and noted that the program office was working with Army headquarters officials to identify a solution.

²⁰Letterkenny officials stated that the depot is in the early stages of adopting cost and schedule performance index metrics, which they believe have the potential to improve the depot's forecasting and better inform program manager decision making. We have previously reported on Army supply planning and made recommendations for the Department of Defense to adopt cost and planning metrics. See [GAO-16-450, *Defense Inventory: Further Analysis and Enhanced Metrics Could Improve Service Supply and Depot Operations*](#) (Washington, D.C.: June 9, 2016).

²¹We have previously recommended that the Department of Defense should develop a mechanism to ensure that program offices obtain information from contractors on single source of supply risk. See [GAO-17-768, *Defense Supply Chain: DOD Needs Complete Information on Single Sources of Supply to Proactively Manage the Risks*](#) (Washington, D.C.: Sept. 28, 2017).

The Army uses a series of measures to mitigate parts availability issues, such as having the depot utilize its own equipment to fabricate some items on short notice (see fig. 3) and, according to Army officials, by taking parts from incoming equipment and using them for equipment nearing completion of maintenance. Additionally, in July 2017, the depot received permission to purchase critical “long-lead” parts for specific Patriot items in advance of anticipated need, although, according to officials, as a general rule and practice, the depot is not allowed to purchase items without funding in place.²² Letterkenny officials told us that in cases where they are unable to acquire critical parts, or lack the funds to do so, delays can occur.

Figure 3: Example of Patriot Equipment Item Fabricated by Letterkenny Army Depot



The item at left was fabricated by Letterkenny Army Depot in order to reduce the frequency of failures from the original part, shown on the right. Depot officials told us that the depot-manufactured part was constructed from a single piece of metal, eliminating the weakness of the welds in the original item.

Source: Letterkenny Army Depot. | GAO-18-447

- *Depot quality controls.* Time spent remedying maintenance errors and quality defects—such as incorrect assemblies, defective parts, or improper painting during depot operations—may contribute to the depot’s timeliness challenges.²³ Army officials stressed that the Patriot system is complex, and certain maintenance tasks can be challenging because it can be difficult to isolate equipment faults. For

²²Letterkenny officials told us that to accomplish this they must ensure funds are available to purchase these parts when necessary.

²³GAO previously reported in February 2017 on some of the Army depots’ challenges and efforts to implement process improvements to better meet production schedules. See [GAO-17-82R](#), *Depot Maintenance: Executed Workload and Maintenance Operations at DOD Depots* (Washington, D.C.: Feb. 3, 2017).

example, the Patriot radar system is composed of thousands of elements (see fig. 4), which, according to officials, requires extensive testing to ensure that each element is operational. Depot officials told us that their processes are designed to ensure that finished products meet operational standards, and that doing so sometimes takes longer than expected. Letterkenny uses a series of metrics and reporting methods, such as internal tracking of defects and surveys and reports from customers, to monitor, document, and correct quality defects during the Patriot maintenance process to ensure that any maintenance errors or defects are identified before the equipment is returned to units.

Figure 4: Example of Patriot Radar and Its Elements Undergoing Maintenance



Patriot radar undergoing maintenance.

Source: Letterkenny Army Depot. | GAO-18-447

However, quality defects that may affect timeliness can still arise. Each fiscal year Letterkenny establishes a target for hours spent at the depot correcting quality defects that arise during maintenance, which are then tracked and used as indicators of the overall quality of the maintenance process.²⁴ As tracked by the depot, the monthly time spent correcting quality defects varied, when averaged across each year. Specifically, the average in fiscal year 2015 was below the depot's set target, but the averages in fiscal years 2014, 2016, and 2017 exceeded the targets. For example, the time spent correcting quality defects ranged from 846 hours

²⁴While tracked by Letterkenny, this data is maintained separately from overall depot timeliness data.

a month in fiscal year 2016 to 1,242 hours a month in fiscal year 2017, above those years' monthly target of 800 hours.

- *Equipment transportation.* Transportation time is included in the 180-day policy for returning equipment from reset to Patriot units, and it often takes a significant amount of time before equipment is transported to the depot from theater. As such, according to Army documentation, the depot can be left with only 120 days to complete reset work before it has to return equipment back to units if it is to meet the 180-day policy. According to Army documentation, to mitigate this issue the Army airlifts a number of critical Patriot equipment items, such as radars, from theater to the depot so that reset work can begin earlier on these items. Additionally, unit officials and a program official involved in planning for the Army's reset process noted that equipment items are sent back from the depot as soon as reset work is completed; the depot does not wait until the entire unit equipment set is complete. However, as shown previously in figure 2, these kinds of mitigation actions with respect to transportation have not been sufficient in ensuring that units receive all of their equipment back within the 180 days allowed by policy.

Army Monitors Factors Affecting Maintenance Timeliness, but Has Not Conducted an Analysis of Their Relative Importance

Although the Army monitors the factors that have affected maintenance timeliness, it has not conducted an analysis to identify their relative importance. According to Army documents and officials we interviewed, the Army monitors and uses a number of processes to identify, discuss, and select mitigation actions for factors affecting maintenance timeliness, such as:

- *Quarterly working group meetings of Patriot stakeholders.* The Army monitors maintenance timeliness via a quarterly working group, which includes representatives from key Army Patriot stakeholder organizations such as Training and Doctrine Command, Aviation and Missile Command, Letterkenny, and Patriot unit higher command headquarters. Any timeliness issues discussed at such meetings, such as potential training impacts and transportation delays, are conveyed to units afterwards.
- *Letterkenny weekly production meetings.* Letterkenny command staff hold weekly production meetings to discuss various issues affecting maintenance production, identify potential factors that could delay depot work, and select mitigation measures against such factors.
- *Army Materiel Command oversight of Letterkenny production.* Army Materiel Command monitors and tracks Letterkenny's actual and

projected maintenance performance against the scheduled completion dates for Patriot maintenance projects, and depot officials internally review the depot's performance for each Patriot equipment item each week before submitting the results to Army commands monthly.

Although Army officials are aware of challenges in returning reset equipment to Patriot units within the 180-day policy and have taken some steps to minimize these impacts, they could not quantify how much each of the factors affecting timeliness contributes to delays in completing maintenance and returning equipment to units. Moreover, based on our discussions with different stakeholders associated with the sustainment of the Patriot system, there are different perceptions as to the degree to which the various factors contributed to delays in completing maintenance and returning reset equipment to units. For example, during our meetings, depot officials indicated that supply chain issues were the primary timeliness challenge. In contrast, a senior program office official and unit officials emphasized the importance of transportation of equipment and its effects on timeliness. In addition, Letterkenny and Army stakeholders told us that while they work to identify and correct issues as they arise through the processes described above, their efforts to remedy these issues are conducted in isolation from one another and not compiled and compared to enable the Army to identify their relative importance in terms of each factor's effect on timeliness.

Although aware of the challenges of returning equipment to units in a timely manner, the Army has not comprehensively analyzed the relative importance of the various factors identified above that affect Patriot maintenance timeliness. Army Regulation 702-11 states that fact-based decision-making and the use of performance information to foster continuous improvement are essential activities of quality management and assurance.²⁵ Specifically, activities supporting logistics missions should engage in continued review, evaluation, and improvement. This regulation further states that Army Material Command, as the manager of the Army's quality program, should conduct performance reviews and assist other applicable organizations in developing corrective action plans, such as establishing protocols to mitigate risks and prevent recurrence of issues when nonconforming performance is identified. Although not required by Army regulation, one means of doing this is through conducting comprehensive analysis, such as comparing the

²⁵Army Regulation 702-11, *Army Quality Program* (Feb. 25, 2014).

relative importance of factors affecting performance in order to target improvement efforts.

A comprehensive analysis to identify the relative importance of factors could better position the Army to fully understand current and historic issues affecting its ability to complete Patriot equipment maintenance in a timely manner. Such an understanding would better inform corrective actions than isolated efforts and would position the Army to determine where best to target its efforts in order to ensure units receive equipment back in a timely manner to conduct training.

The Army Plans to Recapitalize Patriot Equipment Every 15 Years, but This Approach Introduces Some Challenges

The Army has decided to recapitalize each battalion set of Patriot equipment once every 15 years, while recognizing that this approach introduces some challenges to upgrading and supporting the system's readiness to meet its assigned missions through 2048. While the Army would prefer to recapitalize Patriot equipment every 10 years, the Army has reviewed two options for recapitalizing Patriot equipment more frequently and determined that these options are not feasible. According to Army documentation, the Army plans to continue sustaining and upgrading Patriot equipment to meet its long-term goal—which is to keep the system viable through 2048—by, for example, improving system reliability and enhancing its warfighting capabilities. The Army considers recapitalization a key program to achieve this goal. Specifically, in its 2014 readiness assessment of the Patriot force, the Army concluded that recapitalization is the single most important program with respect to keeping Patriot equipment viable and sustainable.²⁶ Officials from multiple Army organizations also told us that the age of the Patriot system makes replacement of expendable and aged components and insertion of new technology during recapitalization important to Patriot sustainment, readiness, and its ability to meet emerging threats.

While the Army has emphasized the importance of recapitalization in achieving its long-term goals for the Patriot system, the Army is not planning to adjust its recapitalization pace in the near term, as of March 2018. According to Army documentation, recapitalizing equipment every

²⁶Army Fires Center of Excellence and Fort Sill Capability Development and Integration Directorate Memorandum. *Worldwide Assessment of Patriot Radar Operational Readiness* (Nov. 25, 2014).

10 years would maintain the equipment at the Army's desired condition.²⁷ However, the Army's near-term schedule for recapitalization in fiscal years 2018 through 2022 and its long-term notional schedule for recapitalization of Patriot equipment through fiscal year 2031 both outline cycling one battalion per year through recapitalization. With 15 Patriot battalions, the pace of one battalion per year does not restore the equipment to its desired condition every 10 years.

According to Army Patriot officials, there are two main options for the Army to increase the pace of recapitalization, but each of these options poses challenges. These two options are:

- *Reduce the amount of equipment available for ongoing commitments and recapitalize it at the depot.* Officials told us that one way the Army could increase the pace of recapitalization would be to reduce the amount of equipment available for ongoing commitments, but that this is not feasible given the current high pace of operations. Further, the Army does not anticipate that operational requirements will lessen under the projected security environment. The near-term schedule assumes that ongoing operational commitments will not change and is designed to synchronize recapitalization with currently scheduled operational deployments and training. Army officials responsible for coordinating the near-term schedule told us that the near-term schedule has little flexibility given the Army's limited force structure of 15 battalions, and program and depot officials stated that if the Army were to recapitalize more than one battalion per year, the pool of battalions available to meet these current commitments would decrease.²⁸
- *Procure additional equipment to provide to units turning in equipment for recapitalization.* Army officials said that the Army could buy extra equipment to provide to additional units turning in their equipment for recapitalization if the Army wanted to accelerate the recapitalization pace. At the current pace of recapitalization, the Army has sufficient

²⁷Office of the Assistant Secretary of the Army for Acquisition, Logistics, and Technology Memorandum. *Implementation of Economic Useful Life* (Apr. 22, 2012); Army Fires Center of Excellence and Fort Sill Capability Development and Integration Directorate Memorandum, *Worldwide Assessment of Patriot Radar Operational Readiness*.

²⁸Additionally, adding another Patriot battalion to the Army's inventory may not enable accelerating the pace of recapitalization. Specifically, officials told us that requirements could increase given the current geopolitical and threat environment, and as such, any additional battalions added to the Army's inventory would likely be deployed to meet operational requirements.

quantities of major equipment items to ensure that as a Patriot battalion turns in equipment for recapitalization it receives recently recapitalized equipment back on a one-to-one basis and thus is generally not without equipment. This process prevents removing Patriot battalions from operational rotations during the recapitalization period. However, officials stated that if the Army were to adjust the pace to recapitalize more than the current one battalion per year, it would require buying more equipment to ensure that any additional units undergoing recapitalization would not be left without equipment. Army documents indicate that the Army has assessed whether to acquire additional equipment to enable an accelerated pace of recapitalization. However, an official with responsibility for the Patriot capability and senior Army headquarters officials with responsibility for Patriot resourcing and planning told us that the Army instead has prioritized developing a replacement for the Patriot radar. This replacement radar is expected to address capability needs related to radar reliability and range to better defend against advanced threats.²⁹ Army documentation indicates that this replacement radar is expected to reach initial operational capability in fiscal year 2025.

If the Army decided to reduce the amount of equipment available for ongoing commitments or buy more equipment, then the Army would also need to make additional investments in depot resources to support accelerating the pace of recapitalization. According to Army documents and officials we interviewed, these include personnel, facilities, and equipment. However, there are a number of challenges related to putting these resources in place.

- *Personnel.* Army documentation shows and depot officials stated that they would likely hire contractors to meet workload demands and the depot could add shifts if the Army decided to adjust the pace of recapitalization to what it considers an optimal pace. Depot officials also told us they would try to hire contractors with some Patriot experience and place them alongside more experienced personnel in order to preserve work quality, as they have done in response to previous surges in reset work. However, the Army recognizes that Letterkenny faces challenges in expanding its workforce due to a limited pool of available workers in the area around the depot.

²⁹A senior Army headquarters official responsible for Patriot planning told us that the Army has already begun discussions to procure sufficient quantities of the planned replacement for the Patriot radar to facilitate increasing the pace of Patriot recapitalization once the replacement is fielded.

Developing skilled Patriot maintenance personnel is also difficult. An Army study of the organic industrial base found that 11 of the 15 most critical personnel positions at Letterkenny are directly associated with Patriot maintenance and officials noted that, due to the complexity of the system, it can take up to 5 years for Patriot maintenance personnel to become proficient.³⁰

- *Facilities and equipment.* Depot officials stated that if the Army decided to adjust the pace of recapitalization to what it considers optimal, they would likely need to review, among other things, the tools, equipment, and facilities needed to support such an adjustment, as well as supply availability. They also told us that Letterkenny already has proposed expanding its facilities to meet projected future work, and the depot has planned for the plant equipment it will need to continue maintaining the Patriot system as upgrades are incorporated. However, they noted that it takes a full year to recapitalize the Patriot radar, including 3 months of testing, and that Letterkenny has one of only two radar test sites. Given the time required and the single test site, if the Army wanted to recapitalize more than one battalion a year, program officials stated that current conditions probably would not support doing so.

Continuing the current pace of recapitalization could introduce other challenges in meeting the Army's long-term goals for the Patriot system, and Army officials stated they are aware of these challenges. Specifically, Army documentation shows, and Army officials told us, that the current pace is not optimal and that it could introduce the possibility of equipment failure as specific items remain in use past the Army's desired timeframe for recapitalizing equipment every 10 years. Additionally, depot officials told us that their biggest concern with continuing recapitalization at its current pace is that there may be increased costs to conduct recapitalization due to the system's increasing age. As an example, they stated that there may be increased corrosion issues, adding that they have already seen a significant deterioration in the condition of some trailers. Also, the Army's decision to continue recapitalizing equipment every 15 years instead of every 10 years provides fewer opportunities to conduct modernization, which is often done in conjunction with recapitalization. Program officials stated that modernizing the system is important because upgrades reduce the number of items that can fail,

³⁰Army Materiel Command, *Army Materiel Command's Industrial Base Baseline Assessment Program Organic Industrial Base Workforce Fragility and Criticality Assessment* (September 2015).

thereby making field maintenance easier. Moreover, officials from one Patriot brigade stated that their main concern with respect to Patriot is that additional operational commitments could potentially slow modernization progress and affect the Army's capability to meet threats, particularly since the capabilities and sophistication of enemy threats continue to increase.

The Army has reviewed its options and the associated challenges related to increasing the pace of recapitalization and has decided the best path forward based on its review is to continue recapitalizing Patriot battalion equipment sets once every 15 years. However, this pace of recapitalization includes some risk—as identified by Army officials—and will likely create challenges in meeting the Army's long-term goals for the system.

Conclusions

Maintaining good equipment condition is particularly important given the current high pace of operations for Patriot units, as well as the potential for a further increase in operational requirements. However, the Army's reset process has often delivered equipment to units late, affecting units' ability to schedule and execute training as they prepare for their next mission. The Army is aware of the challenges in completing maintenance and returning reset equipment to units, and has identified several factors that contribute to delays, but has not analyzed how much each of the factors contribute to delays. Unless the Army conducts a comprehensive analysis of the relative importance of the factors affecting Patriot reset timeliness and develops and implements appropriate corrective actions to address the results of the analysis, it will not be positioned to target its efforts most effectively to take corrective actions.

Recommendation for Executive Action

We recommend that the Secretary of the Army ensure that Army Materiel Command, in coordination with its subordinate and other Army organizations as appropriate, conducts a comprehensive analysis of the primary factors affecting timeliness to identify their relative importance in the Army's Patriot reset program and develops and implements appropriate corrective actions. (Recommendation 1)

Agency Comments

In written comments on a draft of this report, the Department of the Army concurred with our recommendation. The department stated that it is taking steps to address the recommendation, noting that it will continue analysis between Army Materiel Command, Headquarters Department of

the Army, and the Patriot program office to identify and address factors that may affect reset timeliness. The Department of the Army's comments are reprinted in their entirety in appendix II. The department also provided technical comments, which we incorporated into the report as appropriate.

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

If you or your staff have any questions about this report, please contact me at (202) 512-3489 or pendletonj@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 III.



John H. Pendleton, Director
Defense Capabilities and Management

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Chairman

The Honorable Jack Reed
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Richard Shelby
Chairman

The Honorable Dick Durbin
Ranking Member
Subcommittee on Defense
Committee on Appropriations
United States Senate

The Honorable Mac Thornberry
Chairman

The Honorable Adam Smith
Ranking Member
Committee on Armed Services
House of Representatives

The Honorable Kay Granger
Chairwoman

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

Appendix I: Scope and Methodology

To evaluate the extent to which the Army's reset process supports the timely delivery of Patriot equipment back to units, we analyzed Army documents concerning recapitalization and reset activities. This included analysis of, among other things, documents describing the processes for Patriot battalion equipment transfers to and from Letterkenny Army Depot (Letterkenny), depot activities to recapitalize and reset equipment, and testing to ensure the equipment's proper operation. We also reviewed, among other documents, Army guidance on Patriot equipment status reporting, reset, materiel maintenance, and on ensuring the quality of Army programs; as well as planning schedules and documents on backorders and critical items. We evaluated the Army's processes to identify and correct factors causing any reset delays against Army guidance on program performance improvement.¹

Additionally, we analyzed data provided by the Army on Patriot equipment fully mission capable rates and the timeliness of Army Patriot reset activities from fiscal years 2014 through 2017—the most recent data available—to identify any trends. Specifically, we analyzed Patriot unit fully mission capable data as recorded by Army Aviation and Missile Command G-3 (Readiness) based on data submitted by Patriot operational units.² We analyzed it to corroborate statements regarding equipment readiness and the quality of maintenance work made by program and operational unit officials and to compare against the Army's goal for fully mission capable rates. To determine depot timeliness, we analyzed aggregate monthly data provided by the Army on Letterkenny's timeliness in completing Patriot maintenance activities against performance schedules. We also analyzed Patriot battalion-specific Army data on reset timeliness in order to determine the frequency with which Letterkenny met the reset timeliness policy.³ Finally, we reviewed Army data on the time spent re-working and re-inspecting equipment with quality deficiencies found during internal inspections at Letterkenny in order to inform our assessment of the potential effects of addressing quality deficiencies on depot timeliness.

We assessed the reliability of these data by reviewing available system documentation, such as user manuals and data dictionaries for each of

¹Army Regulation 702-11, *Army Quality Program* (Feb. 25, 2014).

²For guidance governing the reporting of Patriot unit readiness data, see Army Regulation 700-138, *Army Logistics Readiness and Sustainability* (Feb. 26, 2004).

³Army Regulation 525-29, *Army Force Generation* (Mar. 14, 2011).

the automated information systems from which the respective data were drawn. We manually checked the data for obvious errors and missing or outlier values. We administered data reliability questionnaires to officials familiar with the data systems and assessed their responses and answers to follow-up questions, and we interviewed cognizant officials about their data management practices and use of the data. Based on these steps, we found these data to be sufficiently reliable for our purposes, to include providing fiscal years 2014 through 2017 Patriot equipment fully mission capable rates, battalion-specific reset timeliness, and the time spent by the depot on correcting quality defects identified during internal inspections.

To describe the Army's plans for supporting the long-term viability of the Patriot system through recapitalization and any challenges associated with its plans, we analyzed Army regulations, guidance, and planning documents, as well as Army studies. These included, among others, the Army's recapitalization management policy; Army documents proposing and approving a recapitalization program for Patriot; Army studies of its depot workforce, worldwide Patriot equipment readiness, and Patriot operational demands in relation to available assets; and Army guidance on materiel maintenance and useful equipment life.⁴ We also analyzed, among other documents, the Army's near-term schedule synchronizing Patriot recapitalization, reset, incremental modernization, training, and deployment schedules for fiscal years 2018 through 2022 and a long-term notional schedule for the recapitalization of Patriot equipment, by battalion set, through 2031. We also reviewed depot equipment and personnel planning documents and the Patriot life-cycle management plan, among other planning documents.

For both objectives, we interviewed cognizant Army personnel involved in the planning and conduct of Patriot recapitalization and reset. We visited Letterkenny to speak with officials and observe the facilities and the conduct of Patriot maintenance activities. In addition, we interviewed officials with responsibility for Patriot funding; for monitoring Patriot unit readiness; as well as officials from two Patriot battalions that recently

⁴For example, see Army Fires Center of Excellence and Fort Sill Capability Development and Integration Directorate Memorandum, *Worldwide Assessment of Patriot Radar Operational Readiness*, (Nov. 25, 2014); Army Regulation 750-1, *Army Materiel Maintenance Policy* (Aug. 3, 2017); Department of the Army Memorandum, *Army Recapitalization Management Policy* (Apr. 11, 2001); Office of the Assistant Secretary of the Army for Acquisition, Logistics, and Technology Memorandum, *Implementation of Economic Useful Life* (Apr. 22, 2012). We did not assess the validity of the Army's studies.

underwent reset and their brigade headquarters; and one Patriot battalion that recently underwent recapitalization and its brigade headquarters to identify challenges, if any, with respect to these maintenance processes, such as any training or equipment transfer delays or maintenance deficiencies.⁵ The list of the organizations and offices we interviewed during the course of our review is below.

- Assistant Secretary of the Army for Acquisition, Logistics, and Technology
 - Acquisition Policy and Logistics Group
 - Program Executive Office, Missiles and Space, Redstone Arsenal, Huntsville, Alabama
 - Lower Tier Project Office, Redstone Arsenal, Huntsville, Alabama
- Headquarters, Department of the Army
 - G-3, Readiness Directorate
 - G-4, Logistics Maintenance Directorate: G-44 (M) Maintenance Sustainment Division
 - G-4, 3/5/7, Current Operations and Strategic Readiness Division
 - G-8, Programs and Priorities, Fires Division
- Army Materiel Command
 - Army Aviation and Missile Life Cycle Management Command, Redstone Arsenal, Huntsville, Alabama
 - Army Aviation and Missile Command Logistics Center, Redstone Arsenal, Huntsville, Alabama
 - Letterkenny Army Depot, Chambersburg, Pennsylvania
- Army Forces Command
 - 32nd Army Air and Missile Defense Command, Fort Bliss, Texas
 - 11th Air Defense Artillery Brigade, Fort Bliss, Texas
 - 3-43 Air Defense Artillery Battalion, 11th Air Defense Artillery Brigade, Fort Bliss, Texas

⁵The information we collected from operational unit officials was not generalizable across the Patriot force.

- 31st Air Defense Artillery Brigade, Fort Sill, Oklahoma
- 3-2 Air Defense Artillery Battalion, 31st Air Defense Artillery Brigade, Fort Sill, Oklahoma
- 4-3 Air Defense Artillery Battalion, 31st Air Defense Artillery Brigade, Fort Sill, Oklahoma
- U.S. Army Training and Doctrine Command
 - Fires Center of Excellence, Fort Sill, Oklahoma
 - Training and Doctrine Command Capability Manager – Army Air and Missile Defense Command, Fort Sill, Oklahoma

We conducted this performance audit from June 2017 to June 2018 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: Comments from the Department of the Army



DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY
ACQUISITION LOGISTICS AND TECHNOLOGY
103 ARMY PENTAGON
WASHINGTON, DC 20310-0103

MAY 1 0 2018

Mr. John Pendleton
Director
Defense Capabilities and Management
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Mr. Pendleton:

This is the Department of Defense (DoD) response to the Government Accountability Office (GAO) Draft Report, GAO 18-447SU, "MILITARY READINESS: Analysis of Maintenance Delays Needed to Improve Availability of Patriot Equipment for Training," dated 20 April 2018 (GAO Code 102120).

DoD concurs with the recommendation in the GAO report and is taking steps to address the recommendation. Specifics regarding comments to the recommendation are enclosed. DoD appreciates this opportunity to address the GAO recommendations for improving Patriot Availability.

Sincerely,

A handwritten signature in black ink, appearing to read "Jeffrey S. White", is positioned above the typed name.

Jeffrey S. White
Principal Deputy Assistant Secretary of the Army
(Acquisition, Logistics, and Technology)

Enclosure

**GAO Draft Report Dated April 20, 2018
GAO-18-447SU (GAO CODE 102021)**

**“MILITARY READINESS: ANALYSIS OF MAINTENANCE DELAYS NEEDED TO
IMPROVE AVAILABILITY OF PATRIOT EQUIPMENT FOR TRAINING”**

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

RECOMMENDATION: The GAO recommends that the Secretary of the Army ensure that Army Materiel Command, in coordination with its subordinate and other Army organizations as appropriate, conducts a comprehensive analysis of the primary factors affecting timeliness to identify their relative importance in the Army’s Patriot reset program and develops and implements appropriate corrective actions.

DoD RESPONSE: Concur. Continue analysis between the Army Materiel Command, Headquarters, Department of the Army G4 (Logistics), and Program Executive Office Missiles and Space to identify and address factors which may affect reset timeliness.

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

John H. Pendleton, (202) 512-3489 or pendletonj@gao.gov

Staff Acknowledgments

In addition to the contact named above, individuals who made key contributions to this report include Kevin O'Neill, Assistant Director; Jason Blake, Vincent Buquicchio, Clarice Ransom, Michael Silver, Erik Wilkins-McKee, and Matthew Young.

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