



July 2021

TACTICAL WHEELED VEHICLES

Army Should Routinely Update Strategy and Improve Communication with Industry

Accessible Version



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GAO Highlights

Highlights of [GAO-21-460](#), a report to congressional committees

Why GAO Did This Study

Due to an increase in near-peer competition from Russia and China, the Army recently changed its operational focus. With this change in focus, the Army is currently studying ways to modernize its TWV fleet. This modernization relies, in part, on a viable industrial base with multiple companies that can compete to deliver the capabilities needed by the warfighter at an affordable price.

The House and Senate Armed Services Committee reports accompanying the National Defense Authorization Act for Fiscal Year 2021 included provisions for GAO to assess the Army's new TWV strategy and implementation efforts. This report assesses, among other things, the Army's progress in identifying specific capabilities and requirements for its 2022 TWV Strategy and the extent to which opportunities exist for expanding the TWV industrial base.

GAO reviewed documents related to the Army's 2022 TWV Strategy; assessed the design for the Army's ongoing TWV study; analyzed contracting data for fiscal years 2015 through 2020; reviewed industrial base studies; and interviewed DOD and industry representatives.

What GAO Recommends

GAO is recommending that the Army routinely update its TWV Strategy to account for evolving information and circumstances, and that it improve communication with industry. The Army concurred with both recommendations.

View [GAO-21-460](#). For more information, contact Jon Ludwigson at (202) 512-4841 or ludwigsonj@gao.gov.

July 2021

TACTICAL WHEELED VEHICLES

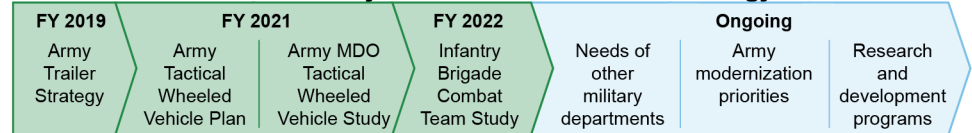
Army Should Routinely Update Strategy and Improve Communication with Industry

What GAO Found

The Army is currently studying ways to modernize its fleet of tactical wheeled vehicles (TWV). TWVs range from light utility vehicles, such as Humvees, to heavy equipment transporters, and support a variety of combat operations by transporting soldiers and materiel such as munitions, water, and fuel.

The Army expects to issue a new TWV Strategy in 2022. Central to informing the TWV Strategy is a TWV study, set to issue in July 2021, which is to identify the capabilities and requirements needed for TWVs to support the strategy. There are, however, other more narrowly focused initiatives that also could influence planning for the TWV fleet (see figure).

Relevant Initiatives for the Army Tactical Wheeled Vehicle Strategy



FY = Fiscal year

MDO = Multi-Domain Operations

Sources: GAO review of Army documents and interviews with Army officials. | GAO-21-460

Text of Relevant Initiatives for the Army Tactical Wheeled Vehicle Strategy

- FY 2019: Army Trailer Strategy
- FY 2021:
 - Army Tactical Wheeled Vehicle Plan
 - Army MDO Tactical Wheeled Vehicle Study
- FY 2022: Infantry Brigade Combat Team Study
- Ongoing:
 - Needs of other military departments
 - Army modernization priorities
 - Research and development programs

Sources: GAO review of Army documents and interviews with Army officials. | GAO-21-460

According to Army officials, there is no Army directive, policy, or guidance to update the strategy beyond what is expected to be issued in 2022. If, however, the Army does not routinely update the TWV strategy to consider information that is developed over time from other initiatives, the service risks using outdated and incomplete information to manage its fleet of TWVs.

Analyses from the Departments of Defense (DOD) and Army—as well as analysis conducted by GAO for this review—indicate that the Army could expand the current industrial base for TWVs. This is due in part to a healthy commercial truck market. According to trade association and company representatives, however, there are several challenges that deter commercial companies from participating in the defense market, including inconsistent communication from

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the Army. For example, industry officials noted that, in the past, the Army has communicated the need for improved capabilities, which causes the companies to then expend their own funds. When the Army chose not to pursue these capabilities, the companies then lost their investment and thus were less likely to be involved in future efforts. Without taking steps to improve its communication with industry, the Army could miss opportunities to increase companies' participation in TWV modernization efforts, facilitate competition, and benefit the taxpayer and the warfighter.

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Abbreviations

DOD	Department of Defense
FY	fiscal year
HHI	Herfindahl–Hirschman Index
MDO	multi-domain operations
MRAP	Mine Resistant Ambush Protected
TWV	tactical wheeled vehicle

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July 15, 2021

The Honorable Jack Reed
Chairman
The Honorable James M. Inhofe
Ranking Member
Committee on Armed Services
United States Senate

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

Due to the drawdown in the global war on terror and rising concern over competition with Russia and China, the Department of the Army (Army) recently changed its operational focus from counterinsurgency to deterring and planning for potential conflict with near-peer competitors. Tactical wheeled vehicles (TWV)—such as the High Mobility Multi-purpose Wheeled Vehicle, popularly known as the Humvee—are critical to support the warfighter, including potential operations against near-peers. According to Army-provided TWV data, the Army has a requirement for over 218,000 TWVs and currently has over 242,000 vehicles in its fleet. The Army is conducting a study to inform development of a new strategy to modernize its TWV fleet. According to Army documentation, the procurement of new or modernized vehicles to support this strategy relies, in part, on a viable industrial base with multiple companies that can compete to deliver the capabilities needed by the warfighter at a price the nation can afford.

The House Armed Services Committee report accompanying the National Defense Authorization Act for Fiscal Year 2021 and the Senate Armed Services Committee report accompanying a bill for the same act included provisions for GAO to assess the Army's new TWV strategy and implementation efforts as well as an analysis of the TWV industrial base and the potential for competition.¹ This report assesses (1) the Army's

¹House Report No. 116-442 accompanying the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021, Pub. L. No. 116-283 (Jan. 1, 2021) and S. Rep. No. 116-236, accompanying S. 4049, 116th Cong. (2nd Sess. 2020).

progress in identifying specific capabilities and requirements for its 2022 TWV Strategy, (2) the extent to which the Army has pursued opportunities for competition in contracts for TWVs, and (3) the extent to which opportunities exist for expanding the TWV industrial base.

For the first objective, the 2022 TWV Strategy, and the 2021 Multi-Domain Operations TWV Study, which supports the Strategy, are not yet complete. In the absence of this information, as agreed with your staff, we analyzed other available documentation, including Army budget submissions. In addition, we assessed the Multi-Domain Operations TWV Study's design against generally accepted research standards identified in our prior report.² We also reviewed the federal standards for internal control on the use of quality information to achieve an entity's objectives.³ We interviewed Army officials from organizations such as Army Futures Command Futures and Concepts Center; the Office of the Deputy Chief of Staff, G-8; and the Program Executive Office for Combat Support & Combat Service Support to obtain their perspectives on the study.

For the second objective, we obtained and analyzed Army contract and other transaction agreement data for fiscal years 2015 through 2020. We assessed the reliability of the data by comparing them to data in the federal contracting database and clarifying discrepancies between the data sets with Army contracting officials. We determined that the data were sufficiently reliable for reporting on TWV contracts. In addition, we reviewed Army initiatives for facilitating future competition. We interviewed Army officials from the Program Executive Office for Combat Support & Combat Service Support, and Army Futures Command Ground Vehicle Systems Center to obtain their perspectives on the contracts and other transaction agreements.

For the third objective, we reviewed Department of Defense (DOD) and Army industrial base studies on the viability of the TWV industrial base. In addition, we conducted a market concentration analysis, covering calendar years 2015 through 2019, of the commercial truck industry. We also reviewed the federal standards for internal control related to quality information and communication with outside entities.⁴ We interviewed

²GAO, *Army Combat Vehicles: Industrial Base Study's Approach Met Research Standards*, [GAO-15-548](#) (Washington, D.C.: June 16, 2015).

³GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: Sept. 10, 2014).

⁴[GAO-14-704G](#).

industry association and companies' representatives as well as DOD and Army industrial base assessment officials to obtain their perspectives on the viability of the industrial base. See appendix I for additional details on our scope and methodology.

We conducted this performance audit from August 2020 to July 2021 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

Tactical Wheeled Vehicles and Multi-Domain Operations

The Army's TWV fleet is a portfolio of wheeled vehicles designed to meet a variety of needs to support combat operations. The TWV fleet is critical for transporting soldiers and materiel such as munitions, armored vehicles, water, food, and fuel, on the battlefield. These vehicles are capable of operating on primary and secondary roads, trails, and cross-county terrain. To meet the Army's warfighting mission requirements, TWVs must be deployable by road, air, sea, and rail to any battlefield in all climate conditions. The Army currently has in its fleet over 242,000 TWVs across light, medium, and heavy classes as well as over 100,000 trailers for these vehicles. Each class generally includes multiple variants built on a common chassis. For example, the Army's Family of Medium Tactical Vehicles consists of 2.5- and 5-ton capacity trucks, each with the same chassis and includes cargo, tractor, van, wrecker, and dump truck variants. Figure 1 provides information on TWVs.

Figure 1: Classes and Examples of Tactical Wheeled Vehicles



Sources: GAO analysis of Army program office information (data); Oshkosh Corporation (Family of Medium Tactical Vehicles image); U.S. Army (other images). | GAO-21-460

Text of Figure 1: Classes and Examples of Tactical Wheeled Vehicles

- Tactical wheeled vehicle class: Light Gross vehicle weight (pounds) 8,000 to 24,000
 - High Mobility Multi-purpose Wheeled Vehicle Number in fleet: 113,014 Manufacturer: AM General
 - Joint Light Tactical Vehicle Number in fleet: 8,806 Manufacturer: Oshkosh Defense
 - Infantry Squad Vehicle Number in fleet: 21, Manufacturer: GM Defense
 - Army-Ground Mobility Vehicle 1.1, Number in fleet: 168, Manufacturers: General Dynamics and Flyer Defense
- Tactical wheeled vehicle class: Medium, Gross vehicle weight (pounds), 28,000 to 49,000
 - Family of Medium Tactical Vehicles, Number in fleet: 67,979, Manufacturers: Oshkosh Defense, Stewart and Stevenson, and BAE Systems
- Tactical wheeled vehicle class: MRAP, Gross vehicle weight (pounds) 37,000 to 56,000
 - Mine Resistant Ambush Protected (MRAP) Vehicles, Number in fleet: 8,466, Manufacturers: Oshkosh Defense, Navistar Defense, General Dynamics, and BAE Systems
- Tactical wheeled vehicle class: Heavy, Gross vehicle weight (pounds) 62,000 to 91,000
 - Heavy Dump Truck, Number in fleet: 1,037, Manufacturers: Mack Defense, AM General, and Freightliner
 - Heavy Expanded Mobility Tactical Truck, Number in fleet: 26,475, Manufacturer: Oshkosh Defense
 - Palletized Load System, Number in fleet: 7,479, Manufacturer: Oshkosh Defense
 - Heavy Equipment Transporter System, Number in fleet: 2,161, Manufacturer: Oshkosh Defense
 - Line Haul Tractor Truck, Number in fleet: 7,313, Manufacturer: Freightliner

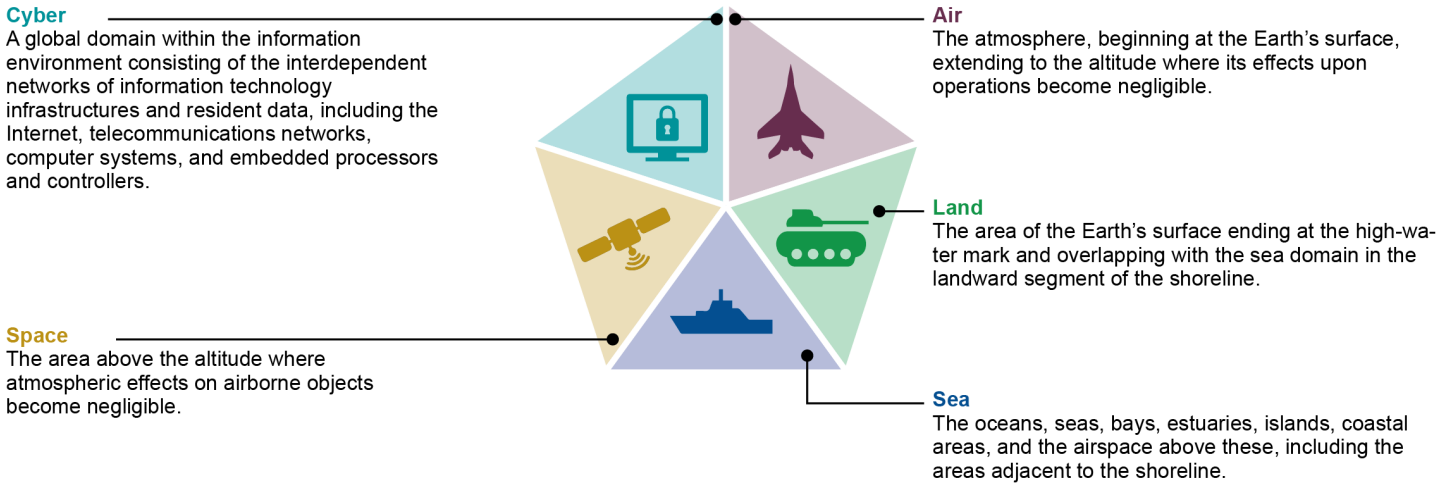
Sources: GAO analysis of Army program office information (data); Oshkosh Corporation (Family of Medium Tactical Vehicles image); U.S. Army (other images). | GAO-21-460

The Army has identified modernizing its TWV fleet as a key priority. Many of the Army's TWVs are based on designs last updated prior to the year 2000. In addition, the Army would like to incorporate advances in technology to make the fleet more efficient and useful in future operations and conflicts. For the purposes of our review, we define the capabilities of TWVs as the technologies and abilities needed to achieve a specific mission, for example, the fuel capacity, or equivalent, needed to travel 300 miles. We also define requirements as the number and types of TWVs needed to achieve Army objectives.

As the Army considers how best to modernize its fleet of TWVs, it is also planning for changes in the way it intends to operate on the battlefield. Due to the rise of near-peer competitors such as China and Russia, the Army is developing a new warfighting concept to guide how it will engage jointly with other services in multiple domains. This concept, known as multi-domain operations (MDO), centers on presenting adversaries with multiple challenges through the combination of capabilities across land, air, sea, cyber, and space simultaneously. The Army plans to have a MDO-capable force in a single theater by 2028. The Army's plans to change how it operates on the battlefield will affect its capabilities and requirements planning for vehicles within the TWV portfolio. We have reported previously on other adjustments the Army is making to its units for MDO. We also recommended in 2019 that the Army comprehensively assess the risk associated with staffing, equipping, and training such units. The Army concurred with the recommendation and stated that it will conduct a risk assessment in accordance with its policy and procedures before activating any new units.⁵ See figure 2 for descriptions of the domains.

⁵GAO, *Future Warfare: Army Is Preparing for Cyber and Electronic Warfare Threats, but Needs to Fully Assess the Staffing, Equipping, and Training of New Organizations*, [GAO-19-570](#) (Washington, D.C.: Aug 15, 2019).

Figure 2: Domains within the Multi-Domain Operations Concept



Source: GAO analysis of Department of Defense information. | GAO-21-460

Text of Figure 2: Domains within the Multi-Domain Operations Concept

- **Cyber:**
A global domain within the information environment consisting of the interdependent networks of information technology infrastructures and resident data, including the Internet, telecommunications networks, computer systems, and embedded processors and controllers.
- **Air:**
The atmosphere, beginning at the Earth's surface, extending to the altitude where its effects upon operations become negligible.
- **Land:**
The area of the Earth's surface ending at the high-water mark and overlapping with the sea domain in the landward segment of the shoreline.
- **Sea:**
The oceans, seas, bays, estuaries, islands, coastal areas, and the airspace above these, including the areas adjacent to the shoreline.
- **Space:**
The area above the altitude where atmospheric effects on airborne objects become negligible.

Source: GAO analysis of Department of Defense information. | GAO-21-460

Industrial Base and Competition

The Army relies on a diverse industrial base for development and production of TWVs. The U.S. defense industrial base is the combination of people, technology, institutions, technological know-how, and facilities used to design, develop, manufacture, and maintain the weapons needed to meet U.S. national security objectives. The base encompasses all the components of the acquisition life cycle: research and development, production, and maintenance and repair. It includes companies that manufacture the vehicles as well as the companies that manufacture the parts of those vehicles, such as engines, transmissions, axles, armor, and trailers. For the purposes of this report, when we refer to the TWV industrial base, we are referring to the collection of companies that currently supply vehicles and related parts to the Army.

Competition within the industrial base is the cornerstone of a sound acquisition process and a critical tool for the government to achieve the best prices and return on investment for taxpayers. According to DOD documentation, competition enhances a strong defense industrial base which provides an operational surge capability to handle demand spikes. It also provides opportunities for capable small businesses to enter new markets. Federal statutes and the Federal Acquisition Regulation, as well as DOD and Army regulations, generally require that contracts be awarded competitively, with full and open competition, but recognize that such competition is not feasible in all circumstances, and authorize agencies to make awards without full and open competition under certain conditions, which we refer to as a non-competitive award.

Generally, contracts awarded using other than full and open competition must be supported by written justifications and approvals that contain sufficient facts and rationale to justify the use of the specific exception to full and open competition. The approval level for these types of contracts varies according to the dollar value of the procurement. Agencies are generally required to perform acquisition planning and conduct market research to promote full and open competition. In 2015, Congress granted DOD permanent authority to enter into transactions known as other transaction agreements for prototype projects, for which DOD is required to use competitive procedures to the maximum extent practicable when entering into these agreements. DOD can exercise this authority to, among other things, carry out prototype projects that can demonstrate whether technologies and products developed by companies can be adapted for DOD's use. These agreements can help DOD attract

companies that do not typically do business with DOD. This is because other transaction agreements are not subject to many federal statutes and regulations that apply to government procurement contracts, allowing DOD and companies to negotiate terms and conditions specific to a project. DOD may enter into these transactions with a consortium, which may be composed of various types of entities including non-defense companies, and may be managed by a management company.

Industry concentration is often used as an indicator of market competitiveness for specific goods or services. When a market is highly concentrated, a small number of companies supply a large share of the market, although that does not preclude the presence of multiple companies in that market. In less concentrated markets, the share of the market is distributed more evenly across a large number of companies in the market. For the purposes of this report, when we refer to the commercial truck industry, we are referring to the companies that sell these types of vehicles.

The Army's 2022 TWV Strategy Will Not Capture Information from All Relevant Initiatives for Determining TWV Needs

The Army is developing a new TWV strategy for 2022 to guide decisions on TWVs, but the strategy will not capture all relevant initiatives for determining TWV needs. To inform its 2022 TWV Strategy, the Army is first conducting a study—set to issue in July 2021—to identify the capabilities and requirements needed for TWVs in the MDO environment. The study has completed its design phase and is currently in the process of completing the execution phase. In addition, there are a number of other relevant initiatives underway that could have implications for Army TWV capabilities and requirements. Because some of these studies will continue beyond the scheduled 2022 completion of the TWV Strategy, that strategy could benefit from updates in the future to account for evolving information and circumstances. According to Army officials, currently there is no direction or requirement to update beyond 2022.

The Army Is Formulating Its First TWV Strategy Since 2014

In light of its shift from fighting counterinsurgencies to deterring near-peer competitors, the Army expects to release a new TWV strategy by 2022. The Army last issued a TWV strategy to outline the actions needed to adjust fleet size and mix in 2014. According to Army officials, the Department of the Army is not required to routinely or regularly publish a TWV strategy.

According to Army documentation, the 2022 TWV Strategy is expected to encompass an enterprise-wide view of the TWV fleet and synchronize the plans and actions of Army agencies involved in TWV requirements, procurement, integration, sustainment, and management. Further, the new TWV strategy is expected to inform the selection of capabilities, fleet acquisition, management plans, and the development of Army funding requests. In January 2020, while planning to update the TWV strategy, the Vice Chief of Staff of the Army expressed concern that the fleet was not optimized in terms of quantity and quality for MDO and cited reduced investments in TWVs. Responding to these concerns, the Deputy Chief of Staff, G-8—who leads the office that analyzes and determines available resources—requested that the Army Futures Command’s Futures and Concepts Center conduct a study to identify required capabilities and requirements of the TWV fleet in a MDO force.⁶

Army Is Informing Its TWV Strategy through Multi-Domain Operations Study

According to Army officials, to inform its 2022 TWV Strategy, the Army is first conducting a 2021 MDO TWV Study to identify the capabilities and requirements needed for TWVs in an MDO environment by 2028. As directed by Army senior leadership, the Army Futures Command’s Futures and Concepts Center is conducting the study, which, according to Army officials, is scheduled for completion by July 2021.

⁶Department of the Army, Deputy Chief of Staff, G-8, Memorandum, *Tactical Wheeled Vehicle Study* (Apr. 30, 2020), and Army Tactical Wheeled Vehicle Study Advisory Group Briefing (May 28, 2020).

To determine the necessary capabilities and requirements, the Army is using a process that focuses on three areas that encompass how TWVs are used on the battlefield:⁷

- **Mobility.** The ability of a unit to move from point A to B using only its own assets, expressed as a percentage. For example, an airborne unit is required to be 100 percent mobile.
- **Launch and Support Platforms.** Some TWVs are used as a platform for weapon systems such as the High Mobility Artillery Rocket System or communication systems.⁸
- **Distribution and Transportation.** The conveyance and delivery of supplies, equipment, and troops; for example, truck companies that deliver water, fuel, ammunition, and food to the battlefield.

Initial Steps in the Ongoing Multi-Domain Operations TWV Study Are Generally Consistent with Relevant Standards

While the 2021 MDO TWV Study is not yet complete and we cannot assess whether the study will fully support the TWV Strategy, we found that the portions of the study we were able to assess were consistent with generally accepted research standards.⁹ These research standards identify three key elements of a study: design, execution, and presentation. A full list of the generally accepted research standards by which we assessed portions of the Army's 2021 MDO TWV Study are included in appendix II.

Design. The design of a study includes, for example, establishing the objective, scope, and methodology of a study, and identifying assumptions related to the study. We assessed the study's objective, scope, methodology, and assumptions, and determined that the study's overall design is consistent with generally accepted research standards.

⁷A Capabilities Based Assessment provides an analytic basis to identify capability requirements and associated capability gaps prior to development and submission of capability requirements documents for review and validation.

⁸The Army refers to launch and support platforms as data interchange platforms as they require different Army offices to exchange in order to integrate the two systems into one.

⁹[GAO-15-548](#).

- Generally accepted research standards state that objectives outline what a study is intended to accomplish. The study's objective is consistent with generally accepted research standards in that it addresses Army G-8's direction to identify gaps and requirements to provide recommendations on TWV capabilities and requirements. This objective was broad enough to encompass the required capabilities of TWVs for a MDO environment as well as look holistically at requirements for the TWV fleet size.
- Generally accepted research standards state that a study's scope should be directly related to the objectives and define the subject matter to be assessed and reported on. We found that the study's scope addresses study objectives and includes the TWVs the Army needs for a notional force in a European MDO environment—the stressor force for the study according to Futures and Concepts Center officials. This force included about 66 percent of the types of units currently used in the Army and included use of some surrogate units for those that currently do not exist but may in 2028—such as Strategic Fires Battalions. The scope is also relevant to the Indo-Pacific Theater as the types of units in the study represented about 95 percent of that theater's types of units. According to Army officials, this commonality will allow the Army to extrapolate the results to other theaters.
- According to generally accepted research standards, assumptions underlying a study should be explicitly identified to provide a better understanding of how the analysis was conducted and how it reached its findings and conclusions. Sensitivity analysis against these assumptions can also mitigate for them. The assumptions used within the study are consistent with these standards as they are clearly defined, and mitigation assessments were performed. For example, the Army assumes an operational readiness rate of 90 percent but then mitigates for this assumption by varying readiness rates to perform sensitivity analysis according to Army officials.

Execution. Because the 2021 MDO TWV Study is ongoing, we limited our assessment to a portion of the execution phase of the study. In particular, we assessed the methodology, modeling, data use, and limitations and found that these elements of the study's execution are consistent with generally accepted research standards.

- Generally accepted research standards state that a study's methodology should be consistent with and address a study's objective. We found that the study's methodology included an assessment of all three of its lines of effort using a capabilities based

assessment that identified the operational tasks, conditions, and standards needed to achieve military objectives; assessed current and future capabilities to identify gaps; and sought to determine TWV solutions.

- Generally accepted research standards require that models are adequate for the intended purpose, represent a complete range of conditions, and that data used are valid and complete. We found that the study's model is consistent with these criteria as it is a generally accepted model used by the Army for various efforts with similar purposes. For example, for the Distribution and Transportation line of effort, the Army used its standard Logistics Battle Command model. This model simulates the consumption and distribution of all classes of supply at either the platform level or the unit level. While the model requires extensive data inputs from various sources, Army modeling officials told us they use an internal verification and validation process involving experts not involved with the project to review the model and ensure it is appropriate.
- Generally accepted research standards state that the data used in a study should be valid for the intended research purpose and reliable in that they are consistent and verifiable. We found the data used by the study are consistent with research standards for validity and reliability. For example, the study used the expertise of the Future Operational Environment Directorate within the Futures and Concepts Center to validate two elements of the evaluation criteria for the Mobility line of effort: Priority of Targeting and Signature Detection. In addition, subject matter experts reviewed the mobility percentages for each unit to determine their reliability. The Launch and Support Platforms line of effort used an Army force design update process to identify capability gaps and potential solutions. The Army then provided information on the identified solutions to program managers to validate how many vehicles were required to meet these expected gaps. Finally, subject matter experts from the Capabilities Developments Integration Directorates reviewed and validated data for the Distribution and Transportation line of effort at workshops conducted prior to modeling.
- Studies generally have limitations. Generally accepted research standards do not require the elimination of all limitations but do call for limitations to be identified, assessed, mitigated, and explained. We determined that the study identified limitations and associated mitigation efforts. For example, in the Distribution and Transportation line of effort, the Army identified the lack of a sufficient, Office of the Secretary of Defense-approved, Multi-Domain Operations Defense

Planning Scenario for the European theater as a limitation.¹⁰ To mitigate this limitation, modeling officials stated they modified an existing scenario previously developed to support a European Command wargame.

Another limitation identified for this line of effort was a sustainment analysis focused on distribution from the theater operations down to the brigade level. Modeling officials stated that no mitigation was necessary for this limitation since there were no specific shortfalls identified at the brigade level.

- As the study is not yet complete, we were not able to examine the consistency and verifiability of data measurement as well as the description and documentation of the models used for the study.

According to MDO TWV Study officials, they delayed the final report from March 2021 until July 2021 due to the time required to accurately define the level of detail needed for the force used in the model. The initial results indicated the potential need for an increase in TWVs and associated trailers due to mobility requirements and the need for additional launch and support platforms. However, Army officials stated that these results did not reflect the results of modeling and relied, in part, on previously completed analyses. Recently, Army officials told us that the initial results of modeling for the Distribution and Transportation line of effort shows the current TWV fleet is sufficient to provide sustainment. Therefore, the preliminary results showing a potential increase may no longer be accurate.

Army Is Assessing Additional Information but Has No Direction to Update the Strategy beyond 2022

While the MDO TWV Study is central to the strategy, other initiatives cover topics directly related to TWV capabilities and requirements as well. According to Army officials, however, there is no Army directive, policy, or guidance to routinely update the results of the MDO TWV study or the strategy. As currently scheduled, the Army will issue its new TWV strategy in fiscal year 2022 which will not account for all relevant

¹⁰We have reported previously that DOD has not kept its planning scenarios up-to-date. As a result, we found that senior DOD leaders do not have the analytic support they need to evaluate investments in capabilities and requirements. GAO, *Defense Strategy: Revised Analytic Approach Needed to Support Force Structure Decision-Making*, [GAO-19-385](#) (Washington, D.C., March 2019). DOD concurred with all three recommendations made in this report.

initiatives that could help with planning for future TWVs. Figure 3 identifies selected relevant initiatives.

Figure 3: Relevant Initiatives for the Army Tactical Wheeled Vehicle Strategy



FY = Fiscal year
MDO = Multi-Domain Operations

Sources: GAO review of Army documents and interviews with Army officials. | GAO-21-460

Text of Figure 3: Relevant Initiatives for the Army Tactical Wheeled Vehicle Strategy

- FY 2019: Army Trailer Strategy
- FY 2021:
Army Tactical Wheeled Vehicle Plan
Army MDO Tactical Wheeled Vehicle Study
- FY 2022: Infantry Brigade Combat Team Study
- Ongoing:
Needs of other military departments
Army modernization priorities
Research and development programs

Sources: GAO review of Army documents and interviews with Army officials. | GAO-21-460

Further information on these initiatives follows.

- In 2018, the Army determined that the current tactical trailer fleet does not have the required capabilities to support the Army’s mission, lacks flexibility, and is redundant.¹¹ The Army issued a Trailer Strategy in fiscal year 2019 to guide efforts to consolidate the number of tactical wheeled trailers in the fleet. Trailers are critical to providing the capabilities necessary for TWVs and the Army will incorporate findings from the trailer strategy into the TWV strategy.
- Army G-8 periodically issues a TWV plan containing a comprehensive outline of investments and key decisions related to the TWV fleet. The Army’s most recent TWV Plan for 2021-2035 was issued in January 2021 and focused on preparing the TWV fleet for the transition to

¹¹Department of the Army, *Trailer Strategy*, Fiscal Year 2019.

MDO. According to officials, the Army will incorporate information from this plan into the TWV strategy.

- The Army has an ongoing study to determine optimal capabilities and requirements for light TWVs within Infantry Brigade Combat Teams.¹² According to Army officials, the Infantry Brigade Combat Team Study will have a pronounced effect on the number and types of vehicles recommended for these teams. These officials told us the study is scheduled for completion in the first quarter of fiscal year 2022 and they are uncertain if it will be completed in time to inform the 2022 TWV Strategy.
- Acquiring TWVs to support other military departments' needs under joint operations in MDO is an Army responsibility. Army officials we spoke with stated that the department has not yet determined how other military department's needs will affect the numbers and types of vehicles in its TWV fleet.
- The Army is pursuing 35 modernization initiatives, some of which could incorporate a need for TWVs to serve as launch and support platforms. For example, one Army modernization priority is Long-Range Precision Fires, which includes a Precision Strike Missile mounted to the Family of Medium Tactical Vehicles truck as a launch platform.
- On an ongoing basis, the Army conducts research and development projects related to TWVs. For example, according to Army officials, the Army is researching electrification—such as next-generation ion batteries with advanced power storage capacity—for use within the TWV fleet. The effect of research and development efforts on the number and types of vehicles in the TWV fleet will not be fully known until projects are completed and further analysis can be performed.

As discussed, some initiatives have been completed, some are still in progress, and some do not have a clear end date. The outcome of these initiatives could affect the continuing validity of the 2022 TWV Strategy, as information about the role of TWVs to support MDO will continue to evolve. Army officials we spoke with indicated that current Army leadership plans to update the estimate of the number and types of TWVs in relation to MDO every 6 to 12 months for internal Army use. As previously mentioned, officials have agreed that there is no Army

¹²An infantry brigade combat team includes three infantry battalions, a cavalry squadron, a field artillery battalion, and a brigade engineer battalion. They are organized to conduct operations by ground, airborne or air-assault, or amphibious assault with little or no advance notice.

directive, policy, or guidance to routinely update the results of the study or the strategy. As the current 2021 MDO TWV Study and the 2022 TWV Strategy cannot completely account for all ongoing efforts, they have the potential to become obsolete. This is especially the case if the Army does not take into account any new TWV capabilities identified for MDO or developed in ongoing research programs. If this information is not routinely updated it could affect Congress's ability to make informed decisions.

Standards for Internal Control in the Federal Government state that management should use quality information to make informed decisions, which involves obtaining relevant information in a timely manner to make informed decisions. If the Army does not routinely update the TWV strategy to consider evolving information from other relevant initiatives and changing circumstances, it risks using outdated and incomplete information to manage its fleet of TWVs. Formalization of updates to the strategy is especially important as Army leadership, and potentially leadership priorities, change.

Army Often Used Non-Competitive Contracts to Acquire TWVs, but Is Pursuing Plans to Facilitate Future Competition

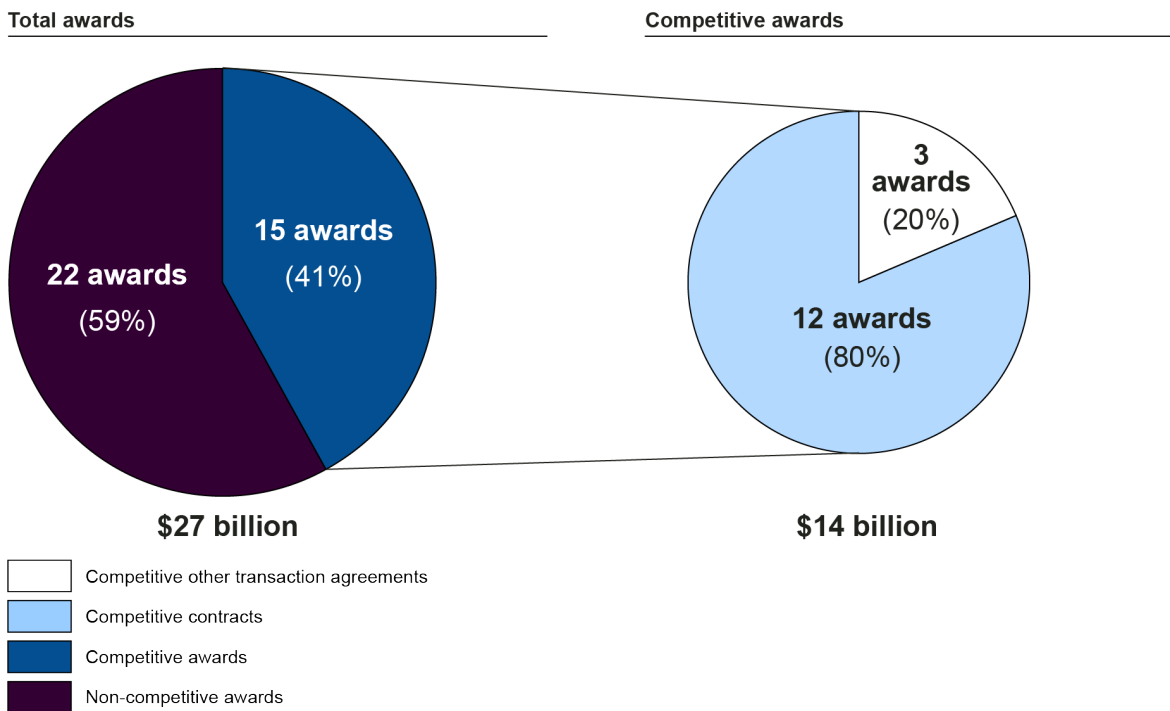
While the Army relied on non-competitive contracts for 22 of 37 (approximately 59 percent) of active contracts and agreements for TWVs over the past 6 fiscal years, it is now considering multiple ways to facilitate competition for future awards. From fiscal years 2015 through 2020, the Army had 37 active contracts and other transaction agreements. Twenty-two of these were awarded on a non-competitive basis while 15 were competitively awarded. The Army acknowledges that it can do more to facilitate competition and plans to do so by acquiring technical data for new production contracts and expanding the use of consortia other transaction agreements for development.

More than Half of Contracts and Agreements Active in the Past 6 Fiscal Years Were Non-Competitive Awards

Of the 37 active contracts and other transaction agreements for TWVs and their associated trailers in fiscal years 2015 through 2020, 22 (or approximately 59 percent) were non-competitive awards and 15 (or

approximately 41 percent) were competitive awards.¹³ The Army awarded both Federal Acquisition Regulation-based contracts and other transaction agreements for TWVs. Figure 4 depicts the number, category, approximately total expected value, and percent of all awards for fiscal years 2015 through 2020.

Figure 4: Active Tactical Wheeled Vehicle Contracts and Other Transaction Agreements for Fiscal Years 2015 through 2020



Sources: GAO analysis of Army provided information and Federal Procurement Data System-Next Generation. | GAO-21-460

Data for Figure 4: Active Tactical Wheeled Vehicle Contracts and Other Transaction Agreements for Fiscal Years 2015 through 2020

Total Awards

- 22 awards (59%) non-competitive
- 15 awards (41%) Competitive Awards

Competitive Awards

¹³We defined “active contracts or agreements” to be any contract or other transaction agreement for which the period of performance, including option periods, remained on-going or the final payment had not been received by the contractor.

- 12 awards (80%) were competitive contracts
- 3 awards (20%) were competitive other transaction agreements.

Sources: GAO review of Army documents and interviews with Army officials. | GAO-21-460

The total expected value for TWV contracts and agreements active during the period of fiscal years 2015 through 2020 was approximately \$27 billion.¹⁴

- The total expected value of the 22 non-competitive contracts was approximately \$13 billion. The two largest non-competitive contracts—approximately \$7.6 billion for Family of Heavy Tactical Vehicles to Oshkosh Defense, and \$2.3 billion for the High Mobility Multi-purpose Wheeled Vehicle to AM General—accounted for 76 percent of the total expected value for these contracts.
- The 12 Federal Acquisition Regulation-based competitive contracts active during the period had a total expected value of approximately \$11.9 billion. The Army awarded Oshkosh Defense the two largest competitive contracts—\$4 billion for the Family of Medium Tactical Vehicle A1 and approximately \$6.2 billion for the Joint Light Tactical Vehicle. These two contracts represent approximately 85 percent of the total expected value for all competitive contracts during the period.
- For the same period, the three other transaction agreements were competitively awarded and had a total expected value of a little over \$2 billion. The largest other transaction agreement award was \$2 billion, representing over 99 percent of the total expected value for other transactions. This award was to the companies participating in the design of the Infantry Squad Vehicle. The remaining two other transaction agreements awards had a total expected value of approximately \$1.8 million.

Army Plans to Compete New Contracts and Use Existing Flexibilities to Facilitate Future Competitions

According to Army program officials, the Army plans to compete new contracts for TWVs when practicable and use flexibilities such as entering

¹⁴The Army defines the “total expected value” of a contract or agreement to be its base year value plus the value of all options if exercised.

into other transaction agreements with consortia to facilitate competition. Some initiatives the Army is using to facilitate competition include:

- **Acquiring technical data rights.** According to Army program office officials, the Army is putting more emphasis on acquiring technical data license rights to allow for future competitive award of new contracts to facilitate greater competition within the industrial base and potentially reduce acquisition cost. For example, program officials reported that the Army exercised a contract option to purchase the Joint Light Tactical Vehicle technical data package and plans to competitively solicit for a new follow-on production contract in fiscal year 2022. This allows the Army to share these data with other interested parties beyond the current manufacturer.
- **Leasing TWVs.** The Army is leasing Joint Light Tactical Vehicles to companies interested in participating in future competitions so that they can learn more about how to produce and improve the vehicle. Representatives from one commercial company that leased the vehicle stated that they will disassemble it to better understand the process necessary to assemble it as well as the specifications and how they may be able to improve both. The company is also performing rigorous field testing to assess mechanical limits, among other things. It plans to use this access to the vehicle to better prepare its offer on the Joint Light Tactical Vehicle solicitation expected in fiscal year 2022, which is expected to propose a 10-year contract with a value of about \$12.3 billion.
- **Using other transaction agreements.** According to Army officials, they plan to expand the use of other transaction agreements. These agreements can be used for basic, applied, and advanced research projects or to carry out prototype projects, and may provide for follow-on procurement contracts or agreements.¹⁵ This approach can help DOD attract companies that do not typically do business with DOD—such as commercial science and technology firms—which we refer to as non-traditional defense companies. This is because other transaction agreements are not subject to many federal statutes and regulations that apply to government procurement contracts, thus allowing DOD and companies to negotiate terms and conditions specific to a project.

¹⁵10 U.S.C. §§ 2371 and 2371b. DOD defines a prototype project in the context of an other transaction as addressing a proof of concept, novel application of commercial technologies for defense purposes, or a process, among other types. A process, including a business process, may be the subject of a prototype project. DOD Other Transactions Guide (November 2018).

We reported in 2020 that the Army tripled its obligations and more than doubled the number of awards of other transaction agreements for prototype projects from fiscal years 2017 through 2019. We also found that more than 75 percent of active or planned other transactions involve, or are expected to involve, significant participation by non-traditional defense contractors.¹⁶ Army program officials involved with TWVs told us the use of other transaction agreements fosters conditions that remove barriers and increase participation of small businesses and non-traditional defense companies. For example, one current Army effort to modernize TWVs—the Expedient Leader-Follower program—used an other transaction agreement to attract non-traditional defense companies.

Other transaction agreements may be awarded with a consortium which may be composed of various types of commercial and non-profit entities. The consortia is managed by a company that provides administrative support in coordinating between these entities and the government. The Army intends to expand the use of other transaction agreements with consortia to leverage its ability to competitively select vendors for projects. According to Army program officials, other transaction agreements with consortia allow flexibility in business arrangements while offering competitive opportunities to non-traditional defense contractors who are members of the consortium. For example, Army officials shared that they used such an agreement to attract a new entrant, GM Defense, through the award of the Infantry Squad Vehicle other transaction agreement in August 2019.

- **Increasing industry outreach.** The Army is improving the way it conducts market research to gauge industry interest in potential projects and identify the availability of commercial capabilities for Army needs. For example, the July 2020 Common Tactical Truck request for information solicited data related to the availability of specific capabilities and technologies in the commercial market—including autonomous or semi-autonomous driving—to help inform the Army’s acquisition strategy for the vehicle. Other examples used to encourage competition include the early release of technical data packages, use of industry days, trade shows, and one-on-one meetings where industry officials can meet with Army officials to pitch commercially available solutions to identified Army needs.

¹⁶GAO, *Army Modernization: Army Should Improve Use of Alternative Agreements and Approaches by Enhancing Oversight and Communication of Lessons Learned*, [GAO-21-8](#) (Washington, D.C.: Oct. 1, 2020).

Analyses Indicate the TWV Industrial Base Can Expand, but the Army Faces Challenges in Communicating with Participants

While multiple analyses have determined that there is a viable industrial base for TWVs, the Army faces challenges in expanding company participation due to communication and other challenges. Multiple studies, including our own, indicate that there are additional companies that could take part in the Army TWV industrial base. Leveraging additional companies' commercial technology advancements could facilitate competition or potentially reduce the cost of the vehicles the Army needs as well as the cost of developing new capabilities. Army and industry officials concede, however, that there are challenges to increasing industry participation. While solutions to these challenges are available—and the Army is pursuing many of them—communication with industry remains an issue.

Multiple Analyses Indicate the Potential for Expanding the TWV Industrial Base beyond Current Participants

Analyses from DOD and the Army indicate that the current industrial base for TWVs could be expanded due, in part, to a healthy commercial truck market with relevant products and manufacturing practices. The Army relies on a stable and healthy industrial base to design and manufacture TWVs with the capabilities it needs and to produce the quantities and types of vehicles required. Army officials noted that they increasingly rely on innovations from commercial companies to define potential capabilities.

According to recent DOD and Army industrial base assessment reports, multiple companies provide the Army with TWVs or their components. In its 2020 Annual Industrial Capabilities Report to Congress, DOD reported that the TWV industrial base consists of several companies but is dominated by two companies, Oshkosh Defense and AM General. In addition, it noted that the TWV industrial base is affected by economic challenges created by demand levels, budgets, and requirements, which negatively affect investments by suppliers in research and development and manufacturing, as well as DOD's ability to attract new entrants. The report acknowledged that because many TWVs are based on commercial vehicles, they benefit from a shared industrial base—including supply

chains, research and development operations, and assembly and production systems. This commonality allows manufacturers to maintain expertise and production line capacity to meet surge demands when necessary and support sustainment. As a result, the report concluded that the TWV industrial base “remains relatively stable and healthy due to its foundation in the commercial truck manufacturing sector.”¹⁷ An Army industrial base assessment of engine manufacturers in 2016 found similar results.¹⁸

Army officials informed us that they regularly assess the state of the industrial base outside of these studies as well.

- **Program managers** provide front line risk assessments via structured reviews designed to identify problems and develop appropriate follow-up actions. Program managers also regularly communicate with industry and perform routine reviews of contractual language and budgets.
- **Army Contracting Command and Defense Contract Management Agency** officials monitor risk via contract execution metrics such as small businesses and non-defense company participation, acquisition of technical data license rights, and contract actions.
- **Headquarters, Department of the Army** monitors risk through the budget process to determine priorities, align science and technology efforts to capabilities, and plan milestones.
- **Army Senior Leaders** monitor risk via focused engagements with program executive officers, program managers, industry executives, and others to make decisions on TWVs.

Commercial Truck Industry Includes Multiple Companies Not Currently Selling TWVs to DOD

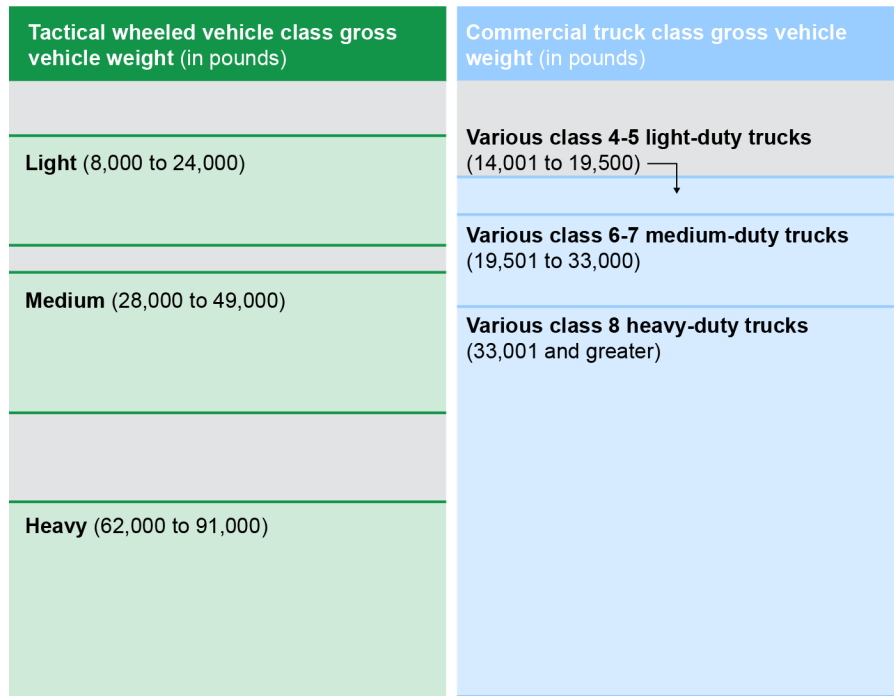
Our analysis of the commercial truck industry supports that there is a viable commercial industrial base available for Army TWVs as well as opportunities to expand the industrial base. While differences exist in how weight classes are categorized between TWVs and commercial trucks, there are similarities. In the U.S., commercial trucks are categorized into classes based on the gross vehicle weight, as are Army TWVs. We used

¹⁷DOD Fiscal Year 2020 Industrial Capabilities Report to Congress, January 2021.

¹⁸TACOM Life Cycle Management Command, Industrial Base Baseline Assessments, Phase V, June 2016.

these classes to assist in calculating the viability of additional TWV industrial base participants. Figure 5 presents a comparison of weight classes.

Figure 5: Tactical Wheeled Vehicles and Commercial Trucks by Weight Class



Sources: Army program office information and Bloomberg data. | GAO-21-460

Text of Figure 5: Tactical Wheeled Vehicles and Commercial Trucks by Weight Class

- Tactical wheeled vehicle class gross vehicle weight (in pounds)
 - Light (8,000 to 24,000)
 - Medium (28,000 to 49,000)
 - Heavy (62,000 to 91,000)
- Commercial truck class gross vehicle weight (in pounds)
 - Various class 4-5 light duty trucks (14,001 to 19,500)
 - Various class 6-7 medium duty trucks (19,501 to 33,000)
 - Various class 8 heavy duty trucks (33,001 and greater)

Sources: Army program office information and Bloomberg data. | GAO-21-460

Notes: Class weight is gross vehicle weight that represents the combined total weight of the vehicle and all passengers and cargo. The figure does not include Mine Resistant Ambush Protected tactical wheeled vehicles.

Our analysis of financial data for U.S. light-duty, medium-duty, and heavy-duty truck manufacturers from calendar years 2015 through 2019 found that:

- The commercial light-duty truck market is highly concentrated. In particular, for 2019, we found that one company accounts for over 50 percent of the commercial market share, but also found there are another seven companies that are a part of this market. Only three of these companies currently supply or have supplied TWVs to the Army. Neither is the company with the greatest market share.
- The medium-duty truck market is less concentrated than the light truck market. For 2019, of the seven commercial medium-duty truck companies our analysis identified, three account for 80 percent of the commercial market share. Three of these companies currently supply or have supplied TWVs to the Army.
- The commercial heavy-duty truck market is highly concentrated. For 2019, two of the four companies identified in our analysis account for 70 percent of the commercial market share. Of these four companies, three currently supply or have supplied TWVs to the Army. The company that does not supply TWVs to the Army is one of the two companies with the greatest commercial market share.

Our analysis supports the notion that multiple companies exist in the private sector with the ability to participate in the TWV industrial base.

Army Can Leverage Commercial Industry Technology Advancements to Add Desired Capabilities

Based on our review of Army documentation and interviews with officials, a healthy commercial truck and automotive industrial base can provide the capabilities the Army is seeking for its TWVs. Using commercial technologies affords the Army the ability to rapidly field new capabilities and the industrial base the ability to adapt to emerging Army TWV requirements. To field these technology advancements, the Army could seek opportunities to work with industry and monitor progress so that the TWV fleet does not diverge from the commercial market to an extent that it can no longer be sustained by the marketplace. For examples of

commercial technologies with applicability to TWVs the Army identified in our review, see table 1.

Table 1: Commercial Technologies Applicable to Army Tactical Wheeled Vehicles

Technology	Description
Active driver assist safety systems	Include features—such as electronic stability control, adaptive cruise control, collision avoidance, and anti-lock brakes—that could help to reduce soldier fatigue and assist in avoiding accidents.
Condition-based maintenance Prognostics and predictive maintenance	Allows monitoring of actual condition of a vehicle and its components by using artificial intelligence to determine what maintenance is required prior to system failure. Telematics is a technology that allows such monitoring, including communicating a fix for the problem.
Vehicle electrification	Electrified components, such as all-electric or hybrid-electric powertrain, anti-idle, and start-stop technology, to achieve fuel savings and demand reduction. Electrification can also provide exportable power and allow for micro-gridding of multiple platforms, thereby providing redundancy or replacing current generator equipment.
Autonomy	Semi-autonomous (driver-assisted) and fully autonomous (driverless) control capabilities to allow crewed-uncrewed teaming or independent operation that could reduce soldier exposure to risk, extend operational reach, and decrease logistical footprint.
Fuels and lubricants	Modern fuel and lubrication technology and emission-control technology to increase fuel efficiency, and reduce maintenance burden due to extended fluid service life and improve emission control. For example, fuel with less sulfur.
Advanced manufacturing	In general, includes manufacturing activities that depend on the use and coordination of information, automation, computation, software, sensing, and networking and making use of cutting-edge materials and emerging capabilities enabled by the physical and biological sciences. It also includes but is not limited to, additive manufacturing (also known as three-dimensional or 3D printing), artificial intelligence, robotics, and advanced composite materials. It can be used to improve readiness of critical, long-lead, or obsolete parts in the field for emergency repair or as a secondary source of supply.

Source: GAO review of Army information. | GAO-21-460

Recent Army requests for information for a new heavy tactical truck and a light electric reconnaissance vehicle look to industry to identify products, including products that leverage commercial investments, to inform development.

Challenges Such as Inconsistent Communication Can Deter Additional Companies from Participating

According to trade association and company representatives we spoke with, there are several challenges, including inconsistent communication, which deter commercial companies from participating in the defense market.¹⁹ There are, however, steps the Army is taking or could take to overcome them.

¹⁹We identified similar challenges in the past. See GAO, *Military Acquisitions: DOD Is Taking Steps to Address Challenges Faced by Certain Companies*, [GAO-17-644](#) (Washington, D.C.: July 20, 2017).

According to the trade association and company representatives we interviewed:

- The Army's inconsistent communication of TWV capabilities and requirements, as well as the resources identified to support them, are a challenge. Some company officials referred to this communication as the "demand signal." They stated that this signal has been inconsistent from the Army due to the infrequent release of a TWV strategy or conflicting information. For example, industry officials noted that, in the past, the Army has periodically communicated the need for capabilities for the TWV fleet. In response, the companies then expend their own funds to develop capabilities and prepare for submitting an offer. When the Army later chose not to pursue new capabilities, the companies may lose their investment and thus were less likely to be involved in future efforts. A conflicting "demand signal" affects companies' ability to understand the Army's needs, plan for investments, and determine whether to participate in upcoming contracts.
- The complexity of the Army's acquisition process presents challenges as it requires companies to hire specialists, at additional cost to the company, to identify opportunities and navigate the regulations, contract terms and conditions, development of technical manuals, extensive testing, and military standards. Companies said this process can add unnecessary costs and burdens when their business success can be sustained by commercial market demands with less complex processes.
- The length of the contracting negotiation and award process can be challenging, delaying the release of funds to companies. We have reported that the awarding of contracts can take a year or more, and this delay can lead to financial difficulties for smaller companies.²⁰
- The protracted length of the development and procurement process is challenging in that the Army is missing opportunities to incorporate emerging technologies that were not considered when the specifications for TWVs were set. Trade association and company representatives we interviewed noted that the evolution of technology development occurs faster in the commercial marketplace than the modernization of systems happens within the Army acquisition model.

²⁰GAO, *Defense Contracts: DOD Should Develop a Strategy for Assessing Contract Award Time Frames*, [GAO-18-467](#) (Washington, D.C.: July 16, 2018), [GAO-17-644](#), and *DOD Payments to Small Businesses: Implementation and Effective Utilization of Electronic Invoicing Could Further Reduce Late Payments*, [GAO-06-358](#) (Washington, D.C.: May 19, 2006).

Many of the companies we spoke with prefer to not to be locked into a design for a long time—as the Army prefers—as the design becomes antiquated over time.

- The rights related to the intellectual property created during development of new vehicles was also cited as a challenge as it is considered critical to the ability of companies to invest in and produce unique capabilities. Company officials said that if they invest money to develop the vehicle/item they do not want to give the government broad license rights to the intellectual property as they could lose their competitive advantage. They also indicated that intellectual property is considered the “life blood” of a company.
- Multiple companies and trade associations’ representatives noted that the Army wants a custom-built vehicle. This is a challenge in that the Army’s specifications are often inflexible and have elements not found in commercial applications such as a heated dump truck bed and multiple tie-downs. The preference for custom-built vehicles drives up cost and development time for the Army. In contrast, industry’s commercial products are highly customizable. That is, their customers can specify commercially available engines, transmissions, suspensions, tires, or other components within an existing truck design.

While Army officials noted that they recognize the challenges identified by industry deter participation in the defense market, they noted that there are initiatives that the Army is using or could use to overcome them.

- As stated in the next paragraph, the Army is actively attempting to improve communication with industry; however, based on interviews with industry officials, it may not be sending a consistent “demand signal.” According to industry representatives, consistent communication of a “demand signal” to industry presents a challenge to the Army generally due to the need for input from multiple offices to generate this signal. These offices include Army Futures Command, the office responsible for analyzing and determining available resources (Army G-8), and the program acquisition offices. Independent communications by any one of these offices, such as requests for information or the annual budget submission, can lead to conflicting information if not coordinated.

We have identified that the Army does, however, provide information to industry that communicates upcoming TWV opportunities. Examples of such communications include presentations by program office officials at annual defense conferences, an advanced planning

industry briefing that identifies TWV contracting opportunities, requests for information, industry days, and one-on-one meetings between companies and Army officials. While these signals are useful, they can conflict with one another. For example, when a program office releases a request for information for a new vehicle, it signals that the Army may, though it is not required to, issue a related future solicitation. As stated above, industry representatives have indicated they can then receive a conflicting signal if the Army's future funding plans do not include a new vehicle. The Army does not always communicate information about future plans in a coordinated manner or provide a consistent message to industry.

In a March 2018 DOD policy memorandum, the then-Deputy Secretary of Defense encouraged communication with industry and indicated that the National Defense Strategy makes clear that DOD-industry dialogue helps industry to make the informed investment and business decisions necessary to meet the department's needs.²¹ Likewise, *Standards for Internal Control in the Federal Government* identify the importance of communication of quality information to outside entities to achieve organizational goals.²² Without addressing this inconsistent communication, the Army risks missing opportunities to increase defense and non-defense companies' participation in TWV modernization efforts, and thus facilitate competition to obtain cost savings and improved capabilities for the warfighter.

- The Army is increasingly using alternative acquisition pathways, such as the middle-tier of acquisitions pathway, in an attempt to reduce the complexity of the acquisition process. Programs following this pathway are generally exempt from many of DOD's traditional acquisition policies. The pathway allows for capabilities to be fielded faster—within 5 years of program start. We reported in 2020 that the Army increasingly used the new middle-tier of acquisition pathway authorities in an attempt to simplify the acquisition process and reduce its length of time.²³
- According to the Army, in order for the Army to accept new vehicles into its fleet, it requires the development of comprehensive technical

²¹DOD Deputy Secretary of Defense Memorandum, *Engaging with Industry* (Mar. 2, 2018), which encouraged DOD communication with industry while complying with the ethics and procurement laws, as well as rules governing interactions with industry.

²²[GAO-14-704G](#).

²³[GAO-21-8](#).

manuals, extensive testing, and adherence to military standards. This is due to the fact that the Army will maintain its own equipment and has unique warfighting requirements not found in the commercial market. While the industry officials we spoke with understand this, they stated that there are things the Army can do to mitigate the need for extensive testing and documentation. This includes working with companies to understand the testing vehicles have already undergone, such as road or endurance testing, and flexibility in applying military standards, especially for vehicles based on commercial variants. Army officials noted that they are exploring these options, especially as the Army conducts more prototyping decisions.

- As we previously reported, the Army has expanded the use of other transaction agreements in part to enable the rapid release of funds to companies. Other transaction agreements enable the Army and companies to negotiate terms and conditions specific to a project without requiring them to comply with many federal laws and regulations that apply to government procurement contracts, and generally award contracts and provide faster payments in shorter periods than Federal Acquisition Regulation-based contracts. This flexibility can help DOD address non-defense companies' concerns about establishing a government-unique cost accounting system or granting intellectual property rights, among other concerns. We reported in 2020 that Army had increased its use of other transaction agreements; however, as we previously reported in 2019, other transaction agreements can take longer to award than Federal Acquisition Regulation-based contracts if there are extensive negotiation of all the terms and conditions.²⁴
- Army officials stated the Army has begun to emphasize the use of modular open systems architectures to enable the insertion of new technology regardless of when initial specifications are set. For example, in future vehicles such as the Common Tactical Truck, the eLectric Light Reconnaissance Vehicle, and the Infantry Squad Vehicle, they plan to use such architectures to allow for insertion of new technologies to gain life cycle modernization benefits. Industry officials echoed this statement, stating that the use of open architecture could allow systems to be less requirements-based and more opportunity-driven based on what technologies and capabilities are available in the commercial marketplace. In addition, industry officials stated that the Army could reduce the length of time vehicles remain in the fleet, say for example, from a 30-year life cycle to a 10-

²⁴GAO-21-8 and *Defense Acquisitions: DOD's Use of Other Transactions for Prototype Projects Has Increased*, GAO-20-84 (Washington, D.C.: Nov. 22, 2019).

year life cycle. Army officials noted that the Army would have to stay aligned with these cycles and give up a little configuration control to be in step with industry.

- Army program office officials stated that under Federal Acquisition Regulation-based contracts, the government’s acquisition of intellectual property rights is tailored to the level of government involvement in development of the TWV.²⁵ For example, for TWVs where the Army had a significant role in development, like the Joint Light Tactical Vehicle, it would obtain a greater amount of technical data license rights. For TWVs based largely on commercial products, such as the new Infantry Squad Vehicle from GM Defense that is based on a commercially available Chevrolet Colorado ZR2 with 90 percent commonality of parts, the Army would obtain a lesser amount of intellectual property rights. Under other transaction agreements, which do not follow the Federal Acquisition Regulation legal framework, all of these license rights can be tailored.
- Army officials have stated that they are open to seeking more of a customizable, rather than custom-built, solution. While the Army has requirements that are different from those found in the commercial market that drive it to custom-built solutions, they are open to using commercial solutions in military applications. They highlighted that the Army is increasingly relying on commercially available technologies and vehicles for new capabilities. Industry officials also noted that if the Army becomes more flexible in its approach to requirements, it might better be able to leverage commercial manufacturing practices and products and related benefits. For example, in pursuing the new Common Tactical Truck and eLeCtric Light Reconnaissance Vehicle, the Army’s requests for information are seeking commercially available solutions before soliciting for specific requirements and capabilities such as autonomy and hybrid or fully-electric powertrains. In pursuing this approach, the Army could reduce time and cost for development. Use of more commercially customizable vehicles also has the potential to reduce the cost of production.

²⁵Under the Defense Federal Acquisition Regulations, if the contractor developed an item or computer software exclusively with government funds, the contractor retains the intellectual property over the technical data pertaining to the item, but the government acquires “unlimited rights” to use the data without restriction. If the contractor developed an item or computer software with mixed funding, then the government normally acquires “government purpose rights.” If the contractor developed the item or computer software completely at private expense, then DOD usually acquires only “limited rights” (for data) or “restricted rights” for software.

Conclusions

Tactical wheeled vehicles provide a critical link for the Army to meet its mission. The Army acknowledges the need for a comprehensive strategy to address the capabilities and requirements for its TWV fleet given the shift to emphasize multi-domain operations. The TWV strategy will, however, be issued before a number of initiatives that could be relevant to planning for future TWVs are completed. Failure to update the strategy with this information creates a risk that investments in capabilities and requirements will have been based on outdated information and may no longer fully meet the evolving needs of the warfighter.

Further, the array of private companies that could produce vehicles to meet the Army's TWV needs is broader than the traditional DOD TWV industrial base, but the Army faces challenges in reaching these companies. Improving coordination among offices within the Army on their external communications could decrease incidences of conflicting "demand signals." Improved external communication could help the Army meet its stated goal of attracting more companies to compete for contracts and, potentially, lead to improved capabilities and reduced costs for the vehicles the Army needs.

Recommendations for Executive Action

We are making the following two recommendations to the Army:

The Secretary of the Army should direct the appropriate offices within the Army to routinely update its tactical wheeled vehicle strategy to account for evolving information and circumstances. (Recommendation 1)

The Secretary of the Army should direct the appropriate offices within the Army to better coordinate external communication with industry to assure their assessment of needs for tactical wheeled vehicles are consistently communicated. (Recommendation 2)

Agency Comments

We provided a draft of this report to the Department of the Army for review and comment. In its comments, reproduced in appendix III, the

Army concurred with both of our recommendations. The Army did not provide any technical comments.

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

If you or your staff have any questions about this report, please contact me at (202) 512-4841 or ludwigsonj@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report are listed in appendix IV.

A handwritten signature in black ink that reads "Jon Ludwigson". The signature is written in a cursive style with a long horizontal flourish at the end.

Jon Ludwigson
Director, Contracting and National Security Acquisitions

Appendix I: Objectives, Scope, and Methodology

The House Armed Services Committee report accompanying the National Defense Authorization Act for Fiscal Year 2021 and the Senate Armed Services Committee report accompanying a bill for the same act included provisions for GAO to assess the Army's new tactical wheeled vehicle (TWV) strategy and implementation efforts as well as an analysis of the TWV industrial base and the potential for competition.¹ This report assesses (1) the Army's progress in identifying specific capabilities and requirements for its 2022 TWV Strategy, (2) the extent to which the Army has pursued opportunities for competition in contracts for TWVs, and (3) the extent to which opportunities exist for expanding the TWV industrial base. Prior to completing its new TWV Strategy in fiscal year 2022, the Army is conducting a Multi-Domain Operations (MDO) TWV Study in fiscal year 2021 to inform the strategy.

To address the Army's progress in identifying specific capabilities and requirements for its 2022 TWV Strategy, we reviewed the Army's 2021 MDO TWV Study looking at the Army's TWV fleet capabilities and requirements required for operating in a MDO environment which is intended to inform the strategy. Both the 2022 TWV Strategy and 2021 MDO TWV Study are not complete. To guide our assessment of the 2021 MDO TWV Study, we relied on generally accepted research standards for the design, execution and presentation of findings that define a sound and complete study, which we identified in previous work.² The 2021 MDO TWV Study final report was not available during the time of our audit so we were able to assess only the design portion and portions of the execution of the study against the standards. Appendix II provides a list of these standards and associated questions. We also reviewed documents the study's authors said guided the conduct of the study: (1) the Army Deputy Chief of Staff G-8 request in an April 30, 2020 memo stating the objective of the 2021 MDO TWV Study, and (2) the Army

¹House Report No. 116-442 accompanying the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021, Pub. L. No. 116-283 (Jan. 1, 2021) and S. Rep. No. 116-236, accompanying S. 4049, 116th Cong. (2nd Sess. 2020).

²GAO, *Army Combat Vehicles: Industrial Base Study's Approach Met Research Standards*, [GAO-15-548](#) (Washington, D.C.: June 16, 2015).

Futures Command Futures and Concepts Center's FCC OPORD 19-014: Multi-Domain Operations Tactical Wheeled Vehicle Study.³ In addition, we reviewed the *Standards for Internal Control in the Federal Government* on the use of quality information to achieve an entity's objectives (13.01).⁴

To assess the 2021 MDO TWV Study, we interviewed the study's authors to better understand how the study was conducted, and to understand the scope, methodology, analyses, assumptions, limitations, data sources, and data validity and reliability steps taken as a part of the study. We also reviewed relevant study documentation such as slides that detail the methodological pieces of the study and various initiatives the Army was conducting to inform the study and the strategy.

To determine the extent to which the Army's study addressed the information required by the Army Deputy Chief of Staff G-8 direction, we reviewed and analyzed the April 30, 2020 memo providing direction and compared it to the study's objective and methodology.

To assess the study against the evidence obtained as a result of our work, two GAO analysts used a data collection tool to independently evaluate the Army study against the generally accepted research standards for a reasonable and complete study. Based on a review of the study and supporting documentation, and consultation with a GAO survey and research methodology specialist, we followed up with discussions and written requests for additional information and clarifications from the study's authors. The two analysts then completed their independent analyses, and the GAO team compared the two sets of observations, discussed, and reconciled any differences.

We also held discussions about the study with Army officials from

- Army Futures Command Futures and Concepts Center (the study's author who is responsible for requirements development),
- Office of the Deputy Chief of Staff, G-8 (responsible for determining the affordability of TWVs),

³Department of the Army, Deputy Chief of Staff, G-8, Memorandum, *Tactical Wheeled Vehicle Study* (Apr. 30, 2020).

⁴GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: Sept. 10, 2014).

- Office of the Assistant Secretary of the Army for Acquisition, Logistics, and Technology (the civilian authority responsible for the overall supervision of acquisition and contracting for the Army), and
- Program Executive Office for Combat Support & Combat Service Support (responsible for providing TWVs to the warfighter).

To address the extent to which the Army has pursued opportunities for competition in contracts for TWVs, we analyzed Army-provided contract data for fiscal years 2015 through 2020. We assessed the reliability of the data by comparing them to data in the Federal Procurement Data System-Next Generation and determined that the data were sufficiently reliable for reporting on TWV contracts. We clarified discrepancies between the data sets with Army contracting officials. In addition, we reviewed Army initiatives for facilitating future competition. We interviewed Army officials from the Program Executive Office for Combat Support & Combat Service Support, Army Futures Command Ground Vehicle Systems Center, and Army Contracting Command-Warren to obtain their perspectives on the contracts and other transaction agreements.

To obtain a better understanding of the TWV industrial base, we reviewed relevant Departments of Defense (DOD) and Army industrial base assessment reports and congressional briefings, as well as applicable DOD and Army industrial base policies and guidance. This included DOD Instruction 5000.60 (Defense Industrial Base Assessments), and Army Regulation 700-90 (Army Industrial Base Process).⁵ We also reviewed *Standards for Internal Control in the Federal Government* related to quality information and communication with outside entities (15.01; 15.02).⁶ We also interviewed cognizant DOD (Office of Industrial Policy) and Army (Army Materiel Command's Industrial Capabilities Division) officials. We also spoke with representatives from traditional and non-traditional defense companies and relevant trade associations about their participation, as well as their perspectives on the TWV industrial base. The views of these entities are not generalizable to the views of all such entities.

⁵Department of Defense Instruction 5000.60, *Defense Industrial Base Assessments* (July 18, 2014, Incorporating Change 2, Aug. 31, 2018); and Army Regulation 700-90, *Army Industrial Base Process* (Jan. 30, 2020).

⁶[GAO-14-704G](#).

For our analysis of the level of concentration in the private commercial trucking sector, we obtained market share data from Bloomberg Terminal (Bloomberg) for the calendar years 2015 through 2019 for light-duty, medium-duty, and heavy-duty classes of truck manufacturers. The truck classes are retail units sold to end users in the U.S.

We measured market concentration using the Herfindahl–Hirschman Index (HHI) by truck-weight classes. The HHI is a commonly accepted measure of market concentration. The HHI is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. According to the Department of Justice and economics literature, the HHI takes into account the relative size distribution of the firms in a market.⁷ To assess the reliability of the Bloomberg data used for our HHI analysis, we compared trends, looked for outliers, and interviewed government and industry officials on their understanding of the industrial base. We determined that the data were adequate and sufficiently reliable for our purpose of calculating the HHI.

We conducted this performance audit from August 2020 to July 2021 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.

⁷[Herfindahl-Hirschman Index \(justice.gov\)](https://www.justice.gov/antitrust/section-2)

Appendix II: Generally Accepted Research Standards Used to Assess the Army's 2021 Multi-Domain Operations Tactical Wheeled Vehicle Study

Figure 6: Generally Accepted Research Standards Used to Assess the Army's 2021 Multi-Domain Operations Tactical Wheeled Vehicle Study

Design: Is the study well designed?

1 Is the study's design clear?	2 Is the study's objective clearly stated?	3 Is the study's scope clearly defined?	4 Are the assumptions explicitly identified?	5 Are the assumptions reasonable and consistent?	6 Are the assumptions varied to allow for sensitivity analyses?	7 Are major constraints identified and discussed?	8 Are the scenarios that were modeled reasonable ones to consider?	9 Do the scenarios represent a reasonably complete range of conditions?
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Execution: Is the study well executed?

1 Is the study's methodology consistent with the study objective?	2 Are the study's objectives addressed?	3 Were the models used to support the analyses appropriate for their intended purpose?	4 Were the data used valid for the study's purposes?	5 Were the data used sufficiently reliable for the study's purposes?	6 Were any data limitations identified and were the impact of the limitations adequately explained?	7 Were any modeling and simulation limitations identified, explained and justified?	8 Have the models used in the study been described and documented adequately?
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Presentation of results: Are the results timely, complete, accurate, concise, and relevant to the client and stakeholders?

1 Do the results of the modeling support the report findings?	2 Does the report present an assessment that is well documented?	3 Are the conclusions sound?	4 Are the study results presented in the report in a clear manner?
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1	Assessed
2	Unable to assess

Sources: Generally accepted research standards adapted from GAO-15-548 and GAO-06-938. | GAO-21-460

Text of Figure 6: Generally Accepted Research Standards Used to Assess the Army's 2021 Multi-Domain Operations Tactical Wheeled Vehicle Study

- 1) Design: Is the study well designed
 - a) Is the study's design clear?
 - b) Is the study's objective clearly stated?
 - c) Is the study's scope clearly defined?
 - d) Are the assumptions explicitly identified?
 - e) Are the assumptions reasonable and consistent?
 - f) Are the assumptions varied to allow for sensitivity analyses?
 - g) Are major constraints identified and discussed?
 - h) Are the scenarios that were modeled reasonable ones to consider?
 - i) Do the scenarios represent a reasonably complete range of conditions?

- 2) Execution: Is the study well executed?
 - a) Is the study's methodology consistent with the study objective?
 - b) Are the study's objectives addressed? (unable to access)
 - c) Were the models used to support the analyses appropriate for their intended purpose?
 - d) Were the data used valid for the study's purposes?
 - e) Were the data used sufficiently reliable for the study's purposes?
 - f) Were any data limitations identified and were the impact of the limitations adequately explained? (unable to access)
 - g) Were any modeling and simulation limitations identified, explained, and justified?
 - h) Have the models used in the study been described and documented adequately? (unable to access)

Appendix II: Generally Accepted Research Standards Used to Assess the Army's 2021 Multi-Domain Operations Tactical Wheeled Vehicle Study

- 3) Presentation of results: Are the results timely, complete, accurate, concise, and relevant to the client and stakeholders? (all were unable to be accessed)
- a) Do the results of the modeling support the report findings?
 - b) Does the report present an assessment that is well documented?
 - c) Are the conclusions sound?
 - d) Are the study results presented in the report in a clear manner?

Sources: Generally accepted research standards adapted from GAO-15-548 and GAO-06-938. | GAO-21-460

Appendix III: Comments from the Department of the Army



DEPARTMENT OF THE ARMY
DEPUTY CHIEF OF STAFF, G-8
700 ARMY PENTAGON
WASHINGTON DC 20310-0700

17 JUN 21

Mr. Jon Ludwigson
Director, Contracting and National Security Acquisitions
U.S. Government Accountability Office
441 G Street, N.W.
Washington, DC 20548

Dear Mr. Ludwigson:

This is the Department of Defense (DoD) response to the Government Accountability Office (GAO) Draft Report, "Tactical Wheeled Vehicles: Army Should Update Strategy and Improve Communications with Industry," dated June 1, 2021, GAO Code 104478.

I have reviewed the report and concur with the recommendations. Specific comments are at the enclosure.

The DoD appreciates the GAO efforts to support our Nation's Defense.

Sincerely,

A handwritten signature in black ink, appearing to read "Erik C. Peterson", is written over the typed name.

Erik C. Peterson
Lieutenant General, U.S. Army
Deputy Chief of Staff, G-8

Encl

GAO DRAFT REPORT DATED JUNE 1, 2021
GAO-21-460 (GAO CODE 104478)

**“TACTICAL WHEELED VEHICLES: ARMY SHOULD UPDATE STRATEGY AND
IMPROVE COMMUNICATIONS WITH INDUSTRY”**

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

RECOMMENDATION 1: The GAO recommends that the Secretary of the Army should direct the appropriate offices within the Army to routinely update its tactical wheeled vehicle (TWV) strategy to account for evolving information and circumstances. (Recommendation 1)

DoD RESPONSE: The Department of Defense concurs with the recommendation. In January 2021, the Department of the Army published the “Tactical Wheeled Vehicle Plan, 2021-2035” that provided key stakeholders with an overview of TWV requirements, funding, and fielding activities. This plan was the first TWV plan developed by the Army since 2014. Concurrent with the development of this plan, and continuing through the date of this document, Army Futures Command has been conducting a comprehensive study of the TWV fleet in Multi Domain Operations (MDO). Upon completion of the study, projected for July 2021, the Army intends to develop a TWV Strategy that addresses the ends, way, and means of the TWV fleet in meeting MDO requirements.

RECOMMENDATION 2: The GAO recommends that the Secretary of the Army should direct the appropriate offices within the Army to better coordinate external communication with industry to assure their assessment of needs for tactical wheeled vehicles are consistently communicated. (Recommendation 2)

DoD RESPONSE: The Department of Defense concurs with the recommendation. During the last several years, the Army has aggressively re-prioritized available resources to meet the challenges of peer and near-peer competitors. Some of these re-prioritizations have affected the industrial base associated with production and sustainment of TWVs. The Army recognizes the need to continually engage industry partners on priorities and resourcing and, as the impact of the pandemic lessens, fully intends to improve communication with industry.

Text of Appendix III: Comments from the Department of the Army

Mr. Jon Ludwigson

Director, Contracting and National Security Acquisitions

U.S. Government Accountability Office 441 G Street, N.W.

Washington, DC 20548 Dear Mr. Ludwigson:

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Sincerely,

Eric C. Peterson,

Lieutenant General

U.S. Army Deputy Chief of Staff, G-8

GAO DRAFT REPORT DATED JUNE 1, 2021 GAO-21-460 (GAO CODE
104478) "TACTICAL WHEELED VEHICLES: ARMY SHOULD UPDATE
STRATEGY AND IMPROVE COMMUNICATIONS WITH INDUSTRY"

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Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact

Jon Ludwigson, (202) 512-4841 or ludwigsonj@gao.gov

Staff Acknowledgments

In addition to the contact named above, J. Kristopher Keener (Assistant Director), Joe E. Hunter (Analyst-in-Charge), Marie P. Ahearn, Pedro A. Almoguera, Lorraine R. Ettaro, Stephanie Gustafson, Andrew N. Powell, and Roxanna T. Sun made key contributions to this report. Michael Holland, Kevin O'Neill, and Hai Tran also contributed to this report.