



June 2023

OPTIONALLY MANNED FIGHTING VEHICLE

Observations on the Objectivity, Validity, and Reliability of the Army's Report

Accessible Version

GAO Highlights

Highlights of [GAO-23-106549](#), a report to congressional committees

Why GAO Did This Study

The Army intends to replace the Bradley Fighting Vehicle, which was first produced in the 1980s, with the OMFV. While the Bradley has been modernized with additional capabilities, the OMFV is to achieve greater firepower and mobility with a design that can quickly integrate future upgrades. The Army awarded contracts to five vendors to develop concept designs in September 2021. Congress included a provision in statute for the Army to submit a report on its analysis of OMFV desired characteristics, force structure and operational concepts, and combat effectiveness.

Congress also included a provision in statute for GAO to assess the objectivity, validity, and reliability of the Army's report, among other things. GAO's report assesses the extent to which the Army's report presents an objective, valid, and reliable analysis of (1) the desired characteristics for the OMFV; (2) the force structure designs and operational concepts for the OMFV; and (3) the combat effectiveness of teams equipped with the OMFV compared to those equipped with the modernized Bradley.

GAO defined objectivity, validity, and reliability, and used its generally accepted research standards to assess the extent to which the Army's March 2023 report to congressional committees presented information that generally met these definitions in research design, execution, and reporting. GAO also interviewed Army officials who were involved in developing the report.

View [GAO-23-106549](#). For more information, contact Mona Sehgal at (202) 512-4841 or SehgalM@gao.gov.

June 2023

OPTIONALLY MANNED FIGHTING VEHICLE

Observations on the Objectivity, Validity, and Reliability of the Army's Report

What GAO Found

In 2018, the Army initiated a program called the Optionally Manned Fighting Vehicle (OMFV) to replace the Bradley Fighting Vehicle. In March 2023, the Army submitted a report to congressional committees about the OMFV. GAO assessed the report for objectivity, validity, and reliability, defining the concepts as follows:

- **Objectivity** includes the elimination of biases and clearly defined limitations,
- **Validity** includes sound conclusions reasonably derived from methods, and
- **Reliability** includes dependable and complete information and data.

Notional Rendering of Optionally Manned Fighting Vehicle



Disclaimer: US Government Concept (Not Production Representative).

Source: U.S. Army. | GAO-23-106549

The Army's report on the desired characteristics of the OMFV presented information that responded to the statutory provision and was generally objective. The Army reported on a range of perspectives by gathering feedback from soldiers and vendors, which contributed to objectivity. However, the Army's report did not include details about the methodologies used or the data collected to allow an assessment of validity and reliability.

The Army presented initial observations on force structure and operational concepts based on studies that were generally objective. For instance, the Army contextualized its findings by reporting on assumptions and limitations. However, the Army's report did not include enough information to draw conclusions regarding the validity and reliability of the force structure and operational concepts analyses completed as of March 2023. The Army noted that it intends to conduct a complete analysis of OMFV force structure and operational concepts over the next 18 to 24 months.

The Army's report also contained information about the combat effectiveness of the OMFV. This information was generally objective in contrasting the three OMFV concepts and Bradley when reporting on desired characteristics such as lethality. This portion of the report did not provide quantitative metrics that would have supported GAO's assessment of the validity of the information. The report also did not present information about data that would have allowed an

assessment of their reliability. Army officials said that more details were not included due to security classification.

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	NDAAs	National Defense Authorization Act
	OMFV	Optionally Manned Fighting Vehicle
	TRAC	The Research and Analysis Center

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June 27, 2023

Congressional Committees

In 2018, the Army initiated a program to replace the Bradley Fighting Vehicle, first produced in the 1980s, with a modernized ground combat vehicle called the Optionally Manned Fighting Vehicle (OMFV).¹ While the Bradley has been modernized with new capabilities over time, potential adversaries of the United States have increased their combat capabilities. As a consequence, the Army stated that it needs to bring greater survivability, lethality, and improved maneuver capabilities to its infantry fighting vehicles. The Army noted this need as early as 2010, but past efforts to replace the Bradley failed due to immature technology and changing and complex requirements, costing the taxpayers billions of dollars.

Section 234 of the National Defense Authorization Act (NDAA) for Fiscal Year 2022 includes a provision for the Army to submit a report to the congressional defense committees on the analysis supporting the Army's determination of OMFV requirements or desired characteristics.² The Army submitted its report on March 21, 2023.

The same act includes a provision for us to analyze the Army's report.³ Our report assesses the extent to which the Army's report presents an objective, valid, and reliable analysis of (1) the desired characteristics for the OMFV; (2) the force structure designs and operational concepts for the OMFV; and (3) the combat effectiveness of teams equipped with the OMFV as compared to those equipped with the modernized Bradley.

We assessed the Army's report for the objectivity, validity, and reliability of the study's design, execution, and presentation.

For each section of the Army's report, two analysts independently assessed (1) the Army's response to the elements in the mandate, (2) whether those responses met generally accepted research standards we identified in prior work, and (3) whether the responses met definitions for

¹For the purposes of this review, we are using the Army-designated name of the program rather than a gender-neutral name.

²Pub. L. No. 117-81 § 234(b) (2021).

³Pub. L. No. 117-81 § 234(d).

objectivity, validity, and reliability. Specifically, the analysts assessed the extent to which the Army's report met definitions for objectivity, validity, and reliability, which we defined within the scope of the generally accepted research standards. The analysts reconciled any differences.

We also reviewed a preliminary briefing that presented the same observations as the Army's report and conducted interviews with Army officials involved in the development of the report. Appendix I provides additional information on our objectives, scope, and methodology.

We conducted this performance audit from January 2023 to June 2023 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

The Bradley, the primary infantry fighting vehicle used in the U.S. Army, was first introduced in the 1980s. Over the years, the Army has modernized the Bradley with additional technologies, including new communications systems, heavier armor, and more powerful engines. The original system was designed with margins for additional space, weight, and power to accommodate such upgrades. However, the accumulation of these upgrades has used much of this margin, and the Army faces increasing constraints in its ability to modernize the Bradley.

Figure 1 shows a picture of the modernized Bradley.

Figure 1: Modernized Bradley Infantry Fighting Vehicle



Source: U.S. Army / Sgt. T. Lowery. | GAO-23-106549

In recent years, peer and near-peer competitors of the United States have significantly increased their combat vehicle and anti-armor capabilities. In addition, the way the Army operates the Bradley in coordination with its other assets, such as aircraft and tanks, has shifted since the vehicle was first produced in the 1980s.

In 2018, the Army initiated a program to replace the Bradley with the OMFV. The OMFV is intended to provide improved protection, firepower, and mobility. The Army also intends for the design of the OMFV to include a modular open systems architecture to allow for rapid integration of

future hardware and software, ensuring that the OMFV remains relevant for future battlefields.

Figure 2 shows a government concept of the OMFV.

Figure 2: Government Concept of Optionally Manned Fighting Vehicle



Disclaimer: US Government Concept
(Not Production Representative).

Source: U.S. Army. | GAO-23-106549

The Army awarded contracts to five vendors for the development of OMFV concept designs in September 2021. The resulting concept designs will be considered as part of the criteria for future contracts. As of

April 2023, the Army plans to use a full and open competition to award up to three contracts for detailed design and prototyping of OMFV concepts.

Section 234 of the fiscal year 2022 NDAA requires the Army to submit a report on requirements analysis for the OMFV prior to awarding a contract for development of a physical prototype.⁴ The Army's report was required to include the following five elements:

- a detailed description of the formal requirements applicable to the OMFV or the desired characteristics guiding the program's physical prototyping phase;
- a description of the analysis conducted to finalize such requirements and characteristics;
- a description of OMFV-equipped force structure designs and operational concepts analyzed during the vehicle concept design and detailed design phases;
- a detailed description of the analysis conducted, trade-offs considered, and conclusions drawn with respect to the force structure designs and operational concepts, survivability, mobility, lethality, payload, and combat effectiveness in execution of the critical operational tasks required of fighting-vehicle-equipped infantry; and
- an assessment and comparison of the combat effectiveness (including survivability, mobility, and lethality) of combined arms company teams equipped with the OMFV compared to those equipped with fully modernized Bradley Fighting Vehicles.⁵

Section 234 of the fiscal year 2022 NDAA also includes a provision for us to assess the objectivity, validity, and reliability of the five elements in the Army's report.⁶ For the purposes of this report, we defined these concepts as follows:

- **Objectivity:** Whether the study was conducted in a way meant to eliminate known sources of biases with clearly defined scope, assumptions, and limitations;

⁴Pub. L. No. 117-81, § 234(b).

⁵Pub. L. No. 117-81, § 234(b)(2).

⁶Pub. L. No. 117-81, § 234(d).

- **Validity:** Whether the study is sound, with consideration of whether the conclusions made are reasonably derived from the underlying methods and information; and
- **Reliability:** Whether the study is dependable, with consideration of the completeness of the underlying information and data.

To assess whether the report contents met these definitions, we used generally accepted research standards. These standards include questions relevant to the key elements of a study—its design, execution, and presentation—and to our definitions of objectivity, validity, and reliability. During our content analysis, we assessed whether the Army’s report addressed the generally accepted research standards in a way that was consistent with our definitions of objectivity, validity, and reliability. Figure 3 presents these standards.

Figure 3: Key Questions Outlined In Generally Accepted Research Standards

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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Sources: Generally accepted research standards adapted from GAO-21-460, GAO-15-548, and GAO-06-938. | GAO-23-106549

Text of Figure 3: Key Questions Outlined In Generally Accepted Research Standards

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. 4Are 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?

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 sufficiently reliable for the study's purposes?
5. Were any data limitations identified and were the impact of the limitations adequately explained?
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?

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?

Sources: Generally accepted research standards adapted from GAO-21-460, GAO-15-548, and GAO-06-938. | GAO-23-106549

An objective study should identify and account for biases. A well-designed study accomplishes this by clearly stating the study's objective, as well as identifying assumptions and constraints (as noted in questions two, four, and seven for study design in the figure above). A well-executed study demonstrates objectivity by addressing those objectives as stated in the design (as noted in questions one and two for study execution). A well-presented study contributes to objectivity by presenting conclusions that do not differ from the study's design and execution (as noted in questions three and four for study presentation).

A valid study should be sound and make reasonable conclusions that are derived from the underlying methods and information. A well-designed study contributes to validity by using reasonable and consistent assumptions (as noted in question five for study design). A well-executed study ensures validity by carrying the methodology out as planned, or appropriately adjusting it to the evidence (as noted in question three for study execution). A well-presented study accomplishes this by presenting conclusions that are supported by the analysis conducted (as noted in questions one and three for study presentation).

A reliable study should be dependable and use complete information and data. A well-designed study contributes to reliability by allowing for the dependability of results through a sensitivity analysis (as noted in question six for study design). A well-executed study contributes to reliability by ensuring the data and information are sufficiently complete and reliable for the study's purposes (as noted in question five for study execution). A well-presented study contributes to reliability by not drawing conclusions from incomplete data or information (as noted in questions two and three for study presentation).

The Army Presentation of OMFV Desired Characteristics Is Generally Objective, but Did Not Detail Supporting Analyses

The Army used existing analyses for the OMFV to present objective information on OMFV characteristics in its March 2023 report, but did not provide enough information on those analyses to assess their validity and

reliability. The Army's report identified nine desired characteristics for the OMFV and prioritized 28 attributes derived from these characteristics. The Army intends for the prioritized attributes to be further refined by vendors under the next contracts.

The Army's report noted that it used seven previously conducted analytical studies that officials stated relied primarily on models and simulations. These studies included analyses of the OMFV in different operational environments and assessed the effectiveness of a two-person crew. The Army's report also used information from four soldier "touchpoints," which officials stated are events that the Army used to gather input from active duty units that fight and train with the Bradley. Lastly, the report noted that the Army conducted four vendor feedback events that provided the Army and its industry partners with opportunities to exchange concepts and comments.

The seven analytical studies and four soldier touchpoints make up what the report referred to as its "11 analytical efforts" used to develop the characteristics desired for the OMFV. Further, the Army report provided several key examples of how these 11 analytical efforts informed the desired characteristics.⁷ For example, soldiers used simulations and virtual and physical models to provide feedback on vehicle designs during soldier touchpoints.

However, the Army report did not clearly describe the methodology of these efforts; the steps it took to ensure data reliability; or the verification, validation, and accreditation of the models and simulations it used.

Objectivity. The Army presented its analyses of the desired characteristics for the OMFV in a way that generally demonstrates objectivity. The design and scope of the Army's report were informed by the requirements of Section 234 of the fiscal year 2022 NDAA. According to generally accepted research standards, a well-executed study addresses the objectives from the design and scope, which is consistent with our definition of objectivity.

The report also used the analytical studies, soldier touchpoints, and vendor feedback events to describe the desired characteristics. Inclusion of all three sources reduced potential biases that could exist from relying

⁷We did not independently assess or verify the analytical efforts supporting the report.

on a single source, contributing to the objectivity of this portion of the report.

While the Army presented the OMFV desired characteristics, the report does not, however, thoroughly describe all of the assumptions and limitations the Army may have considered in the study, which are components of objectivity. In an interview we conducted, Army officials stated that in each of the 11 analytical efforts, they identified the assumptions and limitations as they collected data for the models and simulations.

Validity. While the Army described the OMFV's desired characteristics, as well as the analysis conducted to develop them, the report did not provide sufficient details to draw a conclusion regarding the validity of these two elements. Although the Army disclosed the number and extent of its analytical efforts, as well as a description of those efforts, the report did not include details on the methodologies or models used in the analyses. For example, the report assumes that bridges in Poland are representative of those across Eastern Europe, but the Army does not identify the data and methods used to support this assumption. In an interview we conducted, Army officials stated that the analyses informing the report included data and methods to support the report's assumptions and limitations.

Reliability. While the Army described the OMFV's desired characteristics, as well as the analysis conducted to finalize them, the report did not include sufficient detail to draw a conclusion regarding the reliability of these two elements. Specifically, the report did not include the steps the Army took to assess the reliability of the data used to conduct the supporting analyses or the reliability of the results of its analytical efforts.

Army officials told us that the models and simulations informing the 11 analytical efforts had gone through the Army's standard verification, validation, and accreditation process to ensure their reliability. In an interview, the Army reported using this process to determine:

- whether models and simulations accurately represent the developer's specifications;
- the extent to which models and simulations are accurate, real world representations; and

-
- whether a model or simulation is acceptable to use for a specific purpose.

The Army Is in the Process of Conducting Its Force Structure and Operational Concepts Analysis for OMFV

The Army presented some preliminary observations on force structure and operational concepts in its March 2023 report, and Army officials noted that they intend to conduct a complete analysis over the next 18 to 24 months. The Army's report did not clearly define, however, force structure or operational concepts. In interviews with Army officials, they stated that they considered both in the analyses informing the report. For example, the report discussed various platoon sizes and how the platoons would operate in different terrain. Army officials stated these examples were observations about different force structures. Army officials further stated that the additional analyses of force structure and operational concepts will require completion of the detailed design of the vendors' vehicle concepts, which will occur in the next phase of the acquisition process. The Army has not yet awarded contracts for a detailed design, but plans to do so by the third quarter of fiscal year 2023.

The preliminary observations on force structure and operational concepts in the Army's report included information that is generally objective given the ongoing analyses. However, the report did not include enough information to draw conclusions regarding the validity and reliability of these observations.

Objectivity. The force structure design and operational concept observations presented in the report included elements that are generally objective. The observations rely on two of the 11 analytical efforts used to support the desired characteristics for the OMFV. These include results from one of the Army's soldier touchpoints and one analytical study. Specifically, the report noted the Army used the July 2021 soldier touchpoint conducted by the Maneuver Battle Lab within the Maneuver Capabilities Development and Integration Directorate, and a September 2021 study conducted by the Army's Research and Analysis Center (TRAC). Together these efforts varied both platoon size and operating environment, which relates to force structure and operational concepts. Including analyses from different sources reduces potential bias by

limiting the influence that an individual source can have on the results, contributing to objectivity.

While the Army did present preliminary observations on force structure design and operational concepts from these analyses, the Army did not, however, include at least one other analysis that it may have used. For example, Army officials told us that a second TRAC study expanded on the first, and added another scenario with different terrain and details from a vendor's concepts. The Army report did not include any observations on force structure or operational concepts from this analysis or describe why the analysis was not included. Describing why this analysis was not included could help prevent a perceived bias in the selection of the analyses. Army officials we interviewed stated that observations from this study were not included due to security concerns.

According to generally accepted research standards, a well-designed study identifies the assumptions and limitations used, which is consistent with our definition of objectivity. The Army presented some assumptions and limitations from the two analytical efforts. For example, the report stated that the first TRAC study used the most likely and most dangerous threats that an infantry fighting vehicle could encounter. The soldier touchpoint was based on the assumption of using the Bradley's current force structure as a baseline. Lastly, the Army clearly stated the limitations of the report by acknowledging that force structure and operational concept analyses are ongoing.

Validity. While the Army described preliminary observations on force structure and operational concepts, as well as the associated analysis and considerations, the report did not provide sufficient detail to draw a conclusion regarding the validity of these elements. The report presents the implications of different force structure designs on operations, and the Army highlighted some benefits of alternative force structures in the report. For example, the first TRAC analysis found that a different force structure improved survivability and lethality, and the Maneuver Battle Lab analysis drew similar conclusions. The Army's report, however, does not include details on the methodology of either the TRAC or the Maneuver Battle Lab analyses, which would help determine if the analyses were appropriate to support the force structure observations.

According to Army officials, these analyses were not designed to draw conclusions on force structure alternatives. Instead, the analyses were intended to assess the desired characteristics, indicating that they may not be appropriate to support conclusions on force structure and

operational concepts. Army officials we interviewed stated that analyses of force structure and operational concepts are ongoing.

Reliability. While the Army described preliminary observations on force structure and operational concepts, and its associated analysis and considerations, the report did not include enough details to draw a conclusion regarding the reliability of these elements. The report does not include the steps that the Army took to assess the reliability of the data used for the models and simulations in its analyses. For example, both the first TRAC and the Maneuver Battle Lab analyses present results without details on their methodologies for collecting and vetting information, or steps taken to ensure reliability. Army officials stated that all the models and simulations informing the 11 analytical efforts had gone through their standard verification, validation, and accreditation process to ensure their reliability.

Army officials also noted that the reliability of modeling and analyses like that provided by the Maneuver Battle Lab can be limited in simulating how soldiers would perform in real scenarios. They stated that the Army will conduct further analyses and efforts involving soldiers from appropriate units to determine force structure and operational concepts in the future.

The Army's Comparison of Combat Effectiveness Is Generally Objective but Did Not Detail Supporting Analyses

The Army report's comparison of the combat effectiveness of three OMFV concepts and the modernized Bradley Fighting Vehicle included some objective elements, but the report did not include enough details to draw conclusions about the comparison's validity and reliability. The Army provided a comparison of the modernized Bradley M2A4 and three variants of the OMFV for all nine of the desired characteristics and some of the 28 attributes. The report also provided a high-level review of the key findings from that comparison. This high-level review discussed the analysis, trade-offs, and conclusions drawn with respect to survivability, mobility, lethality, and payload as specified in Section 234 of the fiscal year 2022 NDAA.⁸ However, the report did not include enough details to

⁸Pub. L. No. 117-81, § 234 (b)(2)(D).

draw conclusions about the validity and reliability of the analyses used to make these comparisons.

Objectivity. The Army's comparison of the combat effectiveness of the OMFV concepts with the modernized Bradley includes information that is generally objective. The report compared three government concepts for the OMFV with a modernized version of the M2A4 Bradley. It presented findings on the survivability and force protection, mobility, lethality, payload, and operational effectiveness of the four vehicles. This is consistent with the scope and design of the Army's report. According to generally accepted research standards, a well-executed study addresses the objectives from the study's scope and design, which is consistent with our definition of objectivity.

In addition, the report presented examples where the modernized Bradley did and did not meet the desired characteristics for the OMFV, which helps prevent the appearance of bias toward the OMFV. For example, the report states that the modernized Bradley meets the desired electrical power growth characteristic and offers slightly better urban maneuverability, but notes that it does not meet other desired characteristics.

The report used the 11 analytical efforts to support this comparison, as well as three additional studies. These studies included (1) a 2018 Bradley size, weight, power, and cooling growth study; (2) a study to support the program's market research in 2020; and (3) a study to support concept design in 2021. While these studies are used to support the comparison, the report does not, however, describe how the Army chose the three studies it presented. Describing why these analyses were included could prevent a perceived bias in the selection of analyses. According to Army officials we interviewed, they selected the studies and characteristics that would provide the most illustrative examples and were most closely related to combat effectiveness.

Validity. While the Army compared the combat effectiveness of the OMFV concepts and the modernized Bradley, the comparison did not include enough details for us to draw a conclusion regarding the validity of this element of the report. The comparison did not present a detailed description of the results from the supporting analyses, which would help assess whether the models and simulations were reasonable or the conclusions were sound. For example, the comparison drew conclusions with respect to survivability and force protection, mobility, and lethality, but did not provide quantitative metrics to support the conclusions. Army

officials told us, however, that they had quantitative metrics for each of these characteristics and used them in support of the report. The officials stated that they did not include these metrics in the report due to security concerns.

Reliability. While the Army compared the combat effectiveness of the OMFV concepts and the modernized Bradley, the report did not include enough details to draw a conclusion regarding the reliability of this element. The report varies assumptions for each of the vehicles across some of the desired characteristics. Varying such assumptions provides a form of sensitivity analysis, which can provide increased reliability in results. For example, each OMFV concept presents different assumptions for some of its characteristics, such as engines with varying power or variance in the number of infantry soldiers it can transport.

While the comparison of the combat effectiveness of the OMFV concepts and the modernized Bradley uses the 11 analytical efforts, the report does not describe, however, how the Army ensured the reliability of the data it used. Army officials told us that all of the models and simulations that inform the report had gone through their standard verification, validation, and accreditation process to ensure their reliability.

Agency Comments

We provided a draft of this report to the Army for review and comment. The Army told us that they had no comments on the draft report.

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

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

Letter

A handwritten signature in black ink, appearing to read 'M. Sehgal', written in a cursive style with a long horizontal stroke extending to the left.

Mona Sehgal
Acting Director, Contracting and National Security Acquisitions

List of Committees

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

The Honorable Jon Tester
Chair
The Honorable Susan Collins
Ranking Member
Subcommittee on Defense
Committee on Appropriations
United States Senate

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

The Honorable Ken Calvert
Chair
The Honorable Betty McCollum
Ranking Member
Subcommittee on Defense
Committee on Appropriations
House of Representatives

Appendix I: Objectives, Scope, and Methodology

This report assesses the extent to which the Army's report in response to Section 234 of the National Defense Authorization Act for Fiscal Year 2022¹ presents objective, valid, and reliable analysis of (1) the desired characteristics for the Optionally Manned Fighting Vehicle (OMFV); (2) the force structure designs and operational concepts for the OMFV; and (3) the combat effectiveness of teams equipped with the OMFV as compared to those equipped with the modernized Bradley.

For each section of the Army's report, two analysts independently assessed (1) the Army's response to the elements in the mandate, (2) whether those responses addressed the generally accepted research standards that we identified in prior work, and (3) whether the responses met our definitions for objectivity, validity, and reliability within the context of the research standards. After making their independent assessments, the analysts met to reconcile any differences in their determinations. For example, we drew conclusions that the report was generally objective when available information presented in the report was consistent with our definition of objectivity but was missing information that would have addressed the generally accepted research standards.

To address all three objectives, we defined objectivity, validity, and reliability. We started with common definitions for the terms, and adjusted them to align with our generally accepted research standards. These definitions align with those found in Government Auditing Standards.² For the purposes of this report, we defined these terms as:

- Objectivity: Whether the study was conducted in a way meant to eliminate known sources of biases with clearly defined scope, assumptions, and limitations;
- Validity: Whether the study is sound, with consideration of whether the conclusions made are reasonably derived from the underlying methods and information; and

¹Pub. L. No. 117-81, § 234 (2021).

²GAO, *Government Auditing Standards*, [GAO-21-368G](#) (Washington, D.C.: April 14, 2021).

- Reliability: Whether the study is dependable, with consideration of the completeness of the underlying information and data.

From prior work, we identified generally accepted research standards for the design, execution, and presentation of findings that define a sound and complete study.³ We originally developed these standards by reviewing research literature and Department of Defense guidance. As part of this effort, we identified frequently occurring, generally accepted research standards that are relevant for defense studies and define a quality—or sound and complete—study. We determined that these standards were applicable to this report. These standards state that key elements of a study include its design, execution, and presentation, and contain questions that relate to our definitions of objectivity, validity, and reliability.

In addition to assessing the Army's report, we reviewed a preliminary briefing that presented the same observations. We did not independently assess or verify the analytical efforts supporting the report. To discuss the report's contents and how the supporting analyses contributed to objectivity, validity, and reliability, we interviewed Army officials involved in the report's development, including from the following organizations:

- Next Generation Combat Vehicle Cross-Functional Team;
- Program Executive Office for Ground Combat Systems;
- Office of the Assistant Secretary of the Army for Acquisition, Logistics, and Technology; and
- Research and Analysis Center, White Sands Missile Range, New Mexico.

We conducted this performance audit from January 2023 to June 2023 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

³GAO, *Tactical Wheeled Vehicles: Army Should Routinely Update Strategy and Improve Communication with Industry*, [GAO-21-460](#) (Washington, D.C.: July 15, 2021); *Army Combat Vehicles: Industrial Base Study's Approach Met Research Standards*, [GAO-15-548](#) (Washington, D.C.: June 16, 2015); and *Defense Transportation: Study Limitations Raise Questions about the Adequacy and Completeness of the Mobility Capabilities Study and Report*, [GAO-06-938](#) (Washington, D.C.: September 20, 2006).

**Appendix I: Objectives, Scope, and
Methodology**

the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: GAO Contact and Staff Acknowledgments

GAO Contact

Mona Sehgal, (202) 512-4841 or sehgal@gao.gov

Staff Acknowledgments

In addition to the contact named above, J. Kristopher Keener (Assistant Director), Cale Jones (Analyst-in-Charge), Breanne Cave, Matthew T. Crosby, Stephanie Gustafson, Nathan Hanks, Tonya Humiston, Lauren Lochocki, Kevin O'Neill, Daniel Sosa, Hai Tran, Alyssa Weir, and Tiaye Wooten made significant contributions to this review.

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