



July 2021

MILITARY VEHICLES

Army and Marine Corps Should Take Additional Actions to Mitigate and Prevent Training Accidents

This Report Is Temporarily Restricted Pending Official Public Release.

Why GAO Did This Study

Tactical vehicles are used to train military personnel and to achieve a variety of missions. Both the Army and Marine Corps have experienced tactical vehicle accidents that resulted in deaths of military personnel during non-combat scenarios.

GAO was asked to review issues related to the Army's and Marine Corps' use of tactical vehicles. Among other things, this report examines (1) trends from fiscal years 2010 through 2019 in reported Army and Marine Corps tactical vehicle accidents, deaths, and reported causes; and evaluates the extent to which the Army and Marine Corps have (2) taken steps to mitigate and prevent accidents during tactical vehicle operations; and (3) provided personnel with training to build the skills and experience needed to drive tactical vehicles. GAO analyzed accident data from fiscal years 2010 through 2019 (the most recent full year of data at the time of analysis); reviewed documents; and interviewed officials from a non-generalizable sample of units and training ranges selected based on factors, such as locations where accidents occurred.

What GAO Recommends

GAO is making 9 recommendations to the Department of Defense, including that the Army and Marine Corps more clearly define roles and establish procedures and mechanisms to help supervisors enhance tactical vehicle safety; and develop performance criteria and measurable standards for driver training programs. The department concurred with GAO's recommendations.

View [GAO-21-361](#). For more information, contact Cary Russell at (202) 512-5431 or russellc@gao.gov.

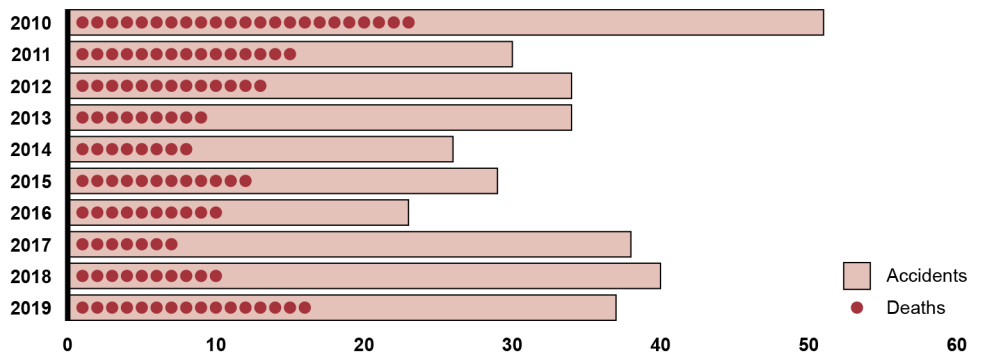
MILITARY VEHICLES

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What GAO Found

The number of serious accidents involving Army and Marine Corps tactical vehicles, such as tanks and trucks, and the number of resulting deaths, fluctuated from fiscal years 2010 through 2019 (see figure). Driver inattentiveness, lapses in supervision, and lack of training were among the most common causes of these accidents, according to GAO analysis of Army and Marine Corps data.

Number of Army and Marine Corps Class A and B Tactical Vehicle Accidents and Resulting Military Deaths, Fiscal Years 2010 through 2019
Fiscal year



Source: GAO analysis of Department of Defense (DOD) data. | GAO-21-361

Note: Class A and B accidents have the most serious injuries and financial costs.

The Army and Marine Corps established practices to mitigate and prevent tactical vehicle accidents, but units did not consistently implement these practices. GAO found that issues affecting vehicle commanders and unit safety officers hindered Army and Marine Corps efforts to implement risk management practices. For example, the Army and Marine Corps had not clearly defined the roles or put procedures and mechanisms in place for first-line supervisors, such as vehicle commanders, to effectively perform their role. As a result, implementation of risk management practices, such as following speed limits and using seat belts, was ad hoc among units.

The Army and Marine Corps provide training for drivers of tactical vehicles that can include formal instruction, unit licensing, and follow-on training, but their respective programs to build driver skills and experience had gaps. GAO found that factors, such as vehicle type and unit priorities, affected the amount of training that vehicle drivers received. Further, licensing classes were often condensed into shorter periods of time than planned with limited drive time, and unit training focused on other priorities rather than driving, according to the units that GAO interviewed. The Army and Marine Corps have taken steps to improve their driver training programs, but have not developed a well-defined process with performance criteria and measurable standards to train their tactical vehicle drivers from basic qualifications to proficiency in diverse driving conditions, such as driving at night or over varied terrain. Developing performance criteria and measurable standards for training would better assure that Army and Marine Corps drivers have the skills to operate tactical vehicles safely and effectively.

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Abbreviations

AAV	Assault Amphibious Vehicle
DOD	Department of Defense
FMTV	Family of Medium Tactical Vehicles
HMMWV	High Mobility Multipurpose Wheeled Vehicle
LAV	Light Armored Vehicle
LVSR	Logistics Vehicle System Replacement
MRAP	Mine Resistant Ambush Protected
MTVR	Medium Tactical Vehicle Replacement

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July 7, 2021

Congressional Requesters

The Army and Marine Corps use tactical vehicles, such as tanks and trucks, to achieve a variety of missions across a broad range of terrain and environmental conditions.¹ The Army and Marine Corps have experienced tactical vehicle accidents that resulted in service member deaths during non-combat scenarios, such as training events.² Tactical vehicle accidents can be caused by human, environmental, and mechanical factors. Accidents take many forms including vehicle-to-vehicle collisions, vehicle-to-pedestrian collisions, and vehicle rollovers, for example.³ Figure 1 shows a tactical vehicle rollover accident.

¹Generally, tactical vehicles are categorized as: (1) wheeled vehicles, which include motor transport vehicles (“trucks”); light armored vehicles (e.g., Stryker); and High Mobility Multipurpose Wheeled Vehicle (HMMWV) Family of Vehicles; and (2) tracked vehicles, which include M1 Abrams tanks, M2 Bradley Fighting Vehicles, and Assault Amphibious Vehicles (AAV).

²The Department of Defense (DOD) refers to accidents that occur outside of engagement with an adversary as “mishaps.” A mishap is an unplanned event or series of events that results in damage to DOD property; occupational illness to DOD personnel; injury or death to on- or off-duty DOD military personnel; injury or death to on-duty DOD civilian personnel; or damage to public or private property; or injury or death or illness to non-DOD personnel, caused by DOD activities. Throughout this report, we use the term “accident” to mean mishap. Department of Defense Instruction 6055.07, *Mishap Notification, Investigation, Reporting, and Record Keeping* (June 6, 2011) (incorporating change 1, Aug. 31, 2018).

³For the purposes of this report, a vehicle “rollover” is any accident that causes the tactical vehicle to come into contact with the ground on any of its surfaces outside of its wheels or tracks.

Figure 1: A Tactical Vehicle Rollover Accident



Source: U.S. Army/Defense Visual Information Distribution Service. | GAO-21-361

The Army and Marine Corps have programs to select, train, test, and license qualified personnel to operate tactical vehicles. Soldiers and marines use training ranges and areas to perform initial licensure events, unit certifications, and exercises involving tactical vehicles.⁴ A mix of training range and unit personnel share responsibility for inspecting, reporting, and mitigating hazards to tactical vehicle operations.⁵

The Army Combat Readiness Center and the Naval Safety Center have the responsibility to track, record, and analyze accidents and accident trends for their respective military services.⁶ In 2018, we reported that the DOD safety centers did not collect standardized data as part of their

⁴“Soldiers” refers to service members who serve as part of the Army. “Marines” refers to service members who serve as part of the Marine Corps.

⁵A hazard is any actual or potential condition that can cause injury, illness, or death of personnel or damage to or loss of equipment, property, or mission degradation.

⁶As the Marine Corps falls under the Department of the Navy, the Naval Safety Center is responsible for keeping records of Marine Corps accidents.

accident investigations.⁷ We recommended that DOD take steps to help ensure that the safety centers collect standardized data elements for aviation accidents specifically. DOD concurred with our recommendations, and as of January 2021, DOD officials reported that they are working to implement them.

You asked us to review issues related to Army and Marine Corps tactical vehicle accidents. This report examines (1) the trends from fiscal years 2010 through 2019 in reported Army and Marine Corps tactical vehicle accidents and deaths in non-combat scenarios and reported causes; and evaluates the extent to which the Army and Marine Corps have (2) taken steps to mitigate and prevent accidents during tactical vehicle operations; (3) provided personnel with training to build the skills and experience needed to drive tactical vehicles; and (4) established methods to identify and communicate hazards on ranges and training areas.

To address our first objective, we analyzed accident data provided by the Army Combat Readiness Center and the Naval Safety Center from fiscal years 2010 through 2019.⁸ We analyzed these data to determine trends in tactical vehicle accidents, such as the number of accidents or deaths by accident class, year, vehicle type, environmental conditions, cause, and event type, such as a vehicle rollover.⁹ We also requested and analyzed available narrative descriptions for selected accident investigations of Class A accidents to identify contributing factors, such as human and environmental factors.¹⁰ We met with agency officials who

⁷GAO, *Military Aviation Mishaps: DOD Needs to Improve Its Approach for Collecting and Analyzing Data to Manage Risks*, [GAO-18-586R](#) (Washington, D.C.: Aug. 15, 2018).

⁸DOD collects data on all vehicle accidents involving service members, including those that took place in privately owned vehicles; however, we did not include privately owned or commercial vehicles in our analysis. We included data from fiscal year 2010 through fiscal year 2019, which was the most recent full year of data available at the time of our analysis.

⁹DOD categorizes the severity of accidents by grouping them into classes, with Class A accidents being the most severe and Class D accidents being the least severe. DOD Instruction 6055.07. The Army and Marine Corps also use Classes E and H to signify other reportable accidents or “near-misses,” according to officials.

¹⁰We requested narratives for 73 Army Class A accidents involving selected tactical vehicles included in the scope of our review: the HMMWV family of vehicles, Family of Medium Tactical Vehicles (FMTV), Strykers, and Bradley Fighting Vehicles that took place in the United States, Germany, or South Korea. Army officials reported that they were unable to provide narratives for 22 of the Class A accidents for various reasons. Detailed narratives describing causal factors were unavailable in the Marine Corps data.

report, maintain, and use the accident data in order to understand how the information is used and to help us assess its reliability and completeness. We also performed electronic testing of the data to check for missing values and internal consistency. We determined the data were sufficiently reliable for the purposes of identifying general trends in the reported number and severity of accidents over time, accident rates, deaths caused by accidents, and common causal factors for certain types of accidents.¹¹

To address our second objective, we reviewed accident data from the Army Combat Readiness Center and the Naval Safety Center to determine the most common causes of accidents or factors that make accidents more serious. We also reviewed reports and documentation on common hazards as identified by the Army and Marine Corps, and we collected and analyzed responses to surveys administered by the Army and Marine Corps that are used to aid commanders in risk assessment by identifying the views of soldiers and marines on operations, maintenance, training, and safety, among other issues. After identifying common hazards related to operating tactical vehicles, we analyzed documents that discuss the Army and Marine Corps procedures to identify risk management controls used to mitigate accidents during tactical vehicle operations. We made a non-generalizable selection of unit personnel to interview based on the number of accidents experienced by the unit and the types of vehicles they operated, among other factors, and we conducted interviews with them to understand the steps taken to implement these controls. We compared the steps taken to implement the controls with Army and Marine Corps risk management guidance. Furthermore, we determined the control environment component of the *Standards for Internal Control in the Federal Government* was significant to this objective, specifically the associated underlying principle that management should enforce accountability by considering excessive pressures on personnel.¹² We assessed the Army and Marine Corps practices for assigning safety personnel to units against this internal control standard.

¹¹For the purposes of this report, we use the term trend to refer to the number of accidents and characteristics of those accidents reported over time or summarized for the period of time covered by our review.

¹²GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: September 2014).

To address our third objective, we selected a subset of the tactical vehicles from the Army and Marine Corps based on the number of Class A and B accidents that involved those vehicles in fiscal years 2015 through 2019, key characteristics of the tactical vehicles (whether they were tracked or wheeled), and type of training program completed by service members, among other factors. We reviewed Army and Marine Corps training procedures and guidance on licensing and driver skill development for the tactical vehicle types we selected.¹³ We interviewed unit personnel to discuss processes to license, train, and build driver skills. We compared the training provided to Army and Marine Corps personnel with DOD and military service-level training guidance.¹⁴

To address our fourth objective, we reviewed joint Army and Marine Corps guidance to determine responsibilities for operating training ranges. We then analyzed Army and Marine Corps training range documentation and interviewed a non-generalizable selection of training range officials that we selected based on the number of accidents that occurred at the location and the types of vehicles that train there, among other factors. We discussed with these officials the use of range control methods and compared their processes with the risk assessment component of the Standards for Internal Control in the Federal Government. We also compared Army and Marine Corps processes to identify and communicate hazards with military service-level guidance and the federal internal control standard on communicating quality information. Appendix I provides further details on our objectives, scope, and methodology.

We conducted this performance audit from October 2019 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.

¹³Army Regulation 600-55, *The Army Driver and Operator Standardization Program (Selection, Training, Testing, and Licensing)* (Sept. 17, 2019) and Marine Corps Order 11240.118A, *Licensing Program for Tactical Wheeled Motor Transport Equipment Operators* (July 13, 2020).

¹⁴Department of Defense Directive 1322.18 *Military Training* (Oct. 3, 2019), Army Doctrine Publication 7-0, *Training (July 31, 2019)* and Marine Corps Order P3500.72A, *Marine Corps Ground Training and Readiness (T&R) Program* (Apr. 18, 2005).

Background

Examples of Army and Marine Corps Tactical Vehicle Types

The Army and Marine Corps use a variety of vehicles to achieve their missions. Figure 2 shows examples of the tactical vehicles operated by the Army and Marine Corps.

Figure 2: Examples of Army and Marine Corps Tactical Vehicles

Army	Army and Marine Corps	Marine Corps
<p>Bradley Fighting Vehicle</p> 	<p>High Mobility Multipurpose Wheeled Vehicle (HMMWV)</p> 	<p>Assault Amphibious Vehicle (AAV)</p> 
<p>Family of Medium Tactical Vehicles (FMTV)</p> 	<p>Military All-Terrain Vehicle (MRZR or UTV)</p> 	<p>Light Armored Vehicle (LAV)</p> 
<p>Stryker</p> 	<p>Mine Resistant Ambush Protected (MRAP)</p> 	<p>Medium Tactical Vehicle Replacement (MTVR)</p> 
<p>Sources (top to bottom): U.S. Army Reserve/Spc. Jorge Reyes Mariano, U.S. Army/Capt. Joseph Warren, and U.S. Army/Sgt. Michael Spandau.</p>	<p>Sources (top to bottom): U.S. Air Force/Senior Master Sgt. John S. Chapman, U.S. Marine Corps/Lance Cpl. Christine Phelps, and U.S. Marine Corps/Sgt. Michael V. Walters.</p>	<p>Sources (top to bottom): U.S. Navy/Petty Officer 1st Class Benjamin Kittleson, U.S. Marine Corps/Sgt. Adam Dublinske, and U.S. Navy/Lt. Cmdr. Brian Wierzbicki.</p>

Source: GAO analysis of Department of Defense information. | GAO-21-361

Military Accident Severity Classes

DOD categorizes accidents by severity, with Class A accidents being the most severe, and Class D accidents being the least severe. The thresholds for accident classes for fiscal years 2010 through 2019 are shown in table 1.¹⁵

Table 1: Department of Defense (DOD) Accident Classes for Fiscal Years 2010 to 2019

Class of accident	Cost of damages	Injuries
Class A ^a	Greater than or equal to \$2 million	Death or permanent total disability
Class B	\$500K or more, but less than \$2 million	Permanent partial disability or inpatient hospital care for three or more individuals
Class C	\$50K or more, but less than \$500K	Injury or occupational illness that results in a lost work day(s) not including shift being worked when injury or occupational illness occurred
Class D ^b	\$20K or more, but less than \$50K	Any recordable injury or illness that does not meet the threshold for Class A, B, or C

Source: DOD Instruction 6055.07. | GAO-21-361

Note: DOD adjusted the thresholds for accident classes upward in October 2019 so that, for example, Class A accidents represent damages of \$2.5 million or higher. As we analyzed accidents that occurred from fiscal years 2010 through 2019, we did not assess any accidents for which these new thresholds applied. Assistant Secretary of Defense for Readiness Memorandum, *Revision to Accident Severity Classification Cost Thresholds and Recording of Injury and Fatality Costs* (Oct. 15, 2019).

^aDestruction of a DOD aircraft, excluding certain types of unmanned aircraft systems, will also result in a Class A mishap.

^bDOD standardized the threshold for Class D accidents across the services in fiscal year 2011. For fiscal year 2010, Army officials told us the Army Class D threshold was \$10,000 in damages or a no-lost time injury and Navy officials told us they treated every reported accident that did not meet the Class C threshold as a Class D accident.

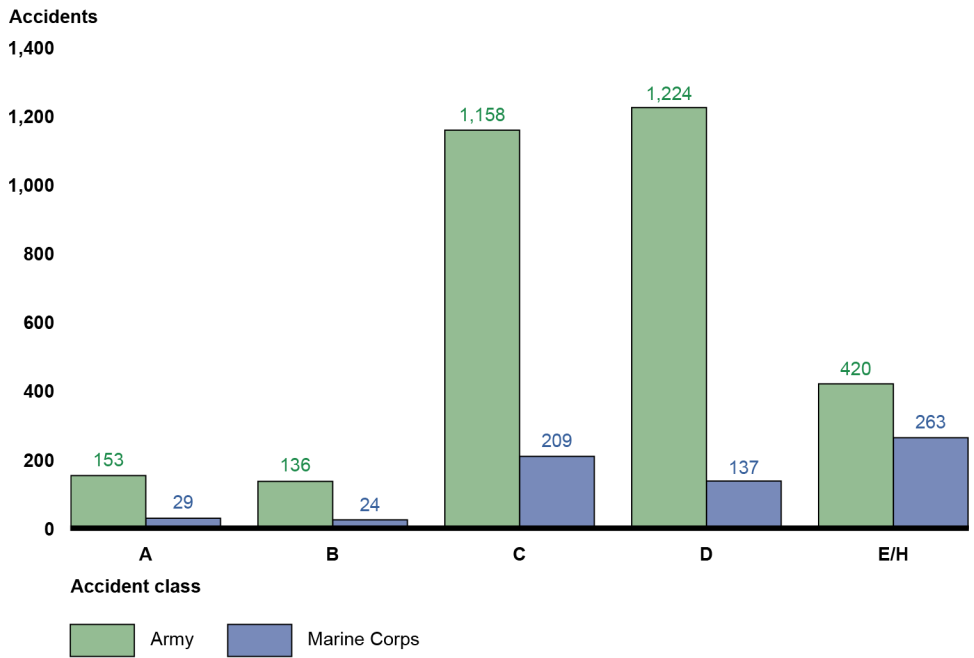
¹⁵The Department of Defense (DOD) adjusted the monetary thresholds for accident classes upward in October 2019 so that, for example, Class A accidents represent damages of \$2.5 million or higher. As we analyzed accidents that occurred from fiscal years 2010 through 2019, we did not assess any accidents for which these new thresholds applied. Assistant Secretary of Defense for Readiness Memorandum, *Revision to Accident Severity Classification Cost Thresholds and Recording of Injury and Fatality Costs* (Oct. 15, 2019). Prior to fiscal year 2011, DOD did not have a standard definition for Class D accidents. For fiscal year 2010, Army officials told us the Army Class D threshold was \$10,000 in damages or a no-lost time injury, and Navy officials told us they treated every reported accident that did not meet the Class C threshold as a Class D accident.

The Army and Marine Corps each have one additional accident class (Class E and H, respectively) for less serious accidents or “near misses.” Army and Marine Corps officials told us that they believe Class A and B accidents are generally reported accurately but that other classes are likely under-reported for a variety of reasons, including that the accident was not deemed serious enough by the unit experiencing the accident or that unit personnel feared retribution for reporting minor accidents.¹⁶ In total, the Army recorded 3,091 tactical vehicle accidents and the Marine Corps recorded 662 tactical vehicle accidents across all classes from fiscal years 2010 through 2019, according to Army and Marine Corps data (see fig. 3).¹⁷

¹⁶We assessed the reliability of the data and found it to be generally reliable, especially for more serious accidents (Class A and B), though incomplete records prevented us from analyzing certain data fields of interest, such as driver characteristics. Overall, we found the data were sufficiently reliable for the purposes of identifying general trends in the reported number and severity of accidents over time, accident rates, deaths caused by accidents, and common causal factors for certain types of accidents.

¹⁷The disparity in number of accidents between the Army and Marine Corps is likely due in part to the Army having about 2.5 times as many active duty personnel as the Marine Corps.

Figure 3: Army and Marine Corps Tactical Vehicle Accidents by Class, Fiscal Years 2010 through 2019



Source: GAO analysis of Department of Defense data. | GAO-21-361

Note: For the period of our review, the Department of Defense (DOD) defined Class A accidents as the most serious accidents—resulting in death or permanent total disability, destruction of a DOD aircraft, or \$2 million in damages or greater. Class B accidents resulted in permanent partial disability, inpatient hospital care for three or more individuals, or damages of \$500,000 or more, but less than \$2 million. Class C accidents resulted in an injury or illness that caused one or more days away from work or damages of \$50,000 or greater, but less than \$500,000, and Class D accidents involved a recordable injury that did not rise to the level of class A, B, or C or \$20,000 to under \$50,000 in damages. Prior to June 2011, DOD did not have a standard definition for Class D accidents. For fiscal year 2010, Army officials told us the Army Class D threshold was \$10,000 in damages or a no-lost time injury, and Navy officials told us they treated every reported accident that did not meet the Class C threshold as a Class D accident. Classes E and H were used to signify other reportable accidents or “near-misses,” according to DOD.

Key DOD Roles and Responsibilities

DOD has established a number of offices with responsibilities related to reporting and recording accidents, training tactical vehicle drivers, establishing safety protocols, and operating training ranges. Some of the key offices are listed in table 2 below.

Table 2: Key Department of Defense (DOD) and Military Service Responsibilities for Accident Reporting, Driver Training, Safety, and Training Range Control

Office of the Director for Force Safety and Occupational Health	Oversees occupational safety and health assessment and reporting, trend analysis, and accident reduction and mitigation activities. Responsible for DOD safety and occupational health policies, oversight, and initiatives.
Office of the Director of Army Safety	Develops and maintains Army safety policy and standards that seek to integrate safety and risk management into all Army activities, and provides direction and oversight for the implementation of the Army Safety and Occupational Health Management System.
Commandant of the Marine Corps Safety Division	Advises the Commandant on safety matters; oversees development of training for safety programs, conducts safety surveys, program reviews, and analysis of accident data to prevent accidents.
Army Combat Readiness Center	Seeks to preserve Army readiness through analysis, training, and the development of systems that prevent accidental loss of resources. Serves as the repository for Army accident data.
Naval Safety Center	Seeks to preserve warfighting capability and combat lethality by identifying hazards and reducing risks to people and resources. Serves as the repository for Navy and Marine Corps accident data.
Army Training and Doctrine Command	The Army major command that has responsibility for developing, educating, and training soldiers and Army civilian personnel. It also oversees ten centers of excellence that develop and execute doctrine, training, and leader education in their assigned issue areas.
Marine Corps Training and Education Command	Leads the Marine Corps training and education continuum from entry-level training, professional military education, and continuous professional development, through unit, collective, and military service-level training.
Army Training Support Center, Training and Doctrine Capability Manager-Live	Designates a technical consultant for Army Range Safety matters who provides advice on Range Safety policies, procedures, and standards for the Army; serves as a subject matter expert on updating Range Safety regulations; analyzes Range Safety parameters and related weapon-system danger zones; and assists in the monitoring of Army Range Safety operations and procedures.
Marine Corps Combat Development Command	Administers and directs the Marine Corps Range Safety Program in support of the Marine Corps Range and Training Area Program. Maintains and updates key Marine Corps Range Safety regulations and policies. Ensures that range standards are incorporated into the standardization and modernization of ranges and that adequate training exists for range personnel.

Sources: Army Regulation 385-10, The Army Safety Program (Feb. 24, 2017); Marine Corps Order 5100.29C, Marine Corps Safety Management System (Oct. 15, 2020); U.S. Army Training and Doctrine Command Regulation 10-5, U.S. Army Training and Doctrine Command (Apr. 21, 2017); Army Regulation 385-63, Marine Corps Order 3570.1C, *Range Safety* (Jan. 30, 2012); and GAO analysis of Department of Defense (DOD) documents. | GAO-21-361

Army and Marine Corps Tactical Vehicle Driver Training

The Army and Marine Corps provide training for tactical vehicle drivers at multiple stages to include formal training at military schools; unit-led licensing programs; and follow-on training to sustain driving skills at their unit of assignment.¹⁸ Depending on their military occupational specialty, some military personnel may receive training to drive tactical vehicles at formal military schools.¹⁹ To license tactical vehicle drivers within operational units, the Army and Marine Corps each use a phased approach to training comprised of classroom and practical application. This training culminates in a road test that an applicant must successfully complete to earn a license. Unit commanders are then responsible for building and maintaining drivers' skills through unit follow-on training. See appendix II for additional details about how the Army and Marine Corps train tactical vehicle drivers during each of these stages.

Risk Management

The Army and Marine Corps have substantively similar processes for identifying hazards and implementing risk management controls to mitigate the identified hazards.²⁰ In general, these processes include: 1) identifying hazards; 2) assessing hazards; 3) developing risk management controls and making risk decisions; 4) implementing controls; and 5) supervising implementation and evaluating controls—which is intended to occur continuously throughout the process, as shown in figure 4.

¹⁸For the purposes of this report, we use “follow-on” training to represent Army and Marine Corps unit-led operational training, including individual and collective training for mission essential tasks as well as required periodic sustainment training used to ensure perishable skills and knowledge do not decay to the point that soldiers and marines can no longer perform the required skills effectively.

¹⁹The Army and Marine Corps delineate their force structure using military occupational specialties. The occupational specialties represent the jobs that are necessary to meet their specific missions and cover a variety of jobs. Soldiers and marines participate in advanced individual training for awarding each military occupational specialty. For example, prior to being awarded the motor transport military occupational specialty and joining their unit of assignment, soldiers and marines receive formal training with the 58th Transportation Battalion and the Motor Transport Instruction Company respectively; both are located at Fort Leonard Wood, Missouri.

²⁰Army Techniques Publication (ATP) 5-19 *Risk Management* (Apr. 14, 2014) (incorporating change 1, Sept. 8, 2014). Marine Corps Order (MCO) 3500.27C, *Risk Management* (Nov. 26, 2014).

Figure 4: Army and Marine Corps Risk Management Processes



Source: GAO analysis of Army Techniques Publication 5-19 *Risk Management* and Marine Corps Order 3500.27c *Risk Management*. | GAO-21-361

Army and Marine Corps guidance documents, though distinct, identify three common categories of risk management controls.

1. **Engineering controls.** Controls that reduce risk by design, material selection, or substitution where technically or economically feasible.
2. **Administrative controls.** Controls that reduce risk through knowledge and awareness, such as by providing signs and notices, establishing written policies and standard operating procedures, and conducting risk management education and training.²¹
3. **Physical controls.** Controls that reduce risk by forming of barriers or guards against a hazard such as fences or personal protective equipment.

Army and Marine Corps Training Ranges

The Army and Marine Corps use training ranges and training areas to provide places for their respective tactical units to train and prepare for

²¹While the Marine Corps refers to these controls collectively as administrative controls, Army guidance makes a distinction between educational controls, i.e., controls that reduce risk through knowledge, awareness, and training, and administrative controls, i.e., controls that reduce risk through administrative measures. ATP 5-19.

combat missions.²² Each range or training area has its own unique characteristics, but they are used to train soldiers and marines to operate and fire the weaponry on their tactical vehicles, build confidence in driving skills with the vehicles, and conduct training exercises that simulate combat.

Each training range also has a range control center where communications and real-time information flow in order to maintain a safe operating environment. Range control tracks the location and firing status of the units using the training ranges, maintains awareness of aircraft overflight, and houses the key communications equipment used to keep in contact with units. Figure 5 shows an example of what a range control center looks like.

Figure 5: Example of a Training Range Control Center at Camp Lejeune, North Carolina



Source: Camp Lejeune range officials. | GAO-21-361

²²In its 2018 *Report to Congress on Sustainable Ranges*, DOD identified approximately 350 range complexes that it owns and operates worldwide. According to DOD, range complexes consist of training ranges (for firing) and training areas (for maneuver) as well as any other associated facilities. About 270 of these training ranges are operated by the Army and 14 are operated by the Marine Corps.

Numbers of Tactical Vehicle Accidents and Deaths Fluctuated, and Accidents Were Primarily Caused by Lapses in Driver Attention, Supervision, and Training

Tactical Vehicle Accidents and Resulting Deaths Fluctuated for Fiscal Years 2010 through 2019, and Vehicle Rollovers Generally Declined

The Army and Marine Corps reported 3,753 tactical vehicle accidents from non-combat scenarios and 123 resulting military deaths for fiscal years 2010 through 2019, according to our analysis of Army and Marine Corps data. Of the total, 342 were Class A and B accidents, which have the most serious injuries and financial costs.²³ The annual number of Class A and B tactical vehicle accidents fluctuated during these 10 years. Reported accidents in less serious classes also fluctuated, but officials were uncertain about whether the reporting of those incidents was complete.²⁴ Officials told us that less serious accidents are likely under-reported for a variety of reasons, including that the accident was not deemed serious enough by the unit to warrant reporting.

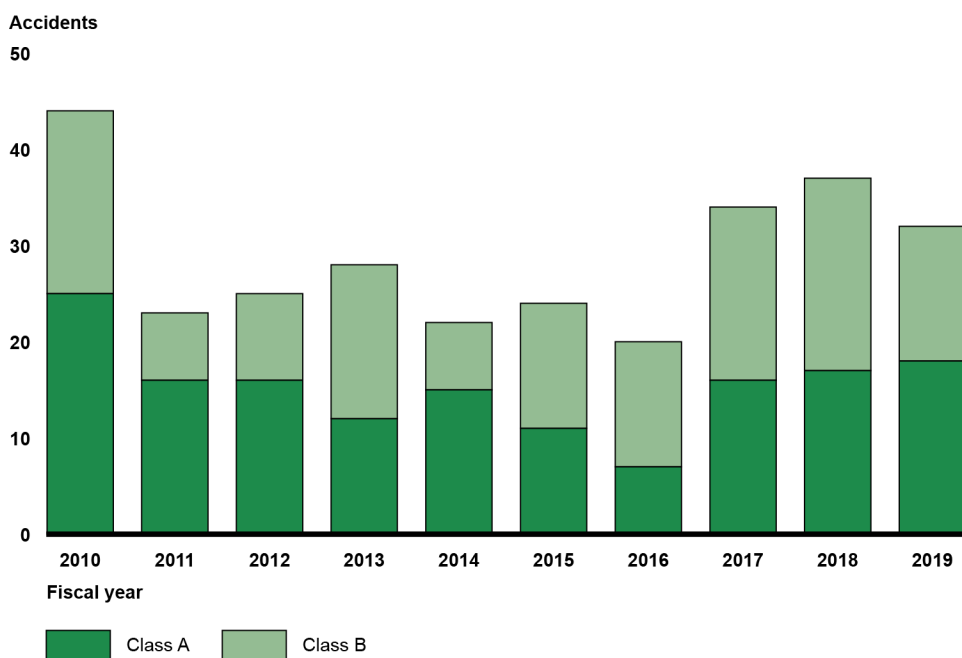
Army. The Army averaged about 29 Class A and B tactical vehicle accidents per year during fiscal years 2010 through 2019 (see fig. 6). The year with the highest number of Class A and B accidents was fiscal year

²³Class A accidents are the most serious and involve a death, permanent total disability, or, for the period of our analysis, damage greater than or equal to \$2 million. Class B accidents result in a permanent partial disability, three or more personnel receiving inpatient hospital care, or, for the period of our analysis, \$500,000 to under \$2 million in damages. The Army had 289 Class A and B accidents in fiscal years 2010 through 2019, and the Marine Corps had 53 over the same timeframe. The disparity in number of accidents between the two military services is likely due in part to the Army having 2.5 times as many active duty personnel as the Marine Corps.

²⁴We have previously identified areas for improvement and made recommendations regarding DOD's approach for collecting, analyzing, and reporting accident data. See, for example, [GAO-18-586R](#). DOD has made some progress addressing the recommendations, but has not yet fully addressed any of them.

2010, with 44 accidents. Appendix III provides more detailed information on Army accidents by fiscal year, accident class, and tactical vehicle type.

Figure 6: Number of Army Class A and B Tactical Vehicle Accidents, Fiscal Years 2010 through 2019

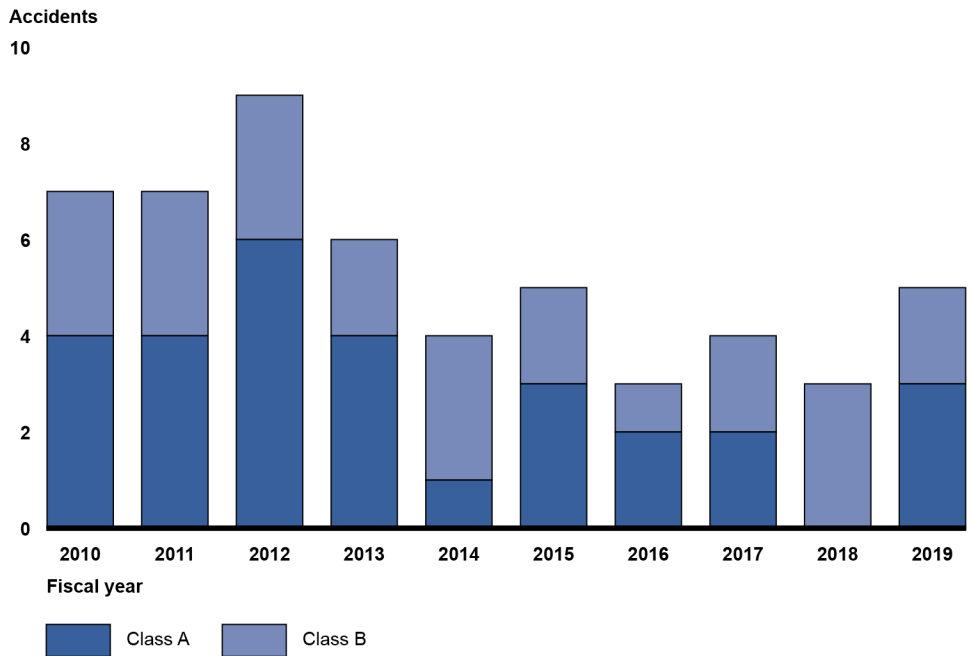


Source: GAO analysis of Department of Defense data. | GAO-21-361

Note: For the period of our review, the Department of Defense (DOD) defined Class A accidents as the most serious accidents—resulting in death or permanent total disability, destruction of a DOD aircraft, or \$2 million in damages or greater. Class B accidents resulted in permanent partial disability, inpatient hospital care for three or more individuals, or damages of \$500,000 or more, but less than \$2 million.

Marine Corps. The Marine Corps averaged about five Class A and B tactical vehicle accidents per year during fiscal years 2010 through 2019 (see fig. 7). The year with the highest number of Class A and B accidents was fiscal year 2012, with nine accidents. Appendix IV provides more detailed information on Marine Corps accidents by fiscal year, accident class, and tactical vehicle type.

Figure 7: Number of Marine Corps Class A and B Tactical Vehicle Accidents, Fiscal Years 2010 through 2019



Source: GAO analysis of Department of Defense data. | GAO-21-361

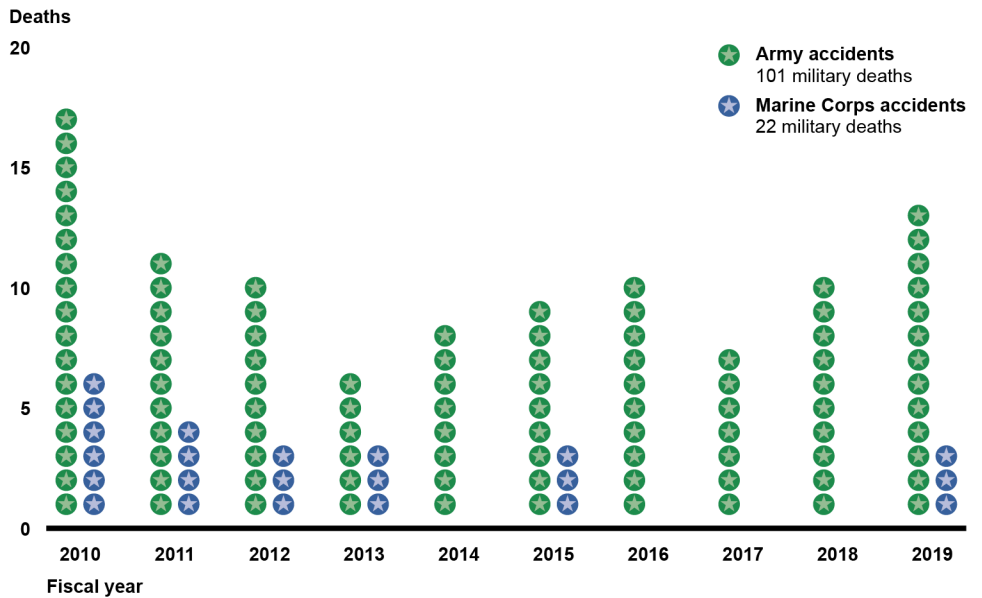
Note: For the period of our review, the Department of Defense (DOD) defined Class A accidents as the most serious accidents—resulting in death or permanent total disability, destruction of a DOD aircraft, or \$2 million in damages or greater. Class B accidents resulted in permanent partial disability, inpatient hospital care for three or more individuals, or damages of \$500,000 or more, but less than \$2 million.

The number of military personnel deaths attributable to Army and Marine Corps tactical vehicle accidents also fluctuated during fiscal years 2010 through 2019, according to our analysis.²⁵ In total, there were 101 military personnel deaths from Army tactical vehicle accidents and 22 military personnel deaths from Marine Corps tactical vehicle accidents in non-combat scenarios during this 10-year period (see fig. 8). According to DOD officials, the disparity in the number of deaths between the Army and Marine Corps is likely due in part to the Army having 2.5 times as many active duty personnel as the Marine Corps and the fact that the

²⁵Civilians, including U.S. citizens and foreign nationals, were also killed in tactical vehicle accidents during this time frame, though accident data did not capture the exact number of civilian deaths.

Army operates a greater number of tactical vehicles than the Marine Corps.

Figure 8: Military Deaths from Army and Marine Corps Tactical Vehicle Accidents, Fiscal Years 2010 through 2019



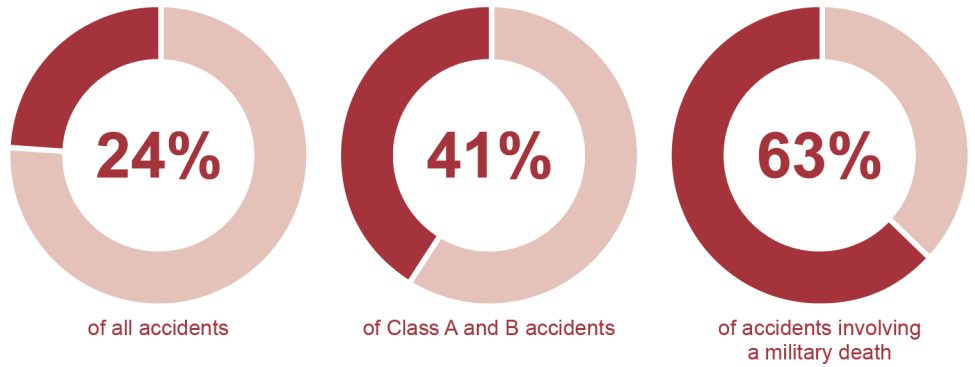
Source: GAO analysis of Department of Defense data. | GAO-21-361

Note: The disparity in number of deaths between the two military services is likely due in part to the Army having 2.5 times as many active duty personnel and operating a greater number of tactical vehicles than the Marine Corps.

Rollovers were associated with almost a quarter of all reported tactical vehicle accidents during fiscal years 2010 through 2019, but they were present in more than 40 percent of Class A and B accidents and 63 percent of accidents involving a military death, according to our analysis (see fig. 9). Appendix V provides more detailed information on Army and Marine Corps accidents involving rollovers.

Figure 9: Percentage of Army and Marine Corps Tactical Vehicle Accidents Involving Rollovers, Fiscal Years 2010 through 2019

Rollovers occurred in:

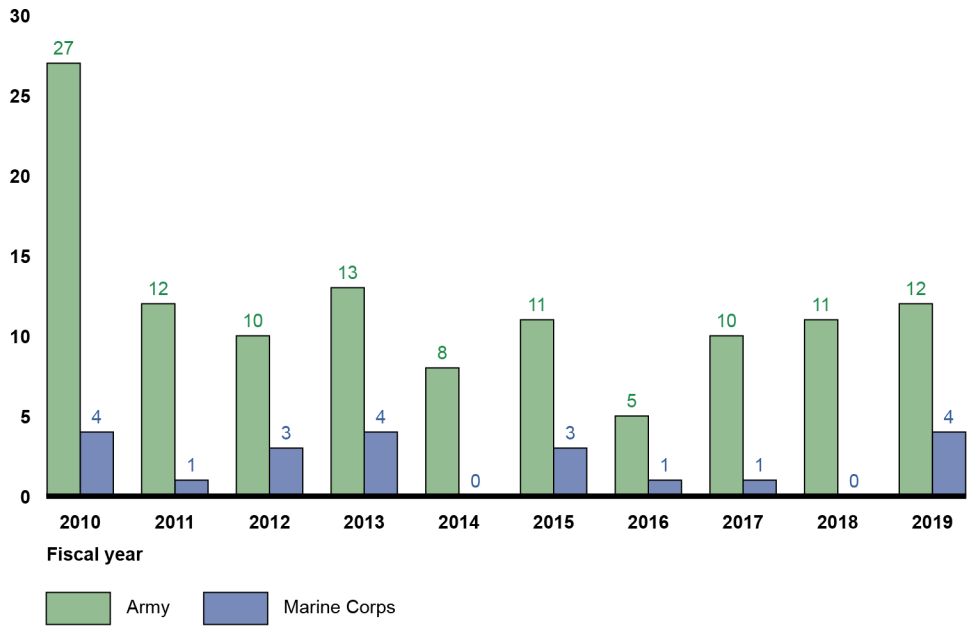


Source: GAO analysis of Department of Defense data. | GAO-21-361

The number of accidents reported involving rollovers generally decreased over this time period, from 131 in fiscal year 2010 to 64 in fiscal year 2019. The number of Class A and B accidents involving rollovers fluctuated during these 10 years, as shown in figure 10, though rollovers generally decreased as a percentage of all Class A and B accidents.

Figure 10: Number of Army and Marine Corps Class A and B Accidents Involving Vehicle Rollovers, Fiscal Years 2010 through 2019

Class A and B rollovers



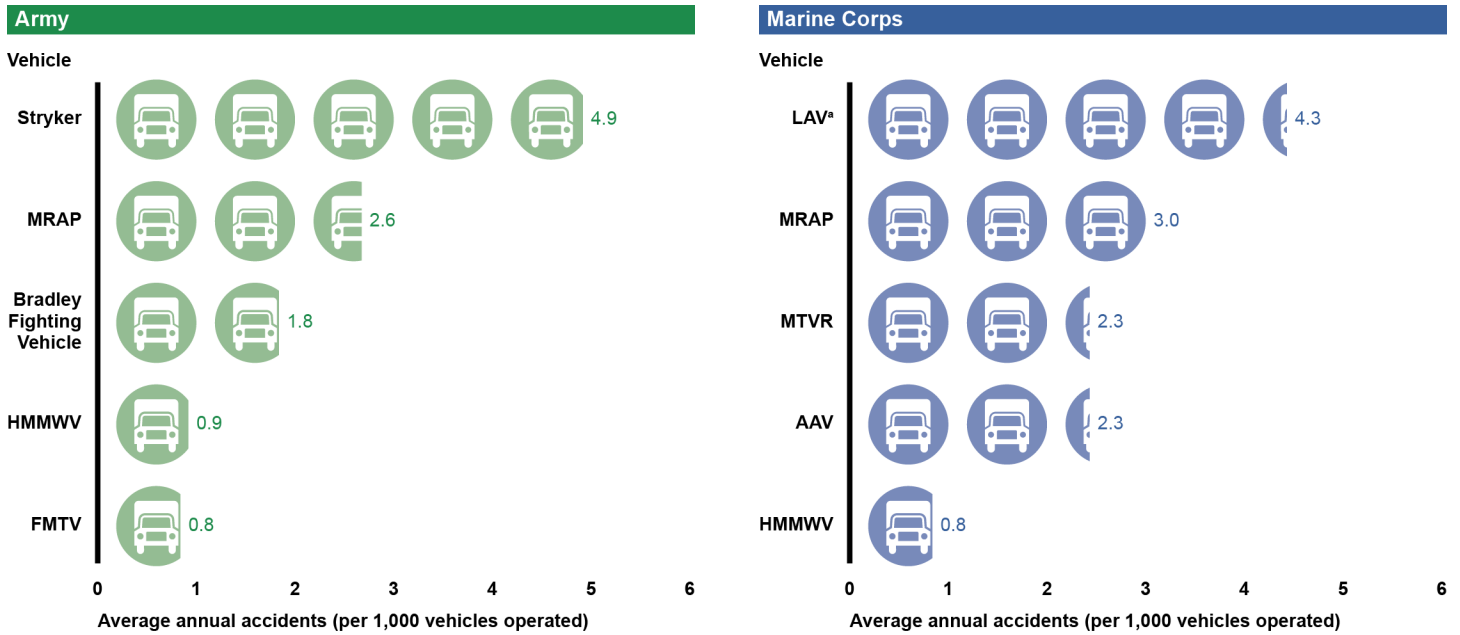
Source: GAO analysis of Department of Defense data. | GAO-21-361

Note: For the period of our review, the Department of Defense (DOD) defined Class A accidents as the most serious accidents—resulting in death or permanent total disability, destruction of a DOD aircraft, or \$2 million in damages or greater. Class B accidents resulted in permanent partial disability, inpatient hospital care for three or more individuals, or damages of \$500,000 or more, but less than \$2 million.

According to data from the safety centers, High Mobility Multipurpose Wheeled Vehicles (HMMWV) were involved in more reported accidents in fiscal years 2010 through 2019 than any other type of tactical vehicle. However, when we took into consideration the number of tactical vehicles of each type being used by the Army and Marine Corps, we found that Army Strykers, Marine Corps Light Armored Vehicles (LAV), and Mine Resistant Ambush Protected (MRAP) vehicles used by both services had higher average rates of accidents than other types of tactical vehicles we analyzed (see fig. 11).²⁶

²⁶We calculated the annual rate of accidents for each vehicle type by dividing the number of accidents involving that type of vehicle (primary vehicle only) by the total number of vehicles of that type reported in the Army's and Marine Corps' inventories over the 10 fiscal years we analyzed. We then multiplied the resulting rates by 1,000 to get average annual rates per thousand vehicles. However, the Marine Corps did not have complete data on the number of Light Armored Vehicles (LAV) operated before fiscal year 2015, so our calculation of the LAV rate is for fiscal years 2015 through 2019. Marine Corps data on the number of Mine Resistant Ambush Protected (MRAP) vehicles were potentially incomplete for two of the fiscal years that we analyzed, so the resulting accident rate may be slightly higher than it would be based on complete MRAP vehicle numbers. According to information provided by the Army, accident rates calculated using mileage data for fiscal years 2015 through 2019 yielded vehicle ranking results that were similar to the accident rates we calculated using vehicle inventory with a few exceptions. Specifically, the mileage-based accident rate for MRAPs was much higher than the rate for other vehicles, and the accident rate for the Bradley Fighting Vehicle was higher than that of the Stryker, likely due to Strykers being driven more miles on average. Army officials told us that mileage information was likely inexact. We were unable to obtain Marine Corps vehicle mileage information for the purposes of calculating accident rates.

Figure 11: Average Annual Number of Army and Marine Corps Tactical Vehicles in Accidents per 1,000 Vehicles for Selected Vehicle Types, Fiscal Years 2010 through 2019



- AAV Assault Amphibious Vehicle
- FMTV Family of Medium Tactical Vehicles
- HMMWV High Mobility Multipurpose Wheeled Vehicle
- LAV Light Armored Vehicle
- MRAP Mine Resistant Ambush Protected
- MTRV Medium Tactical Vehicle Replacement

Source: GAO analysis of Department of Defense data. | GAO-21-361

Note: Accidents are counted only under the primary tactical vehicle for each accident, which is generally the larger or more expensive vehicle if more than one type of vehicle was involved in an accident.

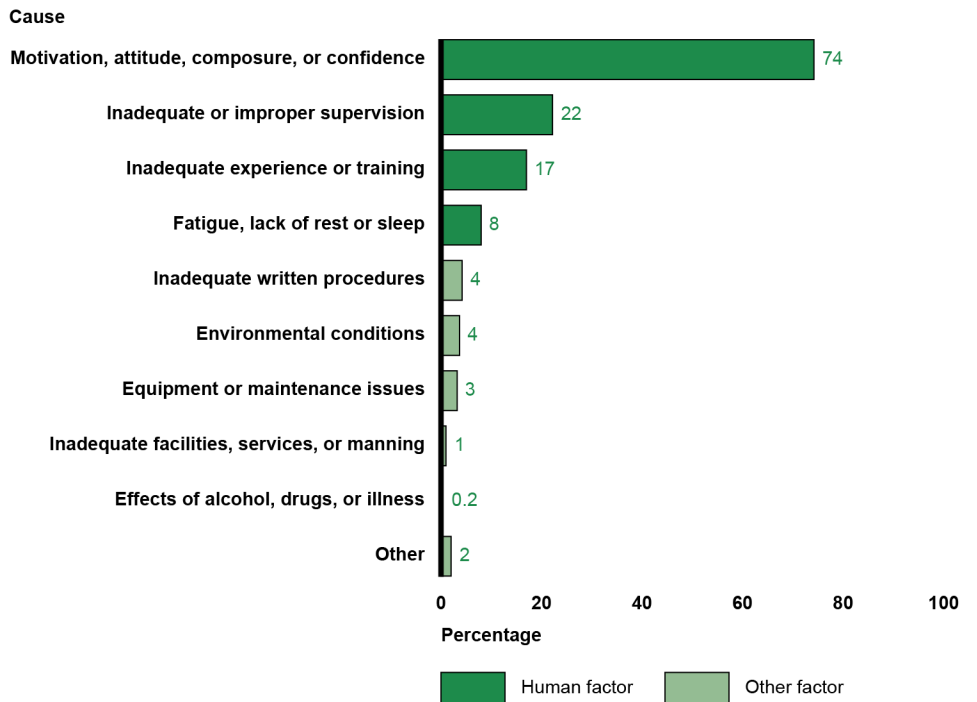
^aThe Marine Corps did not have complete data on the number of LAVs operated before fiscal year 2015, so the LAV rate is for fiscal years 2015 through 2019.

The Army and Marine Corps Reported That Driver Inattentiveness, Lapses in Supervision, and Lack of Training Were the Most Common Causes of Tactical Vehicle Accidents

The Army and Marine Corps reported that human factors such as driver error, mindset, complacency, and confidence were the most common

causes of tactical vehicle accidents, as shown in figures 12 and 13.²⁷ Army and Marine Corps data also frequently cited other human factors such as inadequate supervision and inadequate training or experience. In contrast, the data cited environmental and mechanical factors much less frequently.

Figure 12: Percent of Army Accidents Reporting Causes That Contributed to Tactical Vehicle Accidents, Fiscal Years 2010 through 2019



Source: GAO analysis of Department of Defense data. | GAO-21-361

Notes: This figure includes 2,109 Army accidents that reported specific reasons mistakes were made that contributed to accidents (other than “unknown” or “not reported”). As multiple factors can be reported for each accident, the totals can add up to more than 100 percent.

²⁷DOD Instruction 6055.07 directs the military services to use a common classification system to report on human factors for all accidents, but the Army and Marine Corps report on these factors differently. The Army reports on mistakes (such as speeding or failure to use ground guides) and the reasons for those mistakes (such as complacency or fatigue). The Marine Corps reports on causes, which could include the actual mistake (such as losing control) or the underlying cause (such as lack of attention). Neither the Army nor the Marine Corps reported these types of factors for all accidents in their data. We have previously identified areas for improvement and made recommendations regarding DOD’s approach for collecting accident data. See, for example, [GAO-18-586R](#). DOD has made some progress to address the recommendations, but has not yet fully addressed any of them.

While the Marine Corps uses different terms to describe the causes of accidents, the data showed a trend similar to the Army’s data. Specifically, human errors made up a large majority of the causes for tactical vehicle accidents in non-combat scenarios (see fig. 13).

Figure 13: Percent of Marine Corps Accidents Reporting Causes That Contributed to Tactical Vehicle Accidents, Fiscal Years 2010 through 2019



Source: GAO analysis of Department of Defense data. | GAO-21-361

Notes: This figure includes 478 Marine Corps accidents of all classes that reported on specific causal factors (other than “unknown”). As multiple factors can be reported for each accident, the totals can add up to more than 100 percent.

^aThis category includes mistakes that led to the accident, such as “lost control,” “misjudged clearance,” or “failure to follow procedure.” As noted above, the Army reports on these types of mistakes separately, therefore “driving error or rule violation” would likely have a different underlying cause in Army accident reporting.

Most tactical vehicle accidents, including Class A and B accidents, took place in the United States. Most happened on roadways or in parking lots or facilities, and most took place during the day or in full visibility conditions. This underscores the importance of human factors relative to environmental conditions. Specifically, we found that in fiscal years 2010 through 2019:

-
- 58 percent of Army Class A and B accidents took place in the United States.
 - 58 percent of Army Class A and B accidents for which location was reported took place on a roadway or in a parking lot, vehicle facility, or other facility.²⁸
 - 68 percent of Army Class A and B accidents took place during the day.
 - 67 percent of Marine Corps Class A and B accidents for which country was reported took place in the United States.²⁹
 - 75 percent of Marine Corps Class A and B accidents for which location was reported took place on a roadway or street or in a garage, parking lot, or support facility.³⁰
 - 88 percent of Marine Corps Class A and B accidents for which conditions were reported took place in full visibility conditions.³¹

The percentage of Class A and B non-combat accidents that took place outside of the United States, especially those that took place in Afghanistan and Iraq, was higher in the first few years we analyzed. See appendix VI for a detailed breakdown of Class A and B accidents by country.

To better understand the factors that investigators determined contributed to or were present in the most serious accidents, we also analyzed a subset of cause narratives from the formal investigations of Army Class A accidents between fiscal years 2010 and 2019. Of the 51 narratives the Army provided, we determined that 76 percent identified improper

²⁸The Army did not report a specific type of location for three of 289 Class A and B accidents.

²⁹The Marine Corps did not report data on the country for seven of 53 Class A and B accidents.

³⁰The Marine Corps did not report a specific type of location for 29 of 53 Class A and B accidents. Marine Corps officials told us location data can be missing because the fields are not mandatory and some fully investigated reports may not have been typed into the reporting system.

³¹The Marine Corps did not report visibility conditions for 20 of 53 Class A and B accidents. Data was missing for 17 of those accidents, two had a value indicating visibility was "not applicable," and one had a value for which the Marine Corps was unable to provide a definition. Marine Corps officials told us that visibility became a mandatory field in 2011 and that their quality control process may have failed to identify accidents where visibility was a problem but not reported as such.

supervision or leadership and 73 percent identified inexperience or lack of training as causes that contributed to or were present at the accident (see table 3).³² Furthermore, we found that the Army’s investigations determined that measures designed to manage risk, such as risk assessments, seatbelt use, and adherence to speed limits were not properly implemented in many cases.

Table 3: Present or Contributing Causes Cited in Narratives from Army Investigations of Class A Tactical Vehicle Accidents from Fiscal Years 2010 through 2019

Causes cited	Percentage of cases
Improper supervision or leadership	76
Inexperience or lack of training	73
Improper risk management or other planning or pre-mission briefing	61
Improper maintenance checks, servicing, inspections, or dispatch	49
Improper seatbelt/harness use	41
Improper licensing or lack of license or other qualifications	37
Equipment, material, design, or mechanical failure	33
Lack or improper use of personal protective equipment	22
Speeding	20
Failure to use ground guides or improper ground guiding	14

Source: GAO analysis of Army accident data. | GAO-21-361

Note: As multiple causes can be reported for each accident, the totals can add up to more than 100 percent.

In analyzing the cause narratives for Army Class A accidents, we also found that “complacency” or “overconfidence” were mentioned in 28 of 51 narratives. To better understand what complacency and overconfidence were associated with, we analyzed other factors cited in cause narratives containing “complacency” or “overconfidence” and found that 89 percent also mentioned leadership or supervision failure; 89 percent mentioned inexperience or lack of training; and 82 percent mentioned improper risk management, planning, or pre-mission briefing as a factor. Every

³²We requested narratives for 73 Class A accidents involving HMMWVs, FMTVs, Strykers, and Bradley Fighting Vehicles that took place in the United States, Germany, or South Korea. Army officials reported that they were unable to provide narratives for 22 of the Class A accidents because of blank entries in the accident database. Officials said this could be due to improper data entry, failure to forward final reports to the Combat Readiness Center, or loss of entries due to data migration. Detailed narratives describing causal factors were unavailable in the Marine Corps data.

narrative citing “complacency” or “overconfidence” cited at least one of those three factors.

Army and Marine Corps Established Practices to Mitigate and to Prevent Tactical Vehicle Accidents, but Some Factors Have Hindered Implementation

The Army and Marine Corps have established practices intended to mitigate and to prevent tactical vehicle accidents, such as using risk management processes to identify hazards and assess the risk associated with operating tactical vehicles. However, personnel we interviewed from nine Army brigades and 11 Marine Corps battalions identified factors that affected the implementation of tactical vehicle risk management practices. Additionally, we found that implementation of the practices differed among units. Army and Marine Corps efforts to address implementation challenges and improve the enforcement of risk management practices by first-line supervisors, such as vehicle commanders and unit-level safety officers, have been limited in scope.

The Army and Marine Corps Assessed Risks, Established Safe Driving Practices, and Implemented Initiatives to Mitigate and to Prevent Tactical Vehicle Accidents

The Army and Marine Corps established practices intended to mitigate and to prevent tactical vehicle accidents. These practices include, among other things: (1) using risk management processes to identify hazards and assess the risk associated with operating tactical vehicles, (2) establishing safe driving practices to address hazards in tactical vehicle operations; and (3) implementing other initiatives such as ground-safety programs, safe driving awards, and safety councils.

Assessing risk. Army and Marine Corps leaders use an established process for organizational risk management to identify hazards, assess risk, and develop controls for operations involving tactical vehicles.³³ Prior to a training exercise or a field operation, Army and Marine Corps unit leaders prepare a risk management assessment using a planning tool—known in the Army as the Deliberate Risk Assessment Worksheet and in the Marine Corps as a Basic Risk Assessment Matrix. The risk management process for both the Army and Marine Corps includes identifying information such as potential hazards and associated risk mitigations—often called controls—for the planned event, as well as

³³Department of the Army Pamphlet 385-30, *Risk Management* (Dec. 2, 2014), Army Techniques Publication 5-19, *Risk Management* (Apr. 14, 2014) (incorporating Change No. 1, Sept. 8, 2014) and Marine Corps Order 3500.27C, *Risk Management* (Nov. 26, 2014).

related implementation steps. For example, one set of risk management documentation we reviewed included the information in table 4.

Table 4: Example of Information in an Army Deliberate Risk Assessment Worksheet

Task	Hazard	Control	Implementation steps
<ul style="list-style-type: none"> Tactical vehicle operations 	<ul style="list-style-type: none"> Unfamiliar terrain 	<ul style="list-style-type: none"> Use ground guides 	<ul style="list-style-type: none"> Use safety briefing to identify controls Identify controls in standard operating procedures First-line leaders and vehicle commanders implement controls^a

Source: GAO analysis of Army information. | GAO-21-361

^aThe vehicle commander, sometimes referred to as the senior occupant, assistant driver, or A-Driver, is typically the most senior military personnel riding with the driver. Throughout this report, we use the term vehicle commander to describe soldiers and marines serving in this role.

Both the Army and Marine Corps risk management processes require command review and approval at different levels depending on the risk level of the event. For example, according to Marine Corps risk analysis documentation, a lower risk level event—such as a convoy of one to four vehicles traversing paved roads on a military installation—may require only a junior officer’s approval. A higher risk event—such as a multi-day convoy traversing over 100 miles—could be raised to the approval level of the unit’s executive officer or commanding officer. Unit leaders are expected to evaluate risk levels on a scale from low or negligible to extremely high or critical for both the overall event and for individual hazards.

Establishing safe driving practices. The Army and Marine Corps have established a number of safe driving practices to address hazards that can put soldiers and marines at increased risk when driving tactical vehicles. These hazards include, among other things: excessive speeding, not using personal protective equipment or seat belts, inattentiveness, and faulty mission planning. Safety practices that have been established as controls against these hazards are publicized through standard operating procedures that cascade down the various organizational levels of the Army and Marine Corps.³⁴ Examples of practices that are often included in unit standard operating procedures

³⁴According to Army and Marine Corps officials, standard operating procedures are typically published at the corps, division, brigade, and battalion levels in the Army, and the marine expeditionary force, marine division or marine logistics group, and battalion levels in the Marine Corps.

include convoy speed limits, minimum requirements for personal protective equipment use when operating a vehicle, standards for the use of ground guides in hazardous areas, and pre-mission briefing requirements.

Other safety initiatives. In addition, the Army and Marine Corps may implement other safety initiatives such as:

- Ground-safety programs led by unit safety officers responsible for, among other things, distributing tactical vehicle safety information and managing tactical vehicle accident reporting;
- Awards programs for tactical vehicle drivers who maintain safe driving records;
- Safety councils to share lessons learned and best practices for tactical vehicle safety; and
- Spot checks and other inspections of unit driving programs or enforcement of unit regulations by personnel such as master drivers and road masters.

Army and Marine Corps Units Identified Factors That Hindered Implementation of Risk Management Practices

Personnel from the nine Army brigades and 11 Marine Corps battalions we interviewed identified factors that affected the implementation of tactical vehicle risk management practices, and we found that implementation of the practices differed among units. More specifically, Army and Marine Corps unit personnel identified several factors affecting the implementation of risk management practices including time pressure, haste and inexperience, maintenance and availability of protective restraints, and differing application of certain risk management practices. As a result, among the Army and Marine Corps units we interviewed, unit implementation of risk management practices differed, such as assessing risk, following speed limits, wearing protective restraints such as seat belts or harnesses, using ground guides to aid tactical vehicle driver situational awareness, and attending briefings prior to operating tactical vehicles.

Time pressure affects unit risk assessment preparation. According to Army and Marine Corps personnel, some units faced challenges with preparing risk assessment documentation. For example, personnel from four of nine Army brigades we interviewed expressed concerns about their units' ability to use the risk management process effectively. Personnel with these units and other Army and Marine Corps officials we interviewed stated that some leaders' ability to complete effective risk

assessments differed due to the time available to perform the risk management assessment process and the low level of perceived risk associated with the use of tactical vehicles for certain types of training. Personnel described examples of risk assessments that were not being completed by the appropriate subject matter expert, risk assessments being reused by units without updating details such as tactical vehicle type or terrain hazards, or deliberately assessing certain training events at lower risk levels to enable a lower-level approval.

Haste and driver inexperience contributes to excessive speed.

Excessive speed was mentioned as a key hazard and contributing factor to tactical vehicle accidents by personnel with eight of nine Army brigades and nine of 11 Marine Corps battalions we interviewed. For example, drivers of the Light Armored Vehicle told us that driving with excessive speed could lead to a rollover when executing a turn. According to Army and Marine Corps personnel, tactical vehicle drivers sometimes drove with excessive speed as a result of haste under mission time pressure or inexperience with the vehicle or terrain. For example, according to tactical vehicle drivers from five of nine Army brigades, speed limits were not universally followed.

Implementation of speed limits also sometimes differed based on the military occupational specialty of the driver. For example, according to soldiers from one brigade, motor transport operators (i.e. soldiers with a military occupational specialty in the motor transportation career field) of the HMMWV and the medium tactical truck consistently followed speed limits, while incidentally licensed drivers (i.e. soldiers outside of the motor transportation career field who are licensed to drive the same tactical vehicles) did not.³⁵

Equipment maintenance and availability affected the use of protective restraints. According to personnel from the nine Army brigades and 11 Marine Corps battalions we interviewed, the use of restraints such as seat belts and harnesses differed by driver

³⁵Motor transport operator is a specific military occupational specialty in the Army and Marine Corps. Motor transport operators operate and maintain motor transport tactical wheeled vehicles to transport troops, supplies, and equipment to support combat or garrison operations. For the purposes of this report, we use “incidentally licensed driver” to refer to all military personnel with a military occupational specialty outside the motor transportation career field, but who are licensed to drive tactical wheeled motor transport vehicles such as the High Mobility Multipurpose Wheeled Vehicle (HMMWV), family of medium tactical vehicles (FMTV), medium tactical vehicle replacement (MTVR) or military all-terrain vehicle.

occupational specialty and tactical vehicle type. According to the soldiers and marines we spoke with, reasons for not using seatbelts and restraints included that they hinder movement into and out of the vehicles and within vehicle compartments, and in some cases, they were not functional or had been removed. For example, according to tactical vehicle drivers, vehicle commanders, and unit leaders we interviewed from all five Army brigades that used either the Bradley Fighting Vehicle (Bradley) or Stryker and officials from all three Marine Corps battalions that used the Light Armored Vehicle, none consistently used seatbelts or harnesses. In contrast, personnel from seven of nine Army brigades and all 11 Marine Corps battalions told us that unit requirements were consistently followed with regard to using certain personal protective equipment—such as wearing Kevlar helmets, flak jackets, and eye protection—while a tactical vehicle is in motion.

Incidentally licensed drivers of the HMMWV or medium tactical trucks from five Army brigades we interviewed stated that seatbelt use varied. According to incidentally licensed tactical vehicle drivers from one brigade, the seatbelts in their HMMWVs and medium tactical trucks were broken and have not been replaced. Conversely, among the Army and Marine Corps motor transport operators we spoke with, nearly all described consistently using seatbelts when driving HMMWVs or medium tactical trucks.

Unit application of certain risk management practices differ. We also found examples where unit application of certain risk management requirements differed. For example, the use of ground guides—personnel outside of the tactical vehicle who communicate with the tactical vehicle driver about surrounding hazards—was highlighted by officials we interviewed across eight of nine Army brigades and all 11 Marine Corps battalions as a key aid to driver situational awareness. However, ground guide use differed across various driving situations. According to Army and Marine Corps personnel, the use of ground guides in the field was not always a requirement, and drivers from five Army brigades stated that ground guides were not always used in the field. In contrast, the use of a ground guide in the motor pool (i.e. parking and maintenance garage areas) was typically cited by soldiers and marines as a requirement in their unit's standard operating procedures.

Additionally, units differed in how they applied the practice of holding pre-mission briefings. Units use these briefings prior to operating tactical vehicles to cover such topics as route, potential hazards, speed limits, communication plans, and emergency procedures. However, the scope of

topics covered and participation in pre-mission briefings differed among the units we interviewed, leading some Army and Marine Corps personnel to view the briefings as ineffective. For example, tactical vehicle drivers from three of nine Army brigades and six of 11 Marine Corps battalions we interviewed stated that they either did not participate in pre-mission briefings, the briefings were ineffective, or that the briefings were only conducted for field operations and not day-to-day operations.

Issues Affecting Vehicle Commanders and Unit Safety Officers Limit Army and Marine Corps Efforts to Implement Risk Management Practices

Army and Marine Corps officials we interviewed recognized the importance of risk management and helping units consistently implement risk management practices. Officials with the units we met with further stated that they had taken specific steps to improve implementation of the risk management practices by instituting procedures, such as standardized risk assessments for motor transport operations, checklists and job aids for tactical vehicle drivers, and training for vehicle commanders. For example, selected units in both the Army and Marine Corps have standardized the risk assessment tools used for motor transport operations by setting a minimum set of risk factors for units to assess such as driver experience within the unit, number of vehicles, traveling distance, road surface, time of day, and potential weather conditions, among others.

In addition, the Army and Marine Corps have developed procedural steps and checklists to use prior to dispatching a tactical vehicle for training or other purposes to help drivers and vehicle commanders adhere to unit standard operating procedures for safe driving. Some units also post a list of bottom-line key practices directly inside their tactical vehicles to remind drivers, vehicle commanders, and crew members of their roles and responsibilities for operation. For example, one of the Marine Corps Light Armored Reconnaissance battalions we spoke with established a set of procedures that all Light Armored Vehicle crews needed to follow. The procedures are printed, laminated, and attached to the door of the vehicle so the crew can readily see and read them (see fig. 14).

Figure 14: Example of Light Armored Vehicle Safety Procedures Laminated and Posted on the Door of the Vehicle



Source: 3rd Light Armored Reconnaissance Battalion. | GAO-21-361

Some Marine Corps units have also taken steps to improve training and clarify the responsibilities for vehicle commanders. For example, the First Marine Logistics Group requires that vehicle commanders be trained on ground guiding, and their group-level standard operating procedures require vehicle commanders to sign off on roles and responsibilities prior to dispatching a tactical vehicle from the motor pool. In addition, the 1st Marine Division instituted a new course in January 2020 to train vehicle commanders on their specific roles and responsibilities.

Risk Management-Related Perspectives from Soldiers and a Marine

“There is more...on their plate, and it is too much of a hassle...they simply stop caring. When everything is a priority, nothing is a priority.”—Army unit leader

“[My unit] basically gives people who are not licensed the role of vehicle commanders as a common practice because they are just viewed as a glorified ground guide.”—Army driver

“We already go through so much risk management before our convoy walks out of the gate. It gets redundant and...takes away the seriousness of it. It takes away the value in each individual step.”—Marine Corps driver

Source: GAO interviews with Army and Marine Corps personnel. | GAO-21-361

Despite these actions, the Army and Marine Corps still face factors that hinder their efforts to implement risk management practices. Personnel we interviewed from seven of nine Army brigades and nine of 11 Marine Corps battalions cited complacency, overconfidence, or inexperience as leading factors that affected a unit’s ability to consistently implement risk management practices (see sidebar). The soldiers and marines we spoke with stated that the procedures and paperwork can become all-consuming, blunting the effectiveness of existing procedures and leading to an overall sense of complacency. As presented earlier in this report, Army and Marine Corps accident data show that human factors, such as driver error and complacency, were the most commonly identified causes of tactical vehicle accidents.

We identified two issues that limited the Army’s and Marine Corps’ efforts to address implementation of risk management practices—limitations in the roles and responsibilities of first-line supervisors (such as vehicle commanders) and unit safety officers.³⁶ Personnel we interviewed across eight of nine Army brigades and nine of 11 Marine Corps battalions cited vehicle commanders—the first-line supervisor in a tactical vehicle every time it leaves a motor pool—as playing an important role in the direct implementation of safe driving practices. Specifically, according to unit personnel, the vehicle commander is responsible for maintaining communications; enforcing speed limits, personal protective equipment use, and seatbelt use; ground guiding; and aiding the driver with situational awareness of potential hazards. According to soldiers and marines we interviewed, the vehicle commander can also help coach a less experienced driver in safe driving procedures.

However, while some units in the Army and Marine Corps have made some efforts to improve the ability of the vehicle commander to implement risk management practices, such as setting certain qualifications or developing training for personnel serving in the role, we found that differences in unit implementation of the role remain. Specifically, based on our review of selected unit standard operating procedures and interviews with units, we observed differences among units with regards to the qualifications for vehicle commanders. For example, one Army unit standard operating procedure we reviewed set minimum qualifications

³⁶For the purposes of this review, by first-line supervisor, we are including personnel such as the senior occupant of a vehicle, the vehicle commander, and other small unit leaders such as junior and senior noncommissioned officers and motor transportation chiefs who have a first-line supervision responsibility over tactical vehicle drivers prior to and during operation.

pertaining to the rank of the vehicle commander. For certain tactical vehicles such as the Bradley and Stryker in the Army and Light Armored Vehicle in the Marine Corps, the vehicle commander is generally of higher rank than the driver, and in some cases, has previous experience as a driver. For other vehicle types, the vehicle commander may be of equal or lesser rank than the driver. For example, motor transport operators we interviewed from the Marine Corps stated that vehicle commander ranks can vary or be more junior in relation to the drivers' ranks. Additional tactical vehicle drivers stated that personnel at a lower rank or with less experience who served as vehicle commanders during more challenging driving scenarios, such as multi-vehicle convoys, increased the risk of those activities.

In addition, according to our review of documents and interviews with Army personnel, some unit-level standard operating procedures require vehicle commanders to hold licenses on the vehicle they are commanding, but service-level guidance does not require all vehicle commanders to hold a license. Other Army and Marine Corps personnel we interviewed stated that it was not a standard operating procedure for vehicle commanders to hold a license on the vehicle that they commanded. Furthermore, according to Army officials, units did not always implement the control to have vehicle commanders hold licenses in cases where unit-specific standard operating procedures required it due to lack of licensed and available personnel in the unit. According to motor transport operators from one Army brigade we spoke with, even though some drivers had completed their advanced individual training and been assigned to an operational unit, they had yet to complete the unit's licensing program. As a result, these personnel served in the vehicle commander role until they were able to complete the licensing training. Unit officials told us that having vehicle commanders who were not licensed and experienced driving the vehicle can increase the risk to safety because they may be unfamiliar with the performance characteristics and capabilities of the vehicle when directing the driver to take certain actions.

Further, according to personnel with Army and Marine Corps units, vehicle commanders do not always have formal training for the role. Based on our review of Army and Marine Corps documents and interviews with unit officials, we found that the services had not established mandatory training for vehicle commanders. Some units we met with stated that unit standard operating procedures required training for vehicle commanders while others stated that formal training was not required. Drivers in both the Army and Marine Corps described instances

where it was up to the driver to inform the vehicle commander of their duties.

Army and Marine Corps risk management guidance identify clearly communicating risk management controls, establishing accountability for implementation, and supervising implementation as aspects of the risk management process.³⁷ Army guidance and Marine Corps risk management training guidance further identify that risk management practices that have been established and implemented for a prolonged period are especially at risk to be ignored due to overconfidence or complacency.³⁸ Implementation and supervision are steps in both services' risk management processes, and Army guidance states that first-line supervisors are critical to implementing risk management controls and ensuring the controls are maintained to standard.³⁹

However, first-line supervisors such as vehicle commanders have been limited in the scope of their responsibilities for implementing tactical vehicle safety practices because the Army and Marine Corps have not consistently established qualifications or put mechanisms and procedures in place service-wide, such as formal training, to help personnel effectively perform the role. Without taking steps to more clearly define the first-line supervisor's role in implementing safe driving practices and establishing mechanisms and procedures to help personnel effectively perform the responsibilities of the role—especially for vehicle commanders—the implementation of Army and Marine Corps risk management practices for tactical vehicle safety will remain ad hoc, which could increase the risk of accidents.

Second, we found that the Army's and Marine Corps' use of safety officers to implement ground vehicle safety programs in their units has been limited in scope. According to Army and Marine Corps guidance, safety officers across organizational echelons (i.e., division, brigade/regiment, battalion/squadron, and company) are responsible for spot checking units for tactical vehicle safety; managing tactical vehicle

³⁷Department of the Army Pamphlet 385-30, *Risk Management* (Dec. 2, 2014); Army Techniques Publication 5-19, *Risk Management* (Apr. 14, 2014) (incorporating Change No. 1, Sept. 8, 2014); Marine Corps Order 3500.27C, *Risk Management* (Nov. 26, 2014).

³⁸Department of the Army Pamphlet 385-30; Army Techniques Publication 5-19; Marine Corps Institute, *Operational Risk Management 1-0* (Feb. 2002).

³⁹ATP 5-19.

accident reporting for their unit; and safety promotion and awareness, which includes distributing tactical vehicle safety information.⁴⁰ However, according to Army and all Marine Corps safety officials we interviewed, unit-level safety officers are limited in their ability to promote and enforce safety in tactical vehicle operations. In fact, 45 percent of marines who responded in 2019 to an internal Marine Corps survey about the effectiveness of their unit's safety personnel said that they were not aware that their unit had a safety officer. Army and Marine Corps safety officials cited a number of factors that limited safety office involvement in tactical vehicle safety, such as limited time to be present in the motor pool to observe safety practices because they fill their role as an additional duty to their primary responsibilities. For example, according to one senior Marine Corps safety official we spoke with, unit-level safety officers may have one hour a day to devote to safety matters, which does not allow time to perform inspections in the motor transportation lots, review risk management worksheets, and give needed attention to many of the tactical vehicle safety programs.

The officials also said that unit-level safety officers have broader responsibilities for safety, to include privately owned vehicle safety or workplace health and safety, and they are not always as well versed in tactical vehicle operation safety requirements as someone from the motor transport occupational field may be. As a result, unit-level safety officers stated that they played a secondary role to unit leadership when it comes to enforcing tactical vehicle safety. Safety officials we interviewed from the Army and Marine Corps stated that with more time available to commit to their safety responsibilities, unit-level safety officers could do more to promote tactical vehicle safety in their units. Further, safety positions in the Marine Corps are not fully staffed. According to senior officials from the Commandant of the Marine Corps Safety Division, Marine Corps safety positions are only staffed at 60 to 70 percent of what their staffing model recommends. This has presented challenges in performing the safety mission. For example, one senior official explained

⁴⁰Army Regulation 385-10, *The Army Safety Program* (Feb. 24, 2017); Department of the Army Pamphlet 385-1, *Small Unit Safety Officer/Noncommissioned Officer Guide* (May 23, 2013); and Marine Corps Order 5100.29C, *Marine Corps Safety Management System* (Oct. 15, 2020). According to Army safety officials, in the Army the safety officer role is staffed with a full-time civilian at the brigade level and above. Below the brigade level, the safety officer role is an additional duty assigned to soldiers in the unit. Each battalion is supposed to have two additional duty safety officers (a primary and secondary) and each company is supposed to have an additional duty safety officer. Similarly, according to Marine Corps safety officials, the Marine Corps uses full-time safety officers above the battalion level and additional duty safety officers at the battalion level and below.

that only one full-time safety professional has been staffed for an entire Marine Corps division, which consists of approximately 22,000 personnel, over 350 armored vehicles, and over 2,300 tactical vehicles.

In addition, in January 2020 the Army updated its safety and occupational health manpower model following the expiration of its previous model in September 2019. The study identified a need for 298 additional safety and occupational health personnel and, according to a senior official from the Assistant Secretary of the Army, Safety and Occupational Health Office, 150 positions have been added to operational units at the brigade level. However, despite these additions, brigades each have at most one assigned, full-time safety professional to manage the safety program elements of these large, complex and high-risk organizations that often include up to 4,500 assigned soldiers, officials told us.

Standards for Internal Control in the Federal Government state that management is responsible for evaluating pressure on personnel to help personnel fulfill their assigned responsibilities in accordance with the entity's standards of conduct.⁴¹ Management can adjust excessive pressures using many different tools, such as rebalancing workloads or increasing resource levels.

However, the Army and Marine Corps have not sufficiently evaluated the number of personnel responsible for tactical vehicle safety and determined if units are appropriately staffed or if adjustments are needed to workload or resource levels to implement their ground-safety programs. Until the Army and Marine Corps do so, they are missing an opportunity to appropriately tailor the number of unit personnel—such as safety officers—needed to meet the safety mission and enhance units' ability to mitigate risk and implement ground-safety programs for tactical vehicle operations.

⁴¹[GAO-14-704G](#).

Army and Marine Corps Have Training Programs to Build Driver Skills and Experience, but Gaps Exist

The Army and Marine Corps provide training for drivers of tactical vehicles at multiple stages to include formal military occupational specialty training, unit-led licensing programs, and unit follow-on training. However, we found that numerous factors have affected the amount and type of training that Army and Marine Corps tactical vehicle drivers receive. The Army and Marine Corps have taken steps to improve their driver training programs, but do not have a well-defined process with specific performance criteria in place to train their tactical vehicle drivers to build their skills from basic qualifications to proficiency in a diverse set of conditions (e.g., varied terrain or at night).

Army and Marine Corps Have Driver Training Programs, but Numerous Factors Contribute to the Amount and Type of Driver Training That Personnel Receive

The Army and Marine Corps train personnel to drive tactical vehicles. Through formal military occupational specialty training, unit-led licensing programs, and unit follow-on training, tactical vehicle drivers are trained on driving rules and regulations, and vehicle capabilities, maintenance, and operation. However, based on interviews with officials from nine Army brigades and 11 Marine Corps battalions, we found that tactical vehicle driver experiences differed at each stage of training in the amount and quality of training. Factors contributing to the differences in training included, among others, type of military occupational specialty, vehicle type, competing unit priorities, vehicle availability for training, driving opportunities for less experienced drivers, reliance on on-the-job training over driver-focused training, and varied approaches to follow-on training requirements.

Initial Training Differs by Military Occupational Specialties and Vehicle Type

Among the tactical vehicles we selected for this review, the Marine Corps Light Armored Vehicle (see sidebar) is the only tactical vehicle fully incorporated into formal military school training for all potential drivers. All marines with a military specialty in light armored reconnaissance receive training and licensing on the Light Armored Vehicle over the course of their 6 weeks of training with the Light Armored Reconnaissance Training Company at Marine Corps Base Camp Pendleton, California.

Light Armored Vehicle, Bradley Fighting Vehicle, and Stryker



Light Armored Vehicle

The Light Armored Vehicle is used by the Marine Corps and is operated by crews comprised of a driver, gunner, and vehicle commander.



Bradley Fighting Vehicle



Stryker

The Bradley Fighting Vehicle and Stryker are tactical vehicles used by the Army that are operated by crews comprised of a driver, gunner, and vehicle commander.

Source: GAO analysis of Department of Defense information. Photos (top to bottom): U.S. Marine Corps/Sgt. Adam Dublinske, U.S. Army Reserve/Spc. Jorge Reyes Mariano, and U.S. Army/Sgt. Michael Spandau. | GAO-21-361

In contrast, according to officials, the Army does not provide driver licenses to cavalry scouts or infantry personnel—both potential drivers of the Stryker and Bradley (see sidebar)—during their one station unit training at their respective military schools. Soldiers participating in one station unit training at the Army Armor School at Fort Benning, Georgia, including cavalry scouts, receive some driver training on the Stryker and Bradley. However, infantry personnel do not receive any driver training at the Army Infantry School, also at Fort Benning, Georgia. According to officials from the Army Infantry School, tactical vehicle driver positions in infantry units are not filled with recent graduates, and all driver training for infantry personnel who will drive the Stryker and Bradley occurs at their respective unit of assignment.

Motor transport operator military occupational specialties in both the Army and Marine Corps gain some experience on tactical vehicles during their school training with the 58th Transportation Battalion and the Motor Transport Instruction Company respectively, both at Fort Leonard Wood, Missouri. However, the programs of instruction differed between the military services, and both programs only offered training on a limited number of tactical vehicle platforms. For example:

Examples of Medium Tactical Trucks



Family of Medium Tactical Vehicles (FMTV)



Medium Tactical Vehicle Replacement (MTVR)

The Family of Medium Tactical Vehicles (Army) and Medium Tactical Vehicle Replacement (Marine Corps) are logistics support vehicles used to transport people and supplies for each service. We refer to these vehicles as “medium tactical trucks” in our report.

Source: GAO analysis of Department of Defense Information. Photos (top to bottom): U.S. Army/Capt. Joseph Warren and U.S. Navy/Lt. Cmdr. Brian Wierzbicki. | GAO-21-361

- According to officials with the 58th Transportation Battalion, motor transport operators in the Army train on two of their heavy tactical truck platforms, but not the HMMWV or medium tactical truck (see sidebar). Officials stated that according to the program of instruction, Army motor transport operators receive about 240 hours total of training between the two heavy tactical truck platforms, with roughly 16 hours of drive time per platform. Motor transport operators will still need to complete the licensing program at their respective unit of assignment prior to being issued a license on any tactical vehicle platform.
- According to officials with the Motor Transport Instruction Company, motor transport operators in the Marine Corps train on both the HMMWV and medium tactical truck platforms in addition to one of their heavy tactical trucks (see sidebar). Officials stated that according to the program of instruction, Marine Corps motor transport operators receive about 62 hours of training on the HMMWV, 83 hours on the medium tactical truck, and 71 hours on the heavy tactical truck. Officials told us that this amounts to about 26 miles of training on the HMMWV and about 55 miles on the medium tactical truck, depending on the number and ability of the training class members. Marine Corps motor transport operators graduate from the program with licenses on all three platforms, though officials told us that they are trained to a basic skill level.

Unit-Led Licensing Programs Provide Differing Amounts of Instruction

According to soldiers and marines we interviewed, unit-led licensing programs provided differing amounts of training in terms of the amount and type of instruction provided. In the Army, all 11 of the master drivers we interviewed across various organizational echelons (i.e., division, brigade/regiment, battalion/squadron, and company) expressed challenges with implementing their licensing programs that affected the

type and amount of training provided to new drivers.⁴² To account for other unit priorities, master drivers either condensed licensing programs into shorter timeframes than intended, or drivers completed training in non-consecutive parts, and licensing programs provided soldiers with limited exposure to driving in diverse conditions such as varied terrain or driving at night. For example:

Army Master Driver Perspectives on Driver Training

“Driver’s training is not a high priority for the units, and it’s never an issue until it becomes an issue.”—Army master driver

“The Army is trying to implement safety through paperwork instead of action. A piece of paper is not going to make drivers safer on the road. The Army needs to get soldiers in the trucks driving more to prevent accidents.”—Army master driver

Source: GAO interviews with Army personnel. | GAO-21-361

- According to the 11 Army master drivers we spoke with, licensing programs of instruction should range from 5 to 10 days of training (40 to 80 hours) depending on the vehicle type. However, all 11 master drivers we spoke with stated that competing unit priorities limited the amount of training time available and, as a result, they were required to conduct licensing programs either under shorter, condensed timeframes or in non-consecutive parts over the course of several weeks or months (see sidebar). For example, master drivers described some unit commanders providing only 3 days to execute the licensing program or taking only 1.5 weeks to complete Stryker licensing—which has a program of instruction that contains 2 weeks of training.
- Ten of 11 Army master drivers we spoke with stated that the licensing program, as designed, does not allow enough time for training in diverse conditions such as off road or driving at night. For example, one master driver stated that training time typically allows for about 30 to 45 minutes of night driving per soldier. A group of four master drivers stated that they typically spend about 4 hours conducting night training, but that they might be training about 10 soldiers at a time on fewer than 10 tactical vehicles. These master drivers stated that it would take one week to complete night training properly, but there is not time on the unit’s calendar for the training.

According to Marine Corps personnel, licensing programs differed in the amount of practical road time they provided and offered limited opportunities to drive in diverse conditions. For example:

⁴²An Army master driver is responsible for licensing and training program execution. Commanders at the brigade and battalion level appoint master drivers within their organization. Army Regulation 600-55, *The Army Driver and Operator Standardization Program (Selection, Training, Testing, and Licensing)* (Sept. 17, 2019). The Marine Corps does not use the master driver designation. Designated units with licensing authority are responsible for establishing and maintaining a licensing program and designate a licensing officer responsible for oversight and execution of the program. Marine Corps Order 11240.118A, *Licensing Program for Tactical Wheeled Motor Transport Equipment Operators* (July 13, 2020).

Unit Follow-on Training Is
Affected by Multiple Factors

- Four groups of Motor Transport Chiefs responsible for driver training that we interviewed described four different mileage requirements associated with the licensing programs for the HMMWV, medium tactical truck, and military all-terrain vehicle. Experiences ranged from 40 miles of practical driving experience to 125 miles.
- Experiences driving in diverse conditions also varied. Two marines we spoke with did not experience night driving during their licensing process, while two others stated that night driving was included, but limited to basic instruction. In addition, according to one of the marines we spoke with, the HMMWV licensing program he participated in did not add any weight or loads to the tactical vehicle, so his first exposure to that condition was while executing a mission for his unit.

Unit commanders are responsible for building upon the basic skills tactical vehicle drivers learn during initial training and through the licensing programs, and according to tactical vehicle drivers across all nine Army brigades and 11 Marine Corps battalions we interviewed, unit follow-on training provides soldiers and marines with more opportunities for hands-on experience to build and sustain driving skills. However, we found that Army and Marine Corps driver experiences with unit follow-on training differed due to lack of vehicle availability for training, lack of driving opportunities for less experienced drivers, and reliance on on-the-job training over driver-focused training. For example:

- Incidentally licensed drivers of the HMMWV and medium tactical truck across four Army brigades commented that they needed more protected time for dedicated driver training but that this time was unavailable. These soldiers described unit training as comprised of on-the-job training to include driving in and around the motor pool; conducting administrative missions around the military installation such as picking up and delivering ammunition, parts, or other supplies; or driving in support of other units' gunnery training. However, these soldiers stated that they would benefit from more dedicated unit-level training to build driver proficiency for more challenging driving scenarios, such as field exercises and convoy operations, which could also involve driving off-road and at night.

Similarly, according to drivers of the Stryker and Bradley, commanders primarily used other training events such as gunnery training and field exercises as driver training. However, this training was limited in the amount of skill-building provided to the driver. For example, according to unit leaders, drivers, and vehicle commanders of the Stryker and Bradley across four Army brigades, gunnery

Marine Corps Driver Perspective on Driver Training

“Operators who have experience get called on to do the missions and others fall by the wayside.”—Marine Corps driver

Source: GAO interview with Marine Corps personnel. | GAO-21-361

training provides some practice with tactical vehicle movement, but the focus is on firing the weapon systems, and the driving maneuvers are less challenging than what a driver would face in a field exercise or convoy operation.

- Motor transport operators from two of the three Marine Corps logistics and support battalions we spoke with described limited opportunities to build upon basic skills learned during unit familiarization training.⁴³ Drivers from these battalions stated that their ability to build more practical driving skills was limited by the small number of missions required of their unit and tactical vehicle availability. As a result, motor transport operators spent more time maintaining their tactical vehicles than driving them. When these units did have missions, more experienced drivers would be assigned, and less-experienced drivers were not provided with opportunities to build skills and experience (see sidebar). According to motor transport operators, this led to drivers being called on to do a task at a level of proficiency they were not ready for.

Army and Marine Corps tactical vehicle drivers complete follow-on training to sustain their proficiency as tactical vehicle drivers. However, we found that units differed in approaches and, in some cases, had not given attention to consistently delivering follow-on training. In the Marine Corps, operational units administer follow-on training and units differed in implementation. For example, according to Marine Corps officials, the 1st Marine Division has a training requirement of 20 miles of driving every 90 days to sustain driver skills. In contrast, some Marine Corps units we spoke with described other methods of follow-on training, such as setting up skills tests in the motor pool, going to a dedicated driver training course on the installation, or using licensing training on other vehicle models.

Army officials that we met with explained that most follow-on training to sustain skills amounted to completing an annual check ride.⁴⁴ However, in

⁴³In total, we met with 11 Marine Corps battalions: three light armored reconnaissance battalions, two reconnaissance battalions, three infantry battalions, and three logistics and support battalions.

⁴⁴Annual check rides in the Army are performed by supervisors, license instructors, or license examiners and are intended to incorporate on and off road driving to determine driver proficiency in extreme or unusual conditions. They are also supposed to be conducted on the most complex version of each variant of equipment that a driver is licensed to operate.

a review of the Army driver training program published in June 2020, the Army Forces Command Inspector General was unable to identify any unit with a driver training program that included consistent sustainment training.⁴⁵

The Army and Marine Corps Have Taken Some Steps to Improve Driver Training Programs

Recognizing factors that contribute to the amount and type of driver training that personnel receive, the Army and Marine Corps have taken steps to improve and better standardize training. For example, officials with the Army Armor School stated that, in 2019, the Army extended the program of instruction from 17 weeks to 22 weeks. This change allowed for additional instruction time for training on the Stryker and Bradley, including an increase in practical driving from 15 miles each to 30 miles and 36 miles, respectively.

In addition, the Army updated the regulation for the *Army Driver and Operator Standardization Program* in September 2019 to include guidance on how units should structure their licensing programs.⁴⁶ The updated guidance added the three phases of training to the licensing program and set forth roles and responsibilities for those involved in executing the licensing program (e.g., master driver, license instructor, and license examiner). Officials from the Army Driver Standardization office told us that under the updated guidance there should be more uniformity with how units are structuring their licensing programs. Further, in 2019, the Army Transportation School instituted a new training course for master drivers. The course is designed to train master drivers to oversee, manage and execute training at the brigade and battalion level. Participants will earn an additional skills identifier that identifies them as a trained master driver.

The Marine Corps has also taken some steps to improve its approach to tactical vehicle driver training. For example, the Marine Corps updated the *Motor Transport Training and Readiness Manual* in 2019, which is used by unit commanders to plan training to include more specifically defined driving events for motor transport operator training—such as operating tactical vehicles in varied terrain.⁴⁷ The Marine Corps increased

⁴⁵United States Army Forces Command Inspector General, *Driver Training Program Inspection* (June 25, 2020).

⁴⁶Army Regulation 600-55, *The Army Driver and Operator Standardization Program (Selection, Training, Testing, and Licensing)* (Sept. 17, 2019).

⁴⁷Navy Marine Corps (NAVMC) 3500.39D *Motor Transport Training and Readiness Manual* (June 7, 2019).

the total number of individual events for motor transport operators from two to 10 (see table 5).

Table 5: Individual Training Events for Motor Transport Operators in Marine Corps Training and Readiness Manual

Training and Readiness Manual 2015	Training and Readiness Manual 2019 Update
Perform preventive maintenance checks	Perform preventive maintenance checks and services
Operate motor transport equipment	Conduct movement of a MTRV ^a
	Conduct Movement of a LVSR ^b
	Operate LVSR Load Handling System
	Tow a tactical trailer
	Operate a MTRV off-road over rough and uneven terrain
	Conduct recovery of disabled MTRV
	Operate a tactical vehicle over soft surfaces terrain and roads
	Operate a tactical vehicle on varying grades and side slopes
	Conduct Recovery of a disabled LVSR

Source: Navy Marine Corps 3500.39D, *Motor Transport Training and Readiness Manual* (June 7, 2019) and Navy Marine Corps 3500.39C, *Motor Transport Training and Readiness Manual* (Mar. 30, 2015). | GAO-21-361

^aMedium Tactical Vehicle Replacement (MTRV) is the Marine Corps' medium tactical truck. It is a logistics support vehicle used to transport people and supplies. We refer to this vehicle as medium tactical truck in our report.

^bLogistics Vehicle System Replacement (LVSR) is the Marine Corps' heavy tactical truck that includes a self-loading/unloading capability.

The update to the Motor Transport Training and Readiness Manual also included a new chapter for incidentally licensed drivers of tactical vehicles. The update included 19 training events that should be taught to incidentally licensed drivers within the operating forces. These events include driving tactical vehicles in varied terrain such as rough road, soft surfaces, and varying grades and side slopes and under different scenarios such as in a convoy, during night operations, and while utilizing vision enhancement devices.

The Army and Marine Corps Have Not Developed a Well-Defined Process to Build Driver Skills and Experiences

Driver Training Perspectives from a Soldier and Marines

"I can make my paperwork look right and look good, but that is not going to ensure that drivers are capable and performing as necessary."—Army master driver

"With the old mileage-based training requirement, quality suffered. Drivers would just run laps around the installation to meet the training requirement; they called it the Camp Lejeune 500."—Marine Corps driver training expert

"The issue is that there are not enough resources to constantly put marines in training scenarios to get the experience, or to get the licensing . . . many more jobs than just driving go into maintaining a motor pool and a truck company."—Marine Corps motor transport operator

Source: GAO interviews with Army and Marine Corps personnel. | GAO-21-361

The Army and Marine Corps have driver training programs that provide a basic level of instruction, skills, and experience. However, the Army and Marine Corps have not developed a well-defined process—to include performance criteria and measurable standards—to build and evaluate tactical vehicle driver skills from basic qualifications to proficiency in a diverse set of conditions (e.g., varied terrain or at night). Specifically, licensing programs in both the Army and Marine Corps do not have specific performance criteria and standards for training, and unit commanders lack deliberate progression models for training drivers in increasingly difficult scenarios.

Army and Marine Corps licensing programs are designed to provide tactical vehicle drivers with the basic qualifications necessary to operate a vehicle. However, the training guidance omits clear, specific performance criteria and measurable standards for training content, leaving the pass or fail road test as the only evaluative measure of training (see sidebar). *The Army Driver and Operator Standardization Program*, for example, states that "training completion will be validated when the license instructor or supervisor feels the trainee is proficient at operating the vehicle or equipment."⁴⁸ It is at this time that licensing instructors decide that a trainee is ready to take the road test evaluation course. Providing leeway for training instructors to make interpretations about a driver's skill level makes some sense, because not all drivers will progress at the same rate, Army officials told us.

However, according to Army master drivers we spoke with, the absence of specific performance criteria or measurable standards beyond completing the road test evaluation leaves licensing programs vulnerable against competing unit priorities. As a result, decisions about when to move drivers on to the road test evaluation are not always based on an evaluation of performance, but rather on other factors such as the availability of time and the number of soldiers unit commanders need to get licensed.

The Marine Corps faces similar challenges. According to Marine Corps officials, prior to 2020, licensing programs included minimum mileage driving requirements for trainees. However, the officials told us the 2020 update to the Tactical Motor Transport Licensing Official's Manual removed such requirements, and the mileage mix during licensing

⁴⁸Army Regulation 600-55, *The Army Driver and Operator Standardization Program (Selection, Training, Testing, and Licensing)* (Sept. 17, 2019).

programs is instead determined by the unit. Marine Corps officials stated that the previous mileage requirement was too much for the units to complete, which led to a lack of quality training. Officials described drivers taking tactical vehicles on laps around the installation to meet the licensing requirement. The Marine Corps has taken some steps to address the lack of performance criteria and measureable standards in the licensing manual. Higher echelon units such as the 1st and 2nd Marine Divisions and 1st and 2nd Marine Logistics Groups have established some minimum requirements for licensing and familiarization training for new drivers in their units; however, officials told us that these are baseline requirements and that driver skill building—especially in diverse conditions such as varied terrain or at night—still occurs at the small-unit level.

According to Army and Marine Corps guidance, unit commanders are responsible to build upon the basic skills drivers develop during licensing programs through unit-led follow-on training. However, unit commanders in the Army and Marine Corps lack deliberate progression models—with performance criteria and measureable standards—for training drivers in increasingly difficult scenarios. For example, in a review of the driver training program in June 2020, the Army Forces Command Inspector General found that commanders focused on the licensing course as their reference point for driver training and equated these programs with proficiency. Few leaders interviewed by the Inspector General understood the scope of follow-on training outlined in regulation and none had established a consistent follow-on training program.

In the Marine Corps, motor transport operators from five marine division battalions we interviewed stated that competing priorities limit their units' ability to conduct unit-led follow-on driver training in increasingly difficult scenarios. Drivers we spoke with stated that there were not enough opportunities for field training, and that more time was spent driving on paved roads, maintaining their motor pool operations, conducting vehicle maintenance, and supporting other unit priorities. To help address these needs, one unit discussed holding a "motor transport operator week" for training dedicated just for the motor transport drivers in their unit where they would conduct off road and night training, and train in different scenarios such as convoy operations or deep water driving.

Incidentally licensed drivers in the Marine Corps we spoke with described having limited opportunities for dedicated driver training, especially under diverse driving conditions. Of the nine incidentally licensed drivers we spoke with, one driver from a marine reconnaissance battalion, licensed

on the HMMWV and military all-terrain vehicle, felt that there were enough opportunities to build driving skills.

In contrast, Light Armored Reconnaissance marines experienced a more deliberate approach to follow-on training. As noted above, these marines receive their license on the Light Armored Vehicle following formal military school training with the Light Armored Reconnaissance Training Company. Upon joining their unit, new drivers go through unit-led follow-on training that deliberately builds on the basic driving skills acquired at the school. For example, each of the three Light Armored Reconnaissance battalions we spoke with described allotting time at the beginning of a unit training workup for new driver and crew familiarization training. As crews build cohesion, the training progressively increases in complexity to include field exercises and road marches.

The updates to the *Motor Transport Training and Readiness Manual* may help address these issues over time as first steps towards developing a more well-defined process with performance criteria and measureable standards. However, the training events for motor transport operators are identified as part of formal military school training, which may lessen the urgency for unit commanders to dedicate unit follow-on training time for drivers to build more experience under these conditions. Further, the training events for both motor transport operators and incidentally licensed drivers come with sustainment intervals of 12 to 24 months. As a result, some drivers may not actually train to these skills for 1 to 2 years after receiving their license.

DOD policy states, and military service guidance reinforces, that soldiers and marines will receive, to the maximum extent possible, timely and effective individual, collective, and staff training, conducted in a safe manner, to enable performance to standard during operations.⁴⁹ DOD policy further states that the satisfactory completion of individual, collective, and staff training will be certified to applicable standards by either the mission commander or the commander responsible for the pre-deployment training. The Army and Marine Corps tactical vehicle driver training programs, in contrast to other types of military training, lack a well-defined process—to include performance criteria and measurable standards—to assist Army and Marine Corps units with building and evaluating tactical vehicle driver skills and experience. For example,

⁴⁹Department of Defense Directive 1322.18 *Military Training* (Oct. 3, 2019), Army Doctrine Publication 7-0, *Training* (Jul. 31, 2019) and Marine Corps Order P3500.72A, *Marine Corps Ground Training and Readiness (T&R) Program* (Apr. 18, 2005).

according to our review of Army training documentation, weapon systems-specific training uses a series of training strategies with performance criteria and measurable standards to progressively train military personnel on how to operate and fire weapon systems. Each training strategy progressively builds on previous performance and requires certification events between certain steps in the strategy. The events represent the critical training path a unit progressively follows to achieve the desired level of proficiency.

Without a well-defined process for tactical vehicle driver training—to include unit-led licensing programs and unit follow-on training—unit commanders do not work from a consistent set of performance criteria and measurable standards to determine how much training to provide, under what conditions, and how to evaluate performance. In addition, opportunities for driver-focused training are not emphasized or prioritized by unit commanders and are limited in their ability to help drivers maintain proficiency in diverse conditions. Moreover, drivers of tactical vehicles will continue to have varied levels of experience, and military leadership may not know if personnel have the skills necessary to drive tactical vehicles under increasingly difficult scenarios.

Army and Marine
Corps Identify and
Communicate
Hazards on Training
Ranges, but Have
Not Fully
Implemented or
Shared Certain
Methods to Mitigate
Accidents

The Army and Marine Corps Are Responsible for Identifying and Communicating Hazards on Training Ranges and Have Fulfilled Some, but Not All Responsibilities

The Army and Marine Corps are responsible for identifying and communicating about hazards before, during, and after training events that are held on ranges and training areas. Generally, activities characterized as “before” occur prior to a unit occupying the training range, and include planning for a training event, developing range policies for safety, and identifying hazards on the range, among others. Activities that are characterized as “during” occur while a training event is underway, and consist of methods such as communicating with the unit and tracking unit location. Activities that are characterized as “after” occur once the event concludes, and include actions such as the unit reporting hazards they encountered and any accidents in which they were involved. In general, these responsibilities are set forth in a joint Army and Marine Corps issuance titled *Range Safety* and several service-specific policies that operationalize and further specify the responsibilities established in that document.⁵⁰

We found that Army and Marine Corps ranges fulfilled most, but not all, of these responsibilities, based on our review of training range documentation and interviews with officials at nine Army and Marine Corps training ranges (see fig. 15).

⁵⁰Army Regulation 385-63, Marine Corps Order 3570.1C, *Range Safety* (Jan. 30, 2012). Army Regulation 600-55, *The Army Driver and Operator Standardization Program (Selection, Training, Testing, and Licensing)* (Sept. 17, 2019). Army Regulation 350-19, *The Army Sustainable Range Program* (Aug. 30, 2005). Marine Corps Order 3550.10, *Policies and Procedures for Range and Training Area Management* (Feb. 15, 2018). Army Training Circular 25-8, *Training Ranges* (July 22, 2016). Marine Corps Reference Publication 8-10B.1, *Operational Training Ranges Required Capabilities* (Apr. 4, 2018).

Figure 15: Army and Marine Corps Fulfillment of Responsibilities to Identify and Communicate Hazards to Units Before, During, and After Training Range Use at Nine Selected Training Ranges

	Army Training Ranges	Marine Corps Training Ranges
Before a training event <i>Activities include planning for the event and developing range policies for safety, among others</i>		
Develop standard operating procedures	✓✓✓✓✓✓	✓✓✓
Perform a range safety briefing	✓✓✓✓✓✓	✓✓✓
Review unit risk management assessments	✓✓✓✓✓✓	✓✓✗
Provide tracked and wheeled driver training facilities	✓✓✓✓✓✗	✓✗✗
Identify known hazards to units	✓✓✓✓✓✓	✓✓✓
Establish a range maintenance schedule	✓✓✓✓✓✓	✓✓✓
Maintain and provide maps to units	✓✓✓✓✓✓	✓✓✓
Implement a certification program for key unit range officers	✓✓✓✓✓✓	✓✓✓
During a training event <i>Activities include communicating with the unit and tracking unit locations</i>		
Maintain communication with unit	✓✓✓✓✓✓	✓✓✓
Track unit location	✓✓✓✓✗✗	✗✗✗
Track the weather	✓✓✓✓✓✓	✓✓✓
After a training event <i>Activities include reporting hazards and any accidents that occurred</i>		
Report and record hazards and accidents	✓✓✓✓✓✓	✓✓✓
Develop reports on safety trends	✓✓✓✓✓✓	✓✓✓
Provide after action reporting	✓✓✓✓✓✓	✓✓✓

Source: GAO analysis of information from nine selected Army and Marine Corps training ranges. | GAO-21-361

We found that all nine of the training ranges we included in the scope of our review had implemented 11 of 14 range responsibilities we evaluated.⁵¹ For example, each of the nine training ranges had standard

⁵¹The nine ranges and training areas included in our scope were as follows, Army: Fort Bliss, Texas; Fort Carson, Colorado; Fort Hood, Texas; Fort Irwin, California; Grafenwöhr Training Area, Germany; Training Support Center Wiesbaden, Germany; Marine Corps: Twentynine Palms, California; Camp Lejeune, North Carolina; and Camp Pendleton, California.

operating procedures that they provided to units using the training range. According to the descriptions and contents of the standard operating procedures we obtained, they:

- Serve as the foundation for location-specific safety requirements and are key to communicating these requirements to units;
- Prescribe regulations, precautions, and other important considerations that users of the ranges and training areas were required to follow; and
- Maximize safe and realistic training opportunities for users who follow the practices as intended.

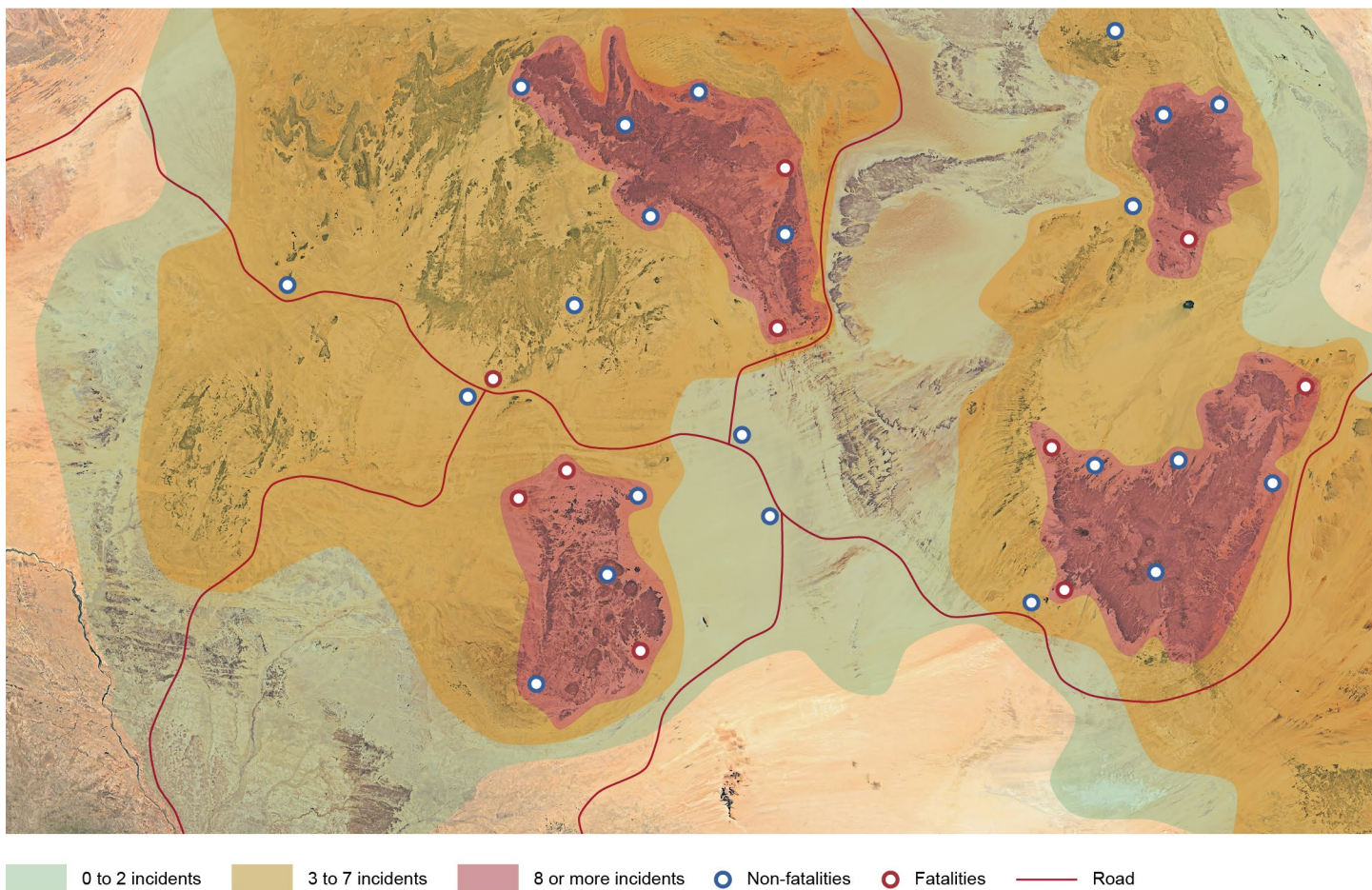
All of the training ranges also made a priority of establishing and maintaining communication with units. For example:

- Five of the ranges and training areas required units to establish primary and secondary forms of communication with training range officials.
- Camp Lejeune's range and training area standard operating procedures explain that radio communications are the primary means of communication between the unit and range control.
- Landline telephones are available at some training range locations and cellular telephones are only authorized as an alternate means of communication.
- Each training range required units to proactively check-in with range control at certain times of the day and before and after the unit participated in live-fire activities.
- Units are to report all accidents and hazards to range control.

The unit is also responsible for reporting accident and hazard information separately to its department's safety center using the appropriate reporting methods. Training range officials told us they require direct reporting of accidents because it helps them ensure they are catching as many accidents and hazards as possible, and it helps them develop tailored hazard maps and other mitigation techniques. For example, all nine of the ranges and training areas we gathered information from also used accident data to develop their own analytic products, such as accident trend charts that are used during safety briefings and maps that show the areas where certain hazards exist. We obtained maps that show rollover risk areas, low water crossings, historical accident locations, and other hazards from several of the training ranges, all of which were

informed by the reporting of hazards and accidents (see fig. 16). These tools convey hazardous conditions to units using the training ranges.

Figure 16: A Map Representing Historical Accident Locations and Hazard Areas on a Department of Defense Training Range



Source: GAO analysis of Department of Defense information; sinlatown/stock.adobe.com. | GAO-21-361

In addition to the safety briefing materials and maps that depict the locations of hazardous conditions, training range officials also use other techniques to communicate hazards to units. Some of these other methods include physical markers such as stakes, signs, and barriers (see fig. 17).

Figure 17: Stakes at Fort Irwin, California, Used to Designate a Hazardous Area



Source: Fort Irwin Range Safety and Procedures Briefing. | GAO-21-361

While we found that the selected Army and Marine Corps training ranges were fulfilling most responsibilities, we also found that some did not fulfill certain responsibilities to identify and communicate hazards across all of the training ranges, as shown above in figure 15. Specifically:

- **Provide tracked and wheeled driver training facilities.** The Army requires ranges and training areas to provide dedicated driver courses for tracked and wheeled vehicle operators or an improvised facility that meets the requirement, and the Marine Corps requires each training range complex to provide wheeled and tracked driver training facilities.⁵² Five of the six Army training ranges we gathered information from had designated driver facilities, and officials at the one that did not said they are assessing potential options of where to build one. In the interim, units at that location told us they design their own facilities for driver training. One of the three Marine Corps training ranges we gathered information from met the requirement to have tracked and wheeled tactical vehicle facilities. According to documentation and interviews with range officials, the Marine Corps training ranges that did not meet this requirement had one or more wheeled tactical vehicle facilities, but not a tracked tactical vehicle

⁵²Army Regulation 600-55, *The Army Driver and Operator Standardization Program (Selection, Training, Testing, and Licensing)* (Sept. 17, 2019). Marine Corps Reference Publication 8-10B.1, *Operational Training Ranges Required Capabilities* (Apr. 4, 2018).

driver training facility. Officials at one training range told us that the driver training facilities were valuable in exposing drivers to steep inclines and declines and more challenging terrain in a controlled environment. These officials noted that the conditions they were able to build into the driver training facility were not easily found elsewhere on their installation. The officials also noted that the driver training facility allowed them to put drivers through more varied terrain with more oversight.

- **Review unit risk management assessments.** The Army and Marine Corps task training range personnel with reviewing and commenting on all risk management documentation that is deemed high-risk or extremely high-risk for training to be conducted on its facilities.⁵³ Additionally, the Marine Corps tasks training range management officials with evaluating risk assessments more generally to mitigate risks associated with ranges and training areas.⁵⁴ All six of the Army training range facilities we evaluated met the Army standard. Two of the three Marine Corps training range facilities we evaluated met the Marine Corps standard. Officials from the facility that did not meet the standard indicated that they do review unit risk assessments in certain situations, but otherwise the unit risk assessments are to be reviewed by the unit commanding officer. Training range officials noted that the use of knowledgeable third parties, like a training range official, in reviewing risk management assessments has proven effective at helping unit leadership thoroughly consider the risks they have faced in various locations. For instance, several training range officials said that upon reviewing unit risk management assessments, they found references to hazards that were inaccurate and vehicles that did not match what the unit actually planned to use in the training exercise.
- **Track unit location.** The Army guidance for training ranges states that range personnel are responsible for managing range use through monitoring training unit locations.⁵⁵ The Marine Corps requires instrumentation systems that track participants, sometimes to a high degree of accuracy.⁵⁶ According to our evaluation, two of the six Army training ranges we gathered information from met the unit tracking

⁵³Army Regulation 385-63, Marine Corps Order 3570.1C, *Range Safety* (Jan. 30, 2012).

⁵⁴Marine Corps Order 3550.10, *Policies and Procedures for Range and Training Area Management* (Feb. 15, 2018).

⁵⁵Army Training Circular 25-8, *Training Ranges* (July 22, 2016).

⁵⁶Marine Corps Reference Publication 8-10B.1, *Operational Training Ranges Required Capabilities* (Apr. 4, 2018).

requirement. None of the three Marine Corps training range facilities met the requirement. Several training range officials we spoke with mentioned that tracking capabilities can be expensive and that they use radio communications to keep low-fidelity information on the location of the units. Marine Corps officials we spoke with said that, ideally, they would like to be able to track the location of every marine on the training range because it would help keep them out of harm's way. It would also help the unit personnel responsible for overseeing the exercise by giving them an idea of people's relative locations when they are unable to establish line-of-sight.

When we asked training range officials about the challenges associated with building driver training facilities, reviewing unit risk management assessments, and tracking unit locations at a higher degree of fidelity, training range officials cited resource constraints as the primary reason for not implementing these requirements. Specifically:

- In relation to establishing designated driver training facilities for tracked and wheeled tactical vehicles, officials from one training range mentioned that they were planning to improve the facility at their location, but funding was not a high priority due to the limited availability of training funds needed to build the facility. Additionally, another official said procuring the equipment to build a driver training facility is a challenge. Furthermore, officials at one location said they have over 300,000 acres of other training land that drivers can use to train on basic skills.
- In regards to reviewing unit risk management assessments, a training range official stated that range control does not have enough personnel to review all of the assessments, but they do reserve the right to review them during unannounced inspections. Marine Corps training range officials further clarified that training range personnel review high-risk training plans and deviation requests (requests to train outside of normal standards set in the range standard operating procedures). They view this as a risk-based method for ensuring safe operations while efficiently using their personnel resources.
- For the tracking of unit locations, the training range officials we spoke with said that they are effective at tracking unit locations in a low-fidelity way, which they said meets their requirements. They said they can achieve this low-fidelity tracking by using the Range Facility Management Support System and radio communications to understand where units are on the range and training areas and what

they are doing.⁵⁷ The officials explained that higher-fidelity tracking, such as the systems used to enable force-on-force exercises, are costly and not always necessary.

DOD officials noted that resource limitations are an important consideration for implementing these methods to identify and communicate hazards to units. While investment in these methods can be costly, so too are accidents. In fact, we found that about 25 percent of all reported Class A and B tactical vehicle accidents for which a specific location was reported occurred on ranges and training areas, and these methods have been established to help reduce the risk of such accidents.

Standards for Internal Control in the Federal Government state that management should identify, analyze, and respond to risks related to achieving defined objectives—in this case, preventing accidental deaths and damage to equipment, and preserving combat readiness.⁵⁸

However, the Army and Marine Corps have not systematically evaluated the extent to which ranges and training areas are fulfilling their responsibilities to identify and to communicate hazards to units, or evaluated whether existing or planned workarounds are adequate or if additional resources should be applied to fulfill these responsibilities. Officials we met with agreed that such an evaluation would allow the Army and the Marine Corps to determine whether they should adjust their approaches to minimize risk or prioritize them so they can be resourced and implemented. Specifically:

- Having wheeled and tracked tactical vehicle training facilities available, for example, allows units a chance to build confidence and skill with their vehicles in a controlled environment that has varied terrain.
- Reviewing unit risk management assessments helps the training range provide independent oversight over unit risk management practices and helps coach unit leadership on how to build effective risk management plans.
- Tracking unit locations can warn them of nearby hazards.

⁵⁷The Range Facility Management Support System is system used by Army and Marine Corps unit and range personnel to schedule, reserve, and manage the use of ranges and training areas.

⁵⁸[GAO-14-704G](#).

Taken together, evaluating the effectiveness of managing risk through these approaches would help the Army and Marine Corps understand if opportunities exist to improve the identification of and communication about hazards, which might in turn prevent injuries, deaths, or equipment being damaged during training.

Army and Marine Corps Training Ranges Are Not Sharing Methods That Have Been Used to Mitigate Tactical Vehicle Accidents

The Army and Marine Corps do not share methods that have been used to mitigate tactical vehicle accidents such as unit rehearsals and new driver familiarization training at facilities. As the Army and Marine Corps use ranges and training areas in similar ways to achieve training goals and prepare units for their missions, there are similarities in their safety requirements and a shared goal of preventing accidents. We found some additional safety methods that were used to mitigate tactical vehicle accidents across all nine of the ranges and training areas we gathered information from, such as conducting post-training inspections of the range or training areas, while other additional methods were only used at some training ranges, such as requiring rehearsals prior to the unit occupying the range.

Post-training inspections. Each of the nine training ranges we gathered information from performed post-training inspections of the ranges and training areas to ensure the area was safe for the next unit. These requirements are clearly communicated to the units using the ranges as part of the check-in, check-out process and as part of range regulations and standard operating procedures. For instance, Fort Hood's range regulation states that the Officer in Charge of the unit will request a clearance inspection from range control prior to departing ranges and training areas. The Army's Fort Hood regulation further explains that inspections must be conducted during hours of daylight, and if it cannot be done prior to a unit's departure, then the Officer in Charge is responsible for coordinating with range control to schedule an inspection. If the unit has not followed proper protocols and fails the inspection, it will have to schedule a re-inspection within 24 hours. Training range officials commented that these inspections are critical for safety because they allow the training range personnel to quickly become aware of any changes in the range that could be hazardous, including ground movement or unexploded ordnance.

Unit rehearsals. Four of the nine training ranges required unit rehearsals prior to allowing that unit to occupy a training range. Further, officials at most of the training ranges that did not require rehearsals encouraged them, or identified certain situations where they were required. For instance, one training range required rehearsals prior to firing exercises,

but only encouraged them prior to other types of exercises, including night exercises in blackout conditions. The training range officials generally believed it was the duty of the unit leadership to manage the risk to their unit in those situations. However, in multiple interviews with tactical vehicle drivers, they identified night operations as challenging and riskier than normal operations, and drivers also shared that they performed night operations without rehearsals and felt it was dangerous. Officials acknowledged that rehearsals are an effective way to prepare training range users for challenging terrain and conditions in a more controlled environment.

Familiarization training. Another measure used to varying degrees to mitigate tactical vehicle accidents is requiring familiarization training for new drivers at the installation. Some of the training ranges we gathered information from required newly arrived drivers to take special driver training courses when they arrived on site in order to familiarize them with different driving laws and to learn about local hazards. Most of the training ranges did not specifically require such familiarization training and some delegated that responsibility to the units. In interviews, unit personnel also told us the base familiarization processes varied. Such familiarization can be valuable to drivers who are new to the area because there are different rules and hazards that vary from location to location. For example, the hazards in North Carolina at Camp Lejeune, which is densely vegetated with swamps and wetland areas, are far different from those at Camp Pendleton in California, which is dusty and hilly. Additionally, driving laws vary from state to state, so familiarization training can cover any key differences.

The Army and Marine Corps each have a military service-level official responsible for coordinating matters related to ranges and training areas. Marine Corps officials told us that, while these formal collaboration mechanisms are in place and used, they do not incorporate views from training range control personnel, but occur at higher level. Additionally, the Army and Marine Corps recognize the importance of sharing information within their organizations, particularly at each installation, as each military service has requirements for installation-level safety councils.⁵⁹ Training range safety officials we met with said these councils are effective at identifying and mitigating training range hazards, but they are limited to sharing lessons learned from one location.

⁵⁹MCO 5100.29C and AR 385-10.

Training range safety officials we met with generally said they did little coordination with other training range safety officials on lessons learned and best practices. Officials from two of the training ranges stated that they did not coordinate with other training ranges at all. Some of the training range officials identified that they informally coordinate on best practices and emerging issues. Training range officials from at least one training range in the Army and the Marine Corps, respectively, mentioned that they coordinate with other ranges. However, there was not consistency in the sharing of range safety best practices, lessons learned, and other initiatives between ranges.

Officials we met with said that information sharing between ranges and training areas is limited because existing mechanisms for sharing training range safety methods between the military services occur at the department-level and do not include range officials who implement solutions for preventing and mitigating hazards on installations and ranges. Given that the Army and Marine Corps have similar maneuver training requirements, it is likely they could learn from each other's experiences with range safety. To that end, three training range safety offices we met with said that they believe they would benefit from coordinating with other ranges. Even some of the training ranges that identified that they already achieved a certain level of collaboration stated that such collaboration was valuable and they would benefit from more frequent range conferences to share lesson learned and best practices. DOD has established such collaborative forums in other areas where the military services share common goals, such as the annual DOD Maintenance Symposium and the DOD Unmanned Systems and Robotics Summit that include representatives from across the military services. Such summits provide DOD organizations with a chance to coordinate and collaborate across the military services and also provide venues for related private sector partners to learn about the cross-cutting needs of the defense department.

Joint Army and Marine Corps guidance on range safety states that the Director of Army Safety is responsible for being the Army focal point to coordinate and integrate range safety policy matters.⁶⁰ For the Marine Corps, the Commanding General of the Marine Corps Combat Development Command serves as coordinator of all range and training area issues. *Standards for Internal Control in the Federal Government* emphasize the importance of communicating quality information down

⁶⁰Army Regulation 385-63, Marine Corps Order 3570.1C, *Range Safety* (Jan. 30, 2012).

and across reporting lines in the organization to help the organization achieve its objectives.

However, the Army and Marine Corps have not established a formal collaboration forum among range officials that allows them to share methods for identifying and communicating hazards to units with each other on a regular basis. By establishing a formal collaboration forum for Army and Marine Corps range officials to share methods that are used to identify and communicate hazards at ranges and training areas, the Army and Marine Corps would enhance their ability to share lessons learned and best practices related to ranges and training areas. This could lead to safer training operations and result in more innovations and efficiencies across training ranges.

Conclusions

From fiscal years 2010 through 2019, 123 soldiers and marines lost their lives in accidents that were caused by operator and supervisory errors in most cases. Tactical vehicle accident prevention is a multifaceted effort that requires effective risk management practices, driver training programs, and methods to identify and communicate potential hazards on training ranges. A breakdown in planning, oversight, or implementation can lead to injuries to service members, including deaths, and damage to expensive vehicles.

However, issues affecting vehicle commanders and unit safety officers have limited Army and Marine Corps efforts to consistently implement risk management practices. For example, first-line supervisors such as vehicle commanders do not have a clearly defined role in tactical vehicle safety, and they lack mechanisms and procedures to effectively perform the role. Additionally, Army and Marine Corps safety officers are limited in their ability to promote and enforce tactical vehicle safety due to time pressure and workload limitations. Until the Army and Marine Corps develop more clearly defined roles, mechanisms, and procedures for first-line supervisors and determine if units are appropriately staffed to implement their ground-safety programs, ad-hoc enforcement of ground-safety procedures—which increases the risk of human error such as complacency—is likely to continue and can lead to more accidents and injuries.

With regard to training, the Army and Marine Corps do not have specific performance criteria and standards for training, which has contributed to drivers receiving different amounts of driving time and opportunities to develop driving skills, such as night driving and off-road driving in difficult terrain. As a result, the Army and Marine Corps do not have reasonable

assurance that their personnel are able to build their driver skills from basic skills to proficiency under diverse conditions.

We found that selected Army and Marine Corps training ranges that we reviewed fulfill most, but not all, of their responsibilities to identify and communicate hazards to units that use the training range. However, they have not systematically evaluated the extent to which their ranges and training areas are fulfilling their responsibilities to identify and communicate hazards to units or evaluated whether existing or planned workarounds are adequate. Furthermore, while Army and Marine Corps training ranges have implemented a number of additional safety procedures that are not service-wide requirements, they do not share these procedures across locations in any formal, periodic way. By evaluating whether training range safety responsibilities are being fulfilled, determining whether existing workarounds are adequate, and establishing a formal collaboration forum for training range officials to share methods that are used to identify and communicate hazards at ranges and training areas across the services, the Army and Marine Corps would be better positioned to improve range and training area safety.

Recommendations for Executive Action

We are making the following 9 recommendations to DOD:

The Secretary of the Army, in consultation with the Chief of Staff of the Army, should ensure that the Army develop more clearly defined roles for vehicle commanders and establish mechanisms and procedures for tactical vehicle risk management to be used by first-line supervisors such as vehicle commanders. (Recommendation 1)

The Secretary of the Navy, in consultation with the Commandant of the Marine Corps, should ensure that the Marine Corps develop more clearly defined roles for vehicle commanders and establish mechanisms and procedures for tactical vehicle risk management to be used by first-line supervisors such as vehicle commanders. (Recommendation 2)

The Secretary of the Army, in consultation with the Chief of Staff of the Army, should evaluate the number of personnel within operational units who are responsible for tactical vehicle safety and determine if these units are appropriately staffed, or if any adjustments are needed to workloads or resource levels to implement operational unit ground-safety programs. (Recommendation 3)

The Secretary of the Navy, in consultation with the Commandant of the Marine Corps, should evaluate the number of personnel within

operational units who are responsible for tactical vehicle safety and determine if these units are appropriately staffed, or if any adjustments are needed to workloads or resource levels to implement operational unit ground-safety programs. (Recommendation 4)

The Secretary of the Army, in consultation with the Chief of Staff of the Army, should ensure that tactical vehicle driver training programs—to include licensing, unit, and follow-on training—have a well-defined process with specific performance criteria and measurable standards to identify driver skills and experience under diverse conditions. (Recommendation 5)

The Secretary of the Navy, in consultation with the Commandant of the Marine Corps, should ensure that tactical vehicle driver training programs—to include licensing, unit, and follow-on training—have a well-defined process with specific performance criteria and measurable standards to identify driver skills and experience under diverse conditions. (Recommendation 6)

The Secretary of the Army, in consultation with the Chief of Staff of the Army, should ensure that the Army evaluates the extent to which its ranges and training areas are fulfilling responsibilities to identify and communicate hazards to units. If the responsibilities are not being carried out, the Army should determine if existing workarounds are adequate or if additional resources should be applied to fulfill these responsibilities. (Recommendation 7).

The Secretary of the Navy, in consultation with the Commandant of the Marine Corps, should ensure that the Marine Corps evaluates the extent to which its ranges and training areas are fulfilling responsibilities to identify and communicate hazards to units. If the responsibilities are not being carried out, the Marine Corps should determine if existing workarounds are adequate or if additional resources should be applied to fulfill these responsibilities. (Recommendation 8)

The Secretary of the Army, in consultation with the Chief of Staff of the Army, and the Secretary of the Navy, in consultation with the Commandant of the Marine Corps, should establish a formal collaboration forum among Army and Marine Corps range officials that allows them to share methods for identifying and communicating hazards to units with each other on a regular basis. (Recommendation 9)

Agency Comments and Our Evaluation

We provided a draft of this report to DOD for comment. In its written comments, reproduced in appendix VII, DOD concurred with all nine of our recommendations and outlined its plan to address our first, third, fourth, seventh, and eighth recommendations. DOD also provided technical comments, which we incorporated as appropriate.

In concurring with our second recommendation, DOD stated that the Marine Corps has adopted mechanisms and procedures to facilitate the risk management process; for example, they are using the Joint Risk Assessment Tool to enable leaders to complete risk assessment worksheets electronically. DOD's response also stated that commands and units can promote safety of personnel by ensuring assigned missions are based on actual capabilities and capacities and confirming units are properly resourced to safely execute assigned tasks. We agree these are positive steps that can help mitigate risk during the operation of tactical vehicles. However, DOD's response does not address the specific limitation we identified in the Marine Corps' efforts to implement risk management practices, that is, to develop more clearly defined roles for vehicle commanders. As we note in our report, vehicle commanders—the first-line supervisor in a tactical vehicle every time it leaves a motor pool—were cited by most Marine Corps units we interviewed as playing an important role in the direct implementation of safe driving practices. Our report also states that differences remain in unit implementation of the vehicle commander role with regards to qualifications, licensing, and training. We continue to believe that the Marine Corps should take further steps to implement safe driving practices, including developing more clearly defined roles for first line supervisors, such as vehicle commanders, and establishing mechanisms and procedures to help these personnel effectively perform the responsibilities of the role.

In concurring with our fifth recommendation, DOD's response stated that Army Regulation 600-55, *The Army Driver and Operator Standardization Program*, contains a well-defined driver training program with three phases for driver licensing. DOD's response also stated that the regulation requires annual sustainment training, reception of reassigned operators, license renewal requirements, and driving with night vision devices. We agree that the Army regulation establishes a driver licensing program that provides instruction, skills, and experience, among other benefits. However, with regard to the Army's driver licensing program, we found that the regulation is not consistently implemented across units and that training was frequently condensed and provided soldiers with limited exposure to diverse conditions, such as varied terrain or driving at night. We further reported that the regulation does not include clear, specific

performance criteria and measurable standards for training content, leaving the pass or fail road test as the only evaluative measure of training. For example, the regulation states that training completion would be validated “when the license instructor or supervisor feels the trainee is proficient at operating the vehicle.” Our report notes that the absence of specific performance criteria or measurable standards beyond completing the road test leaves driver licensing programs vulnerable to competing with other unit priorities. Army officials reported to us that, as a result, decisions about when to move drivers on to the road test evaluation were not always based on an evaluation of performance, but rather on other factors such as the availability of time or the number of soldiers that unit commanders needed to get licensed. With regard to Army follow-on (i.e., sustainment) training, our report notes that the Army lacked deliberate progression models—with performance criteria and measurable standards—to assist commanders with training drivers after they are licensed under increasingly difficult scenarios. This is in contrast to how the Army conducts other types of military training, which require certification events at certain points that represent the critical training path individuals and units progressively follow to achieve the desired level of proficiency. We continue to believe that by developing performance criteria and measurable standards for driver training, the Army would better ensure that its drivers have the skills that are needed to operate vehicles safely and effectively under diverse driving conditions.

In concurring with our sixth recommendation, DOD’s response stated that the Marine Corps has a well-defined process with specific performance criteria and measurable standards for driver training, and noted that it will continue to review and refine training standards per the process outlined in the Marine Corps Ground Training and Readiness Program. For example, in 2019 the Marine Corps updated the Motor Transport Training and Readiness Manual and increased the number of driving specific events from two to 10 for certain vehicles. According to DOD’s response, these new driving events provide additional requirements and standards, to include operating vehicles in varied terrain and in limited visibility conditions. As we state in our report, we agree that this update represents an improvement in the Marine Corps’ driver training program. However, our report also notes that these training events are identified as part of formal military school training where, according to Marine Corps officials, marines are trained to a basic skill level on a limited number of vehicle platforms. Building driver proficiency under diverse conditions remains a unit commander’s responsibility, yet the updated training manual establishes intervals of 12 to 24 months (i.e., 1 to 2 years) for driving-specific events. This can decrease the urgency for unit commanders to

provide follow-on training and result in some drivers not training to these skills for 1 to 2 years after receiving a license. Drivers we met with who operated a range of Marine Corps tactical vehicles also told us that there were not enough opportunities for dedicated driver training under diverse driving conditions to build driving skills. We continue to believe that by developing additional performance criteria and measurable standards for driver training, especially follow-on training, the Marine Corps would better ensure that its drivers have the skills that are needed to operate vehicles safely and effectively under diverse driving conditions.

In concurring with our ninth recommendation, DOD's response stated that the Army and Marine Corps have quarterly Range Safety Working Group meetings to plan, develop, organize, coordinate, review, and oversee the Army and Marine Corps range safety programs. DOD's response also noted that these working group meetings are used to develop and coordinate range safety policy, procedures, and strategies to resolve range safety hazards, as well as develop range safety training curricula. Our report states that the Army and Marine Corps have existing collaboration mechanisms in place, including department-level working groups and installation-specific councils. However, as we also note in our report, Army and Marine Corps officials told us that existing collaboration forums for sharing training range safety methods between the military services do not include range-specific officials who implement solutions for preventing and mitigating hazards on installations and ranges. Range and training area officials we met with told us that they did little coordination with other training range officials on lessons learned and best practices. We continue to believe that the Army and Marine Corps should establish a formal collaboration forum among training range officials that meets on a regular basis—either through the existing Range Safety Working Group or another mechanism—to include officials who work at ranges and training areas so that those officials can share insights and solutions with each other.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 7 days from the report date. At that time, we will send copies of this report to the appropriate congressional committees; the Secretaries of Defense and Army; the Acting Secretary of the Navy; the Commandant of the Marine Corps; 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 questions about this report, please contact me at (202) 512-5431 or russellc@gao.gov. Points of contact 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 VIII.

A handwritten signature in black ink that reads "Cary Russell". The signature is written in a cursive, flowing style.

Cary Russell
Director, Defense Capabilities and Management

List of Requesters

The Honorable Carolyn B. Maloney
Chairwoman
Committee on Oversight and Reform
House of Representatives

The Honorable John Garamendi
Chairman
Subcommittee on Readiness
Committee on Armed Services
House of Representatives

The Honorable Doug Lamborn
Ranking Member
Subcommittee on Readiness
Committee on Armed Services
House of Representatives

The Honorable Benjamin Cardin
United States Senate

The Honorable Chris Van Hollen
United States Senate

The Honorable Anthony Brown
House of Representatives

The Honorable C.A. Dutch Ruppersberger
House of Representatives

Appendix I: Objectives, Scope, and Methodology

This report examined (1) the trends from fiscal years 2010 through 2019 in reported Army and Marine Corps tactical vehicle accidents and deaths in non-combat scenarios and reported causes; and evaluated the extent to which the Army and Marine Corps have (2) taken steps to mitigate and to prevent accidents during tactical vehicle operations; (3) provided personnel with training to build the skills and experience needed to drive tactical vehicles; and (4) established methods to identify and communicate hazards on ranges and training areas.

For objective one, we requested data on all tactical vehicle accidents for fiscal years 2010 through 2019 from the Army Combat Readiness Center and the Naval Safety Center.¹ Different iterations of data provided by the Marine Corps contained different observations and data fields. We joined multiple spreadsheets of data that we received from each service to allow us to run cross-cutting analysis involving fields from different spreadsheets. We met with agency officials who report, maintain, and use the accident data in order to understand how the information is used and to help us assess its reliability and completeness. We also performed electronic testing of the data to check for missing values and internal consistency. In assessing the reliability of the data, we found missing or inconsistent values in certain fields of interest, such as the designator for rollovers not always being recorded when the narrative of the accident mentioned a rollover and driver characteristics not always being noted. Based on officials' statements, we determined that reporting for Class A and B accidents was likely more complete than reporting for less serious accidents, and we focused much of our analysis on Class A and B

¹The Department of Defense (DOD) refers to accidents that occur outside of engagement with an adversary as "mishaps". A mishap is an unplanned event or series of events that results in damage to DOD property; occupational illness to DOD personnel; injury or death to on- or off- duty DOD military personnel; injury or death to on-duty DOD civilian personnel; or damage to public or private property, or injury, death, or illness to non-DOD personnel, caused by DOD activities. Throughout this report we will use the term "accident" to mean mishap. Department of Defense Instruction 6055.07, *Mishap Notification, Investigation, Reporting, and Record Keeping* (June 6, 2011) (incorporating change 1, Aug. 31, 2018). The Department of Defense (DOD) collects data on all vehicle accidents involving service members, including those that took place in privately-owned vehicles; however, we did not include privately-owned or commercial vehicles in our analysis. We included data from fiscal year 2010 through fiscal year 2019, which was the most recent full year of data available at the time of our analysis.

accidents accordingly.² Overall, we determined the data were sufficiently reliable for the purposes of identifying general trends in the reported number and severity of accidents over time, accident rates, deaths caused by accidents, and common causal factors for certain types of accidents.³

Army data classified all vehicles into categories, such as High Mobility Multipurpose Wheeled Vehicles or Family of Medium Tactical Vehicles, and also identified a primary vehicle for each accident. The Marine Corps did not identify a primary vehicle for each accident, so we classified a tactical vehicle category for all Marine Corps tactical vehicles based on variables describing make and model. We applied a business rule to assign a primary vehicle for each Marine Corps accident, generally assigning more expensive vehicles as primary (consistent with how Army officials told us how they assign primary vehicles for accidents in their database). We did not include accidents where the primary vehicle was a privately-owned vehicle, bus, van, or commercial vehicle. We shared drafts of our data tables with the Army and Marine Corps to confirm our approach.

We identified rollovers based on the variable that described the collision in Army data and a variable that described the first impact point in Marine Corps data, but the data were not always complete. The Army did not provide collision data for 39 of 3091 accidents, so we read the narratives for those accidents to determine whether they involved rollovers. We also found that many rollovers in Marine Corps data did not use the standard rollover identifier, so we did a keyword search for the words “roll”, “tip”, “flip”, or “turn” together with “over” in accident narratives and then read the narratives to identify additional Marine Corps accidents that involved rollovers. We also read the narratives for all Marine Corps Class A

²For the period of our review, DOD defined Class A accidents as the most serious accidents resulting in death or permanent total disability, destruction of a DOD aircraft, or \$2 million in damages or greater. Class B accidents resulted in permanent partial disability or inpatient hospital care for three or more individuals and/or damages of \$500,000 or more, but less than \$2 million. DOD adjusted the thresholds for accident classes upward in October 2019 so that, for example, Class A accidents represent damages of \$2.5 million or higher.

³For the purposes of this report, we use the term trend to refer to the number of accidents and characteristics of those accidents reported over time or summarized for the period of time covered by our review.

accidents and compared them to other information received from the Naval Safety Center to identify military fatalities caused by the accidents.⁴

We obtained inventory numbers for the various models of tactical vehicles from the Army and Marine Corps, and we also read and analyzed the cause narratives from accident investigations for 51 Class A accidents that the Army was able to provide.⁵ Similar cause narratives for Marine Corps accidents were not available.

For objective two, we reviewed accident data from the Army Combat Readiness Center and the Naval Safety Center to determine the most common causes of accidents or factors that make accidents more serious. We also reviewed reports and documentation on common hazards as identified by the Army and Marine Corps, and we collected and analyzed responses to command climate surveys administered by the Army and Marine Corps. After identifying common hazards related to operating tactical vehicles, we analyzed documents that discuss the Army and Marine Corps procedures to identify risk management activities used to mitigate accidents during tactical vehicle operations.

We conducted interviews with officials from the Army Combat Readiness Center; the Naval Safety Center; the Army Safety Office; Commandant of the Marine Corps, Safety Division; U.S. Army Europe Safety Division; U.S. Army Pacific Safety Division; Eighth Army Command Safety Office; I Marine Expeditionary Force Safety Division; and II Marine Expeditionary Force Safety Division. In addition, to determine steps taken to implement risk management activities, we interviewed a non-generalizable selection of Army unit personnel from 1st Armored Division, 1st Infantry Division, 4th Infantry Division, 1st Cavalry Division, and 3rd Cavalry Regiment; and Marine Corps unit personnel from 1st Marine Division, 1st Marine Logistics Group, 2nd Marine Division, and 2nd Marine Logistics Group. We made a non-generalizable selection of unit personnel to interview based the vehicle types they operate, the number of Class A and B

⁴The Army data reported on number of military fatalities resulting from each accident.

⁵We requested cause narratives for 73 Class A accidents involving HMMWVs, FMTVs, Strykers, and Bradley Fighting Vehicles that took place in the United States, Germany, or South Korea. Army officials reported that they were unable to provide cause narratives for 22 of the class A accidents because of blank entries in the accident database. Officials said this could be due to improper data entry, failure to forward final reports to the Combat Readiness Center, or loss of entries due to data migration.

mishaps experienced by the unit from fiscal years 2015 through 2019, and the availability of key personnel to interview from each unit.

We compared the steps identified by Army and Marine Corps risk management guidance to the steps taken to implement those controls by the sample of units described above. Furthermore, we determined the control environment component of the *Standards for Internal Control in the Federal Government* was significant to this objective, specifically the associated underlying principle that management should enforce accountability by considering excessive pressures on personnel.⁶ We assessed the Army and Marine Corps practices for assigning safety personnel to units against these internal control standards.

For objective three, we selected tactical vehicles from each military service based on the number of Class A and B accidents involving these tactical vehicles from fiscal years 2015 through 2019, key characteristics of the tactical vehicles (i.e. whether they were tracked or wheeled), and to ensure we selected tactical vehicles that represent a variety of training paradigms (e.g., vehicles only assigned to specific Military Occupational Specialties and tactical vehicles that can be operated by incidentally licensed drivers).⁷ We reviewed Army and Marine Corps training procedures and guidance on licensing and driver skill development for the tactical vehicle types we selected. We interviewed a non-generalizable selection of Army unit personnel from 1st Armored Division, 1st Infantry Division, 4th Infantry Division, 1st Cavalry Division, and 3rd Cavalry Regiment; and Marine Corps unit personnel from 1st Marine Division, 1st Marine Logistics Group, 2nd Marine Division, and 2nd Marine Logistics Group to discuss processes to license, train, and build driver skills. We selected these units to interview based on the vehicle types they operate, the number of Class A and B mishaps experienced by the unit from fiscal years 2015 through 2019, and the availability of key personnel to interview from each unit. In addition, we conducted interviews with officials from Army Training and Doctrine Command, the Army Driver Standardization Office, the Maneuver Support Center of Excellence, the Army Armor School, and the 58th Transportation Battalion; and Marine Corps Training and Education Command, the Motor Transport Instruction

⁶GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: September 2004).

⁷We requested a smaller sample of accident information from the Army Combat Readiness Center and the Naval Safety Center, which we used to inform which units to meet with and what training ranges and tactical vehicles to include in our review.

Company, and the Light Armored Reconnaissance Training Company. We compared the training provided to Army and Marine Corps personnel to drive tactical vehicles with DOD and military service-level training guidance.⁸

For objective four, we reviewed Army and Marine Corps documents related to ranges to determine responsibilities for operating training ranges. Then we analyzed Army and Marine Corps range documentation and interviewed personnel from a non-generalizable selection of training ranges to discuss the use of range control methods, which included six Army and three Marine Corps ranges and training areas. We selected these training ranges based on the number of Class A and B mishaps and total number of mishaps that occurred in those locations from fiscal years 2015 through 2019. We also considered the types of training opportunities offered at each area and selected training ranges so we had a variety of types (whether they support collective training events, large-scale force on force training, and also home unit training). Further, we selected training ranges that served as home stations for the units we interviewed. We compared Army and Marine Corps processes to identify and communicate hazards with the military service-level guidance we identified.⁹ Additionally, we determined that the risk assessment component of the *Standards for Internal Control in the Federal Government* was significant to this objective, including the associated underlying principles of identification, analysis, and response to risks.

Further, we compared efforts to share such methods across range and training area locations with military service requirements, similarly established collaboration forums in other areas where DOD fosters cross-service collaboration, such as for maintenance and unmanned system development, and federal internal control standards. We determined the information and communication component of the *Standards for Internal Control in the Federal Government* was significant to this objective, along with the associated underlying principle that management should communicate quality information down and across reporting lines in the organization to help the organization achieve its objectives.

⁸Department of Defense Directive 1322.18 *Military Training* (Oct. 3, 2019), Army Doctrine Publication 7-0 *Training* (July 31, 2019) and Marine Corps Order P3500.72A, *Marine Corps Ground Training and Readiness (T&R) Program* (Apr. 18, 2005).

⁹For example, Army Regulation 385-63, Marine Corps Order 3570.1C, *Range Safety* (Jan. 30, 2012).

To address all of our objectives, we interviewed officials and, where appropriate, obtained documentation, from the following organizations:

- Department of Defense
 - Office of the Under Secretary of Defense for Personnel and Readiness
 - Office of the Under Secretary of Defense for Acquisition and Sustainment
- Army
 - Office of the Director of Army Safety
 - Training and Doctrine Command
 - Forces Command
 - Combat Readiness Center
 - Army Materiel Command
 - Army Inspector General
 - Department of Army Management Office – Training Simulations
 - Integrated Training Area Management Program
 - U.S. Army Europe
 - U.S. Army Pacific
 - Select unit personnel, training range control officials, and safety personnel at:
 - National Training Center – Fort Irwin
 - Fort Bliss
 - Fort Hood
 - Fort Carson
 - Fort Riley
 - Grafenwöhr Training Area
 - Wiesbaden Training Support Center
- Marine Corps
 - Safety Division
 - Forces Command
 - Forces, Pacific

- I Marine Expeditionary Force
- II Marine Expeditionary Force
- Training and Education Command
- Naval Safety Center
- Marine Corps Installations Command
- Range and Training Area Management
- Select unit personnel, training range control officials, and safety personnel at:
 - Camp Lejeune
 - Twentynine Palms
 - Camp Pendleton

We conducted this performance audit from October 2019 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.

Appendix II: Army and Marine Corps Tactical Vehicle Driver Training

The Army and Marine Corps provide training for tactical vehicle drivers at multiple stages to include formal training at military schools; unit-led licensing programs; and unit follow-on training.¹

Formal training at military schools. Depending on their military occupational specialty, some military personnel may receive training to drive tactical vehicles at formal military schools.² In the Army, for example, armored vehicle personnel and cavalry scouts receive some training on tactical vehicles such as the Abrams tank, Bradley Fighting Vehicle (Bradley), and Stryker through advanced individual training at the Army Armor School at Fort Benning, Georgia. Similarly, in the Marine Corps, light armored reconnaissance marines received training on the Light Armored Vehicle while training with the Light Armored Reconnaissance Training Company at Marine Corps Base Camp Pendleton, California.

Motor transport operators in both the Army and Marine Corps received training on certain tactical vehicle types during their military school training at Fort Leonard Wood, Missouri.³

Licensing programs. To license tactical vehicle drivers, the Army and Marine Corps each use a phased approach to training that culminates in a road-test that needs to be successfully completed for an applicant to earn a license. All tactical vehicle drivers in the Army are required to

¹For the purposes of this report, we use “follow-on” training to represent Army and Marine Corps operational unit-led training, including individual and collective training for mission essential tasks as well as required periodic sustainment training used to ensure perishable skills and knowledge do not decay to the point that soldiers and marines can no longer perform the required skills effectively.

²The Army and Marine Corps delineate their force structure through the use of military occupational specialties. The occupational specialties represent the jobs that are necessary to meet their specific missions and cover a variety of jobs. Soldiers and marines participate in advanced individual training for awarding each military occupational specialty. For example, prior to being awarded the motor transport military occupational specialty and joining their unit of assignment, soldiers and marines receive formal training with the 58th Transportation Battalion and the Motor Transport Instruction Company respectively; both at Fort Leonard Wood, Missouri.

³Motor transport operator is a specific military occupational specialty in the Army and Marine Corps. Motor transport operators inspect, operate, and manage motor transport tactical wheeled vehicles to transport troops, supplies, and equipment to support combat and/or garrison operations. They also perform crew/operator level maintenance, and maintain/manage associated tools and equipment, to rated capacity, of which licensed to operate.

complete the licensing program at their respective unit of assignment, prior to receiving their license. In contrast, Marine Corps schools such as the Light Armored Reconnaissance Training Company and the Motor Transport Instruction Company issue a license to qualifying marines. More specifically:

- **Army.** The Army framework for driver licensing consists of three phases of training.⁴ Phase I is comprised of familiarity with regulations, forms, driver technical manuals, and basic driver skills. Phase II covers how to operate a specific tactical vehicle. Phase III is the culminating event that validates training completion prior to the trainee being issued an Army license. New drivers are required to complete all three phases of training when licensed on the first vehicle or piece of equipment. Once an individual has been issued an Army license for any vehicle, Phases II and III are required for each additional vehicle that the individual is to be licensed on.

Master drivers at the battalion level are responsible for program oversight and implementation including tasks such as coordinating classrooms and setting up driving facilities and road courses. License instructors and license examiners at the company level teach the training courses and evaluate written, hands-on, and road tests. Training materials, such as training circulars and training support packages are developed by Army Training and Doctrine Command and are available for licensing instructors to use when developing their program.

- **Marine Corps.** The Marine Corps framework for driver licensing consists of two phases of training. Phase I is comprised of distance learning or classroom instruction of vehicle-specific training modules. Phase II is hands-on training to include supervised “behind-the-wheel” practical application. Applicants who have successfully passed written testing and approved training curriculum (Phase I and II) are eligible for vehicle inspection and basic controls skills testing and road testing. Upon successful completion of the above requirements, an initial license is granted to the applicant.⁵

⁴Army Regulation 600-55, *The Army Driver and Operator Standardization Program (Selection, Training, Testing, and Licensing)* (Sept. 17, 2019).

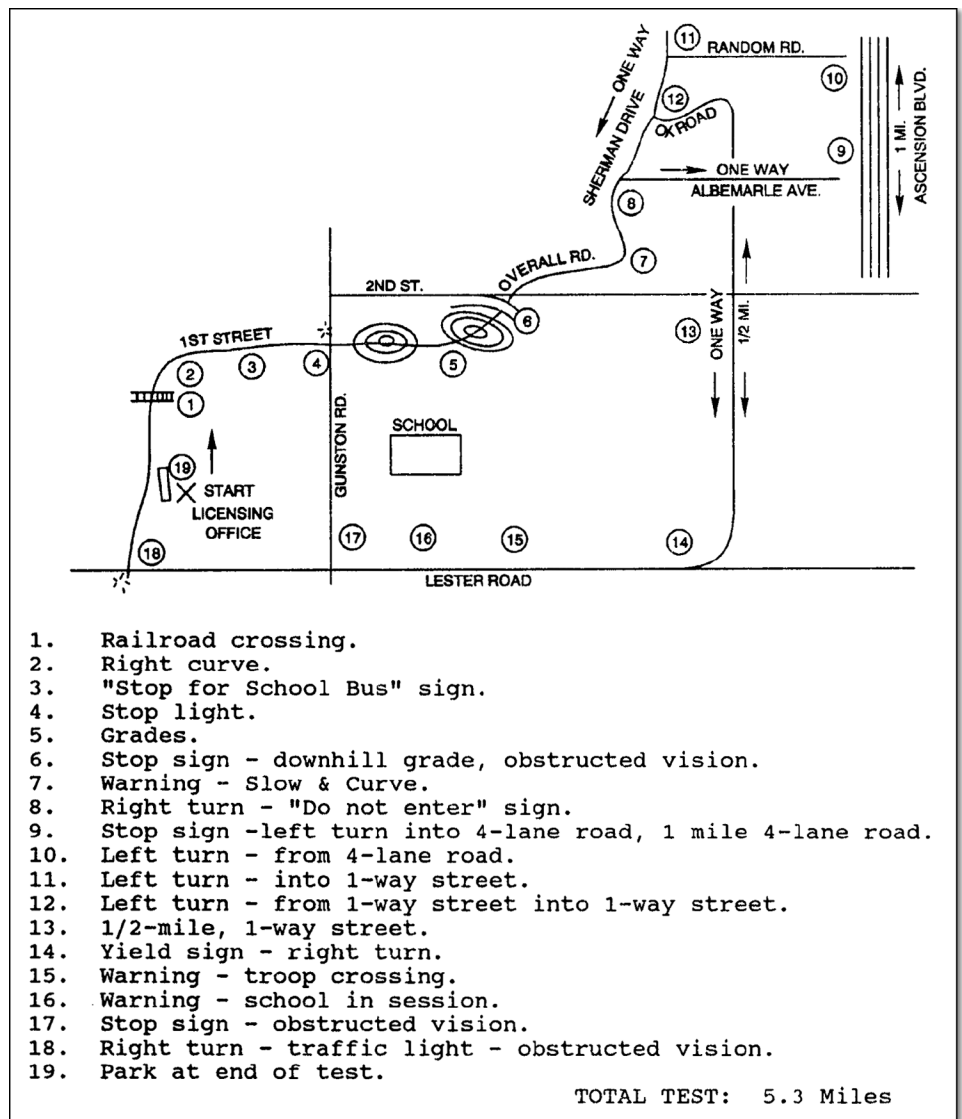
⁵U.S. Marine Corps Technical Manual, TM 11240-15/3H, *Tactical Motor Transport Licensing Official’s Manual* (Jan. 15, 2020).

Drivers of tactical vehicles in the Marine Corps who are not licensed through their military school are considered incidental motor vehicle operators and are trained and licensed through designated operational units. Units with licensing authority designate a licensing officer responsible for the oversight and execution of the licensing program.⁶ Phase I training—the incidental motor vehicle operator course curriculum—is conducted either online or in a classroom, follows a curriculum approved by Training and Education Command, and is intended to follow the Motor Transport Instruction Company military school standards to the greatest extent possible.

The Army and Marine Corps each evaluate practical driving skills prior to issuing a license via two hands-on driving tests. The first test evaluates a potential driver's basic control of the vehicle and is comprised of driving tasks such as straight line backing, offset backing, turning the vehicle and alley docking—e.g. backing the vehicle into a loading dock. The second test is a road test comprised of driving on various road types (i.e., highway and urban streets), and making various types of stops, starts and turns. Each test includes driving over some uphill and downhill grades. Road tests are evaluated on a pass or fail basis, for an example of a road test design from the Marine Corps, see figure 18.

⁶Marine Corps Order 11240.118A, *Licensing Program for Tactical Wheeled Motor Transport Equipment Operators* (July 13, 2020).

Figure 18: Sample Road-Test Driving Course



Source: U.S Marine Corps *Tactical Motor Transport Licensing Official's Manual* (January 15, 2020). | GAO-21-361

Unit follow-on training. Unit commanders are responsible for building drivers' skills through unit follow-on training. This can include driving in and around the motor pool (i.e., parking and maintenance garage areas), conducting administrative missions around the military installation, as well as more demanding scenarios such as during convoys or field exercises.

Annual training requirements for tactical vehicle drivers to maintain a valid license include:

- Annual check rides in the Army that are performed by a supervisor and are intended to incorporate on and off road driving to determine driver proficiency in extreme or unusual conditions. They are also supposed to be conducted on the most complex version of each variant of equipment that a driver is licensed to operate. Licenses are valid up to the same date as the individual's state driver's license expires or 5 years from issue date, whichever is sooner.
- Marine Corps sustainment training is implemented by commanders of licensed drivers. The Marine Corps Licensing Program order leaves these requirements undefined. Licenses are valid for a period of no greater than 8 years from the date of issue.

Appendix III: Army Accidents by Tactical Vehicle from Fiscal Years 2010 through 2019

This appendix provides information on the numbers of tactical vehicle accidents in five classes, based on severity.¹ Table 6 shows all Army tactical vehicle accidents reported in fiscal years 2010 through 2019 by primary vehicle type and accident class.

Table 6: Army Tactical Vehicle Accidents by Primary Vehicle Type and Accident Class in Fiscal Years 2010 through 2019

Vehicle type and accident class	Fiscal year											
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total	
All Terrain Vehicle	A	.	.	.	1	.	1	.	.	.	.	2
	C	8	5	6	1	2	6	7	7	6	2	50
	D	5	6	6	3	.	5	4	1	3	2	35
	E	.	.	.	.	.	2	1	.	1	.	4
	All	13	11	12	5	2	14	12	8	10	4	91
Bradley Fighting Vehicle	A	.	1	.	1	.	1	2	1	.	2	8
	B	.	.	.	1	.	.	2	2	2	.	7
	C	1	.	3	3	15	5	11	10	13	2	63
	D	4	2	4	3	8	3	6	9	5	.	44
	E	.	.	.	.	.	.	.	2	2	1	5
All	5	3	7	8	23	9	21	24	22	5	127	
Carrier (M113)	B	.	.	.	.	.	.	1	.	.	.	1
	C	1	1	1	3	.	3	5	2	5	3	24
	D	1	.	1	2	1	1	3	2	.	1	12
	E	.	.	.	.	6	2	.	.	1	.	9
	All	2	1	2	5	7	6	8	5	6	4	46
Carrier (Other)	A	.	.	.	.	.	.	1	1	.	.	2
	B	.	.	.	.	1	1	2	1	1	2	8
	C	4	1	.	3	3	4	4	6	3	7	35
	D	1	4	1	1	1	2	1	1	.	2	14

¹For the period of our review, the Department of Defense (DOD) defined Class A accidents as the most serious accidents—resulting in death or permanent total disability, destruction of a DOD aircraft, or \$2 million in damages or greater. Class B accidents resulted in permanent partial disability, inpatient hospital care for three or more individuals, or damages of \$500,000 or more, but less than \$2 million. Class C accidents resulted in an injury or illness that caused one or more days away from work or damages of \$50,000 or greater, but less than \$500,000, and Class D accidents involved a recordable injury that did not rise to the level of class A, B, or C or \$20,000 to under \$50,000 in damages. Prior to June 2011, DOD did not have a standard definition for Class D accidents. According to Army officials, the Army Class D threshold for fiscal year 2010 was \$10,000 in damages or a no-lost time injury. Class E was used to signify other reportable accidents or “near-misses,” according to DOD.

Appendix III: Army Accidents by Tactical Vehicle from Fiscal Years 2010 through 2019

Vehicle type and accident class	Fiscal year											Total
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019		
	E	.	.	.	.	.	1	1	2	1	2	7
	All	5	5	1	4	5	8	8	11	6	13	66
Combat Engineer Vehicle	B	.	.	1	.	.	.	.	.	.	.	1
	C	.	.	.	.	.	.	2	.	.	.	2
	D	.	.	.	2	.	.	.	.	.	.	2
	All	.	.	1	2	.	.	2	.	.	.	5
Family of Medium Tactical Vehicles (FMTV)	A	2	1	1	3	3	1	1	3	3	1	19
	B	.	.	1	2	.	2	1	.	1	1	8
	C	11	9	6	14	9	15	14	20	14	20	132
	D	20	19	15	28	17	12	11	6	14	5	147
	E	.	.	.	.	14	26	23	11	14	13	101
	All	33	29	23	47	43	56	50	40	46	40	407
Heavy Equipment Transporter	A	1	.	1	.	.	.	.	.	.	.	2
	B	.	.	.	2	.	.	.	.	.	.	2
	C	4	.	1	.	3	1	3	2	1	.	15
	D	6	4	1	1	.	2	1	2	.	.	17
	E	.	.	.	.	1	.	2	.	.	.	3
	All	11	4	3	3	4	3	6	4	1	.	39
Heavy Expanded Mobility Tactical Truck	A	2	1	1	.	3	.	.	1	2	4	14
	B	1	1	1	2	.	1	.	1	2	2	11
	C	3	5	8	6	7	6	9	7	17	10	78
	D	6	18	20	23	14	10	3	13	8	2	117
	E	.	.	.	.	8	11	12	11	8	4	54
	All	12	25	30	31	32	28	24	33	37	22	274
High Mobility Multipurpose Wheeled Vehicle (HMMWV)	A	7	3	4	3	5	5	2	5	3	5	42
	B	3	1	2	.	4	2	4	7	3	3	29
	C	35	30	18	13	22	33	37	37	40	35	300
	D	72	51	45	70	44	32	27	12	12	7	372
	E	.	.	.	1	23	23	25	9	17	9	107
	All	117	85	69	87	98	95	95	70	75	59	850
Joint Light Tactical Vehicle	C	1	.	.	.	.	.	.	.	.	.	1
	All	1	.	.	.	.	.	.	.	.	.	1
Mine Resistant Ambush Protected (MRAP)	A	6	8	6	1	.	1	.	.	1	.	23
	B	15	5	3	7	1	.	.	1	.	1	33
	C	31	54	51	19	6	1	3	3	5	1	174
	D	32	35	67	19	4	3	4	1	2	.	167

**Appendix III: Army Accidents by Tactical
Vehicle from Fiscal Years 2010 through 2019**

Vehicle type and accident class	Fiscal year											Total
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019		
	E	.	.	.	.	1	4	1	4	.	1	11
	All	84	102	127	46	12	9	8	9	8	3	408
Other tactical trucks (5 tons and over)	A	1	.	1	.	.	.	1	.	.	.	3
	C	5	5	5	1	1	1	1	.	1	2	22
	D	15	9	8	15	1	2	3	1	1	.	55
	E	.	.	.	.	4	1	5	5	4	1	20
	All	21	14	14	16	6	4	10	6	6	3	100
Other tactical trucks (Less than 5 tons)	C	.	.	.	.	.	.	.	.	.	1	1
	D	1	1	1	2	.	.	.	.	.	.	5
	E	.	.	.	.	.	.	2	.	1	.	3
	All	1	1	1	2	.	.	2	.	1	1	9
Other, tactical	A	2	.	.	.	1	.	.	1	.	.	4
	B	.	.	.	.	.	1	1	1	.	1	4
	C	4	2	4	4	4	3	2	7	7	5	42
	D	5	5	6	12	5	3	2	2	1	1	42
	E	.	.	.	.	2	3	5	5	5	1	21
	All	11	7	10	16	12	10	10	16	13	8	113
Palletized Load System	A	.	1	.	.	.	.	.	.	.	.	1
	B	.	.	.	.	.	1	.	.	.	.	1
	C	8	1	1	.	3	3	3	2	2	1	24
	D	2	3	9	5	1	3	.	1	.	.	24
	E	.	.	.	.	1	4	4	.	1	1	11
	All	10	5	10	5	5	11	7	3	3	2	61
Stryker	A	3	.	2	3	3	2	.	3	3	3	22
	B	.	.	.	.	.	4	.	3	4	.	11
	C	7	12	5	4	7	12	15	10	2	10	84
	D	10	15	.	4	8	2	2	3	.	1	45
	E	.	.	.	.	3	4	2	1	3	6	19
	All	20	27	7	11	21	24	19	20	12	20	181
Tactical Trailers	A	1	.	.	.	.	.	.	.	.	.	1
	B	.	.	.	.	.	.	1	.	.	.	1
	C	1	.	11	6	4	1	2	2	7	5	39
	D	9	11	13	23	5	4	1	3	2	1	72
	E	.	.	.	1	8	3	9	2	4	7	34
	All	11	11	24	30	17	8	13	7	13	13	147
Tank	A	.	1	.	.	.	.	1	1	1	2	6

**Appendix III: Army Accidents by Tactical
Vehicle from Fiscal Years 2010 through 2019**

Vehicle type and accident class	Fiscal year										Total
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
B	.	.	1	2	.	1	.	1	5	3	13
C	1	1	4	2	10	8	6	9	4	6	51
D	4	3	4	6	4	7	3	8	1	.	40
E	.	.	.	.	2	2	1	2	1	1	9
All	5	5	9	10	16	18	11	21	12	12	119
Vehicle Track Recovery											
A	.	.	.	.	.	.	.	.	3	1	4
B	.	.	.	.	1	.	2	.	2	1	6
C	.	1	.	5	1	1	.	7	3	3	21
D	3	1	.	4	2	1	.	3	.	.	14
E	.	.	.	.	.	.	.	1	1	.	2
All	3	2	.	9	4	2	2	11	9	5	47
Total	365	337	350	337	307	305	308	288	280	214	3091

Source: GAO analysis of Army accident data. | GAO-21-361

Note: For the period of our review, the Department of Defense (DOD) defined Class A accidents as the most serious accidents—resulting in death or permanent total disability, destruction of a DOD aircraft, or \$2 million in damages or greater. Class B accidents resulted in permanent partial disability, inpatient hospital care for three or more individuals, or damages of \$500,000 or more, but less than \$2 million. Class C accidents resulted in an injury or illness that caused one or more days away from work or damages of \$50,000 or greater, but less than \$500,000, and Class D accidents involved a recordable injury that did not rise to the level of class A, B, or C or \$20,000 to under \$50,000 in damages. Prior to June 2011, DOD did not have a standard definition for Class D accidents. According to Army officials, the Army Class D threshold for fiscal year 2010 was \$10,000 in damages or a no-lost time injury. Class E was used to signify other reportable accidents or “near-misses,” according to DOD.

Appendix IV: Marine Corps Accidents by Tactical Vehicle from Fiscal Years 2010 through 2019

This appendix provides information on the numbers of tactical vehicle accidents in five classes, based on severity.¹ Table 7 shows all Marine Corps tactical vehicle accidents reported in fiscal years 2010 through 2019 by primary vehicle type and accident class.

Table 7: Marine Corps Tactical Vehicle Accidents by Primary Vehicle Type and Accident Class in Fiscal Years 2010 through 2019

Vehicle type and accident class		Fiscal year										Total
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Assault Amphibious Vehicle (AAV)	A	-	1	1	-	-	-	-	1	-	-	3
	B	-	1	-	-	-	1	-	-	-	1	3
	C	1	2	-	2	1	1	-	1	-	2	10
	D	-	1	1	2	-	-	-	-	-	1	5
	H	-	1	-	-	1	1	-	-	1	1	5
	All	1	6	2	4	2	3	-	2	1	5	26
All Terrain Vehicle	A	-	-	-	-	-	-	1	-	-	1	2
	B	-	-	-	2	-	-	-	-	-	-	2
	C	1	-	1	3	2	1	-	1	3	1	13
	D	-	-	-	1	1	-	-	-	-	-	2
	H	-	-	1	-	-	-	2	2	-	1	6
	All	1	-	2	6	3	1	3	3	3	3	25
High Mobility Multipurpose Wheeled Vehicle (HMMWV)	A	1	-	1	2	-	-	-	-	-	1	5
	B	1	-	-	-	1	-	-	-	-	-	2
	C	11	10	8	6	2	4	2	3	1	8	55
	D	11	2	1	3	4	3	1	2	2	5	34
	H	-	2	6	24	9	7	6	4	6	7	71
	All	24	14	16	35	16	14	9	9	9	21	167
Joint Light Tactical Vehicle	H	-	-	-	-	-	-	-	1	-	1	

¹For the period of our review, the Department of Defense (DOD) defined Class A accidents as the most serious accidents—resulting in death or permanent total disability, destruction of a DOD aircraft, or \$2 million in damages or greater. Class B accidents resulted in permanent partial disability, inpatient hospital care for three or more individuals, or damages of \$500,000 or more, but less than \$2 million. Class C accidents resulted in an injury or illness that caused one or more days away from work or damages of \$50,000 or greater, but less than \$500,000, and Class D accidents involved a recordable injury that did not rise to the level of class A, B, or C or \$20,000 to under \$50,000 in damages. Prior to June 2011, DOD did not have a standard definition for Class D accidents. For fiscal year 2010, Navy officials told us they treated every reported accident that did not meet the Class C threshold as a Class D accident. Class H was used to signify other reportable accidents or “near-misses,” according to DOD.

**Appendix IV: Marine Corps Accidents by
Tactical Vehicle from Fiscal Years 2010
through 2019**

Vehicle type and accident class		Fiscal year										Total
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
	All	-	-	-	-	-	-	-	-	1	-	1
Light Armored Vehicle (LAV)	A	-	1	-	-	-	1	-	-	-	1	3
	C	-	1	-	1	1	-	2	2	2	-	9
	D	-	-	-	1	2	-	-	2	2	-	7
	H	-	-	-	-	-	1	-	1	1	-	3
	All	-	2	-	2	3	2	2	5	5	1	22
Logistics Vehicle System Replacement (LVSR)	B	-	-	1	-	-	-	-	-	-	1	2
	C	-	1	1	2	-	-	-	-	1	-	5
	D	7	2	-	-	1	1	-	-	1	2	14
	H	-	1	1	13	7	6	7	3	2	4	44
	All	7	4	3	15	8	7	7	3	4	7	65
Mine Resistant Ambush Protected (MRAP)	A	3	1	2	-	-	-	-	-	-	-	6
	B	1	-	2	-	1	1	-	-	-	-	5
	C	8	6	8	4	2	-	-	-	1	-	29
	D	6	3	7	2	-	-	-	1	1	2	22
	H	-	-	5	3	-	-	-	-	1	1	10
	All	18	10	24	9	3	1	-	1	3	3	72
Medium Tactical Vehicle Replacement (MTVR)	A	-	1	1	-	1	2	1	1	-	-	7
	B	1	-	-	-	-	-	-	-	2	-	3
	C	13	11	4	3	1	5	1	6	3	5	52
	D	7	3	1	2	2	1	2	4	3	2	27
	H	-	7	10	22	8	10	5	3	8	11	84
	All	21	22	16	27	12	18	9	14	16	18	173
Other, Tactical	B	-	-	-	-	1	-	-	-	-	-	1
	C	1	1	1	-	1	-	1	-	-	-	5
	H	-	-	-	-	-	-	-	-	1	-	1
	All	1	1	1	-	2	-	1	-	1	-	7
Recovery Vehicle	A	-	-	1	-	-	-	-	-	-	-	1
	B	-	2	-	-	-	-	1	-	1	-	4
	C	-	-	-	-	-	1	-	-	-	-	1
	H	-	-	-	-	-	-	-	-	1	-	1
	All	-	2	1	-	-	1	1	-	2	-	7
Support/Construction	C	-	3	2	-	2	1	2	2	-	2	14
	D	-	-	-	2	3	2	1	-	-	2	10
	H	-	-	-	1	1	3	4	4	3	8	24
	All	-	3	2	3	6	6	7	6	3	12	48

**Appendix IV: Marine Corps Accidents by
Tactical Vehicle from Fiscal Years 2010
through 2019**

Vehicle type and accident class		Fiscal year										
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Tank	B	-	-	-	-	-	-	-	2	-	-	2
	C	-	-	-	1	-	-	-	1	1	-	3
	D	-	1	-	-	2	2	-	-	-	-	5
	H	-	-	1	-	-	1	-	1	-	-	3
	All	-	1	1	1	2	3	-	4	1	-	13
Truck/Trailer	A	-	-	-	1	-	-	-	-	-	-	1
	C	1	-	-	1	-	-	1	1	3	-	7
	D	1	2	-	1	-	-	-	2	1	2	9
	H	-	-	-	2	-	1	-	1	1	4	9
	All	2	2	-	5	-	1	1	4	5	6	26
Unknown	A	-	-	-	1	-	-	-	-	-	-	1
	C	1	-	-	1	1	2	-	-	1	-	6
	D	-	-	-	1	1	-	-	-	-	-	2
	H	-	-	-	-	-	-	-	-	1	-	1
	All	1	-	-	3	2	2	-	-	2	-	10
Total	76	67	68	110	59	59	40	51	56	76	662	

Source: GAO analysis of Marine Corps accident data. | GAO-21-361

Note: For the period of our review, the Department of Defense (DOD) defined Class A accidents as the most serious accidents—resulting in death or permanent total disability, destruction of a DOD aircraft, or \$2 million in damages or greater. Class B accidents resulted in permanent partial disability, inpatient hospital care for three or more individuals, or damages of \$500,000 or more, but less than \$2 million. Class C accidents resulted in an injury or illness that caused one or more days away from work or damages of \$50,000 or greater, but less than \$500,000, and Class D accidents involved a recordable injury that did not rise to the level of class A, B, or C or \$20,000 to under \$50,000 in damages. Prior to June 2011, DOD did not have a standard definition for Class D accidents. For fiscal year 2010, Navy officials told us they treated every reported accident that did not meet the Class C threshold as a Class D accident. Class H was used to signify other reportable accidents or “near-misses,” according to DOD.

Appendix V: Percent of Army and Marine Corps Accidents Involving Rollovers, by Select Characteristics, Fiscal Years 2010 through 2019

This appendix provides information on the numbers of tactical vehicle accidents and rollovers organized by all classes of accidents, Class A and B accidents, and accidents with military deaths.¹ Table 8 shows this information for all Army and Marine Corps tactical vehicle accidents reported in fiscal years 2010 through 2019 as well as the percent of each category that involved a rollover.²

Table 8: Percent of All Accidents, Class A and B Accidents, and Accidents with Military Deaths That Involved a Rollover, Fiscal Years 2010 through 2019

Military service and accident type	All accidents	Accidents involving rollovers	Percent involving rollovers
Army - All Classes	3091	726	23
Army - Class A and B	289	119	41
Army - Accidents with Military Deaths	84	53	63
Marine Corps - All Classes	662	170	26
Marine Corps - Class A and B	53	21	40
Marine Corps - Accidents with Military Deaths	20	13	65
Total - All Classes	3753	896	24
Total - Class A and B	342	140	41
Total - Accidents with Deaths	104	66	63

Source: GAO analysis of Army and Marine Corps accident data. | GAO-21-361

Note: For the period of our review, the Department of Defense (DOD) defined Class A accidents as the most serious accidents—resulting in death or permanent total disability, destruction of a DOD aircraft, or \$2 million in damages or greater. Class B accidents resulted in permanent partial disability, inpatient hospital care for three or more individuals, or damages of \$500,000 or more, but less than \$2 million.

¹For the period of our review, the Department of Defense (DOD) defined Class A accidents as the most serious accidents—resulting in death or permanent total disability, destruction of a DOD aircraft, or \$2 million in damages or greater. Class B accidents resulted in permanent partial disability, inpatient hospital care for three or more individuals, or damages of \$500,000 or more, but less than \$2 million.

²For the purposes of this report, a vehicle “rollover” is any accident that causes the tactical vehicle to come into contact with the ground on any of its surfaces outside of its wheels or tracks.

Appendix VI: Army and Marine Corps Class A and B Accidents by Country, Fiscal Years 2010 through 2019

This appendix provides information on the countries in which Army and Marine Corps Class A and B tactical vehicle accidents took place in fiscal years 2010 through 2019.¹ We excluded damages and injuries that occurred during contact with enemy combatants from our analysis, because, according to DOD's definition, they are not accidents. Table 9 shows the Army Class A and B accidents broken down by the country they occurred in for fiscal years 2010 through 2019.

Table 9: Army Class A and B Tactical Vehicle Accidents by Country, Fiscal Years 2010 through 2019

Country	Fiscal year										Total
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
United States	3	5	8	15	18	21	16	22	33	27	168
Afghanistan	11	12	12	10	1	0	0	0	1	1	48
Canada	0	0	0	0	0	0	0	1	0	0	1
Djibouti	0	0	0	0	1	0	0	0	0	0	1
Georgia	0	0	0	0	0	0	0	1	0	0	1
Germany	1	0	1	1	1	1	1	4	1	3	14
Iraq	24	5	1	0	0	0	1	1	0	0	32
Jordan	0	0	0	0	0	1	0	0	0	0	1
South Korea	1	0	1	1	1	0	2	2	0	0	8
Kuwait	4	1	2	1	0	1	0	3	0	1	13
Lithuania	0	0	0	0	0	0	0	0	1	0	1
Slovakia	0	0	0	0	0	0	0	0	1	0	1
Total	44	23	25	28	22	24	20	34	37	32	289

Source: GAO analysis of Army accident data. | GAO-21-361

Note: For the period of our review, the Department of Defense (DOD) defined Class A accidents as the most serious accidents—resulting in death or permanent total disability, destruction of a DOD aircraft, or \$2 million in damages or greater. Class B accidents resulted in permanent partial disability, inpatient hospital care for three or more individuals, or damages of \$500,000 or more, but less than \$2 million.

Table 10 shows the Marine Corps Class A and B accidents broken down by the country they occurred in for fiscal years 2010 through 2019.

¹For the period of our review, the Department of Defense (DOD) defined Class A accidents as the most serious accidents—resulting in death or permanent total disability, destruction of a DOD aircraft, or \$2 million in damages or greater. Class B accidents resulted in permanent partial disability, inpatient hospital care for three or more individuals, or damages of \$500,000 or more, but less than \$2 million.

**Appendix VI: Army and Marine Corps Class A
and B Accidents by Country, Fiscal Years 2010
through 2019**

Table 10: Marine Corps Class A and B Tactical Vehicle Accidents by Country, Fiscal Years 2010 through 2019

Country	Fiscal year										Total
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Not reported	0	0	1	1	1	1	1	2	0	0	7
United States	3	5	2	4	2	4	2	2	3	4	31
Afghanistan	4	2	6	1	1	0	0	0	0	0	14
Australia	0	0	0	0	0	0	0	0	0	1	1
Total	7	7	9	6	4	5	3	4	3	5	53

Source: GAO analysis of Marine Corps accident data. | GAO-21-361

Note: For the period of our review, the Department of Defense (DOD) defined Class A accidents as the most serious accidents—resulting in death or permanent total disability, destruction of a DOD aircraft, or \$2 million in damages or greater. Class B accidents resulted in permanent partial disability, inpatient hospital care for three or more individuals, or damages of \$500,000 or more, but less than \$2 million.

Appendix VII: Comments from the Department of Defense



OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

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

Dear Mr. Russell:

This is the Department of Defense (DoD) response to the GAO Draft Report, GAO-21-361, 'MILITARY VEHICLES: Army and Marine Corps Should Take Additional Actions to Mitigate and Prevent Training Accidents,' dated May 4, 2021 (GAO Code 103877).

The Department appreciates the opportunity to comment on the draft report. We concur with the recommendations and the Department's comments are attached.

The point of contact for this effort is Mr. R.J. Jimenez, who can be reached at 571-292-7417, or ricardo.jjimenez2.civ@mail.mil.

Sincerely,



Thomas A. Constable
Acting Assistant Secretary of Defense for
Readiness

Attachment:
As stated

GAO DRAFT REPORT DATED MAY 4, 2021
GAO-21-361 (GAO CODE 103877)

**“MILITARY VEHICLES: ARMY AND MARINE CORPS SHOULD TAKE
ADDITIONAL ACTIONS TO MITIGATE AND PREVENT TRAINING ACCIDENTS”**

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

RECOMMENDATION 1: The Secretary of the Army, in consultation with the Chief of Staff of the Army should ensure that the Army develop more clearly defined roles for vehicle commanders and establish mechanisms and procedures for tactical vehicle risk management to be used by first-line supervisors such as vehicle commanders.

DoD RESPONSE: Concur. The Army will develop requirements for vehicle commander qualifications to ensure Soldiers assigned these responsibilities are aware of their duties to ensure safe operations of the vehicle and management of risks. The Army continuously works to ensure integration of risk management at all levels and the procedures for the management of risk already exists. The Army will continue our efforts to include risk management training in all levels of professional development and will develop tools and techniques to assist junior leaders and vehicle commanders in dynamic risk management efforts in the field.

RECOMMENDATION 2: The Secretary of the Navy, in consultation with the Commandant of the Marine Corps, should ensure that the Marine Corps develop more clearly defined roles for vehicle commanders and establish mechanisms and procedures for tactical vehicle risk management to be used by first-line supervisors such as vehicle commanders.

DoD RESPONSE: Concur. Marine Corps Order 5100.29C, Marine Corps Safety Management System, Volume 2, Risk Management, requires risk management assessments of all operations, work-tasks conducted, to include tactical vehicle operation and movements. To facilitate the risk management process, the Marine Corps adopted the Joint Risk Assessment Tool that enables leaders to complete risk assessment worksheets and gain approval through electronic means. Two important measures commands and units can implement to ensure the safety of its personnel are: (1) ensure assigned missions and tasks are based on actual capabilities and capacities and (2) confirm units are properly resourced with the required number of skilled personnel, equipment and time to safely execute those assigned tasks. Ideally, all units will be appropriately staffed, trained and equipped prior to the beginning of pre work-up training.

RECOMMENDATION 3: The Secretary of the Army, in consultation with the Chief of Staff of the Army, should evaluate the number of personnel within operational units who are responsible for tactical vehicle safety and determine if these units are appropriately staffed, or if any adjustments are needed to workloads or resource levels to implement operational unit ground-safety programs.

DoD RESPONSE: Concur. The Army will evaluate operational unit tactical vehicle safety manpower levels and determine whether workload or resourcing adjustments are required to implement operational unit ground safety programs.

RECOMMENDATION 4: The Secretary of the Navy, in consultation with the Commandant of the Marine Corps, should evaluate the number of personnel within operational units who are responsible for tactical vehicle safety and determine if these units are appropriately staffed or if any adjustments are needed to workloads or resource levels to implement operational unit ground-safety programs.

DoD RESPONSE: Concur. The majority of personnel assigned safety cadre duties within the various elements of a Marine Air-Ground Task Force are uniformed service members who serve in collateral or additional duty roles and typically receive 80-hours of specialized safety and occupational health training. Moreover, the collateral or additional duty nature of safety billets, coupled with the demands of regular full-time assignments, allows little time for proactive safety management measures. The GAO report mentions that one Marine serving in a collateral or additional duty safety billet reported he was unable to dedicate more than a single hour each day towards safety duties. As such, the Marine Corps Safety Division will be leading an effort to rationalize the full-time Safety & Occupational Workforce (military and civilian) to better understand where safety specialists are currently assigned and working and also where unidentified, uncontrolled hazards and risk are present in the absence of skilled full-time safety and occupational health specialists.

RECOMMENDATION 5: The Secretary of the Army, in consultation with the Chief of Staff of the Army, should ensure that tactical vehicle driver training programs—to include licensing, unit, and follow-on training—have a well-defined process with specific performance criteria and measureable standards to identify driver skills and experience under diverse conditions.

DoD RESPONSE: Concur. The Army has a well-defined driver's training program codified in Army Regulation (AR) 600-55, The Army Driver and Operator Standardization Program (Selection, Training, Testing, and Licensing). The Army's framework for driver licensing consists of three phases: phase I is comprised of familiarity with regulations, forms, driver technical manuals, and basic driver skills; phase II covers how to operate a specific vehicle; and phase III is the culminating event that validates training completion prior to issuing an Army driver's license. In addition to the three-phased training program, AR 600-55 requires annual sustainment training, reception of reassigned operators, license renewal requirements, and driving with night vision devices. This multi-phase approach to driver's training contains many measurable standards and performance criteria to ensure a driver is properly trained prior to and after receiving an Army driver's license.

RECOMMENDATION 6: The Secretary of the Navy, in consultation with the Commandant of the Marine Corps, should ensure that tactical vehicle driver training programs—to include licensing, unit, and follow-on training—have a well-defined process with specific performance criteria and measureable standards to identify driver skills and experience under diverse conditions.

DoD RESPONSE: Concur. The Marine Corps has, and executes, tactical vehicle driver training programs-to include formal licensing, formal school instruction and training, and follow-on, managed-on-the-job training. The Marine Corps has a well-defined process, with specific performance criteria, and measurable standards. The Marine Corps will continue to review and refine training standards per the process outlined in NAVMC 3500.106A Ground Training and Readiness Program. The Marine Corps recently updated the Motor Transport Training and Readiness Manual in 2019 and increased the number of driving specific events from two to ten. These new driving events provide additional requirements and standards, to include operating vehicles in varied terrain and driving in limited visibility conditions.

RECOMMENDATION 7: The Secretary of the Army, in consultation with the Chief of Staff of the Army, should ensure that the Army evaluate the extent to which its ranges and training areas are fulfilling responsibilities to identify and communicate hazards to units. If the responsibilities are not being carried out, the Army should determine if existing workarounds are adequate or if additional resources should be applied to fulfill these responsibilities.

DoD RESPONSE: Concur. The Army will publish an Execution Order requiring training ranges that conduct tactical vehicles driver training to incorporate the GAO's recommendations into applicable training instructions and field manuals. The Army is in the process of reviewing Range Safety policy and will ensure that Range Safety Risk Management processes and procedures implement appropriate controls to identify, address and communicate range hazards. The Army will evaluate the Army's ranges and training areas to ensure inspections are completed, and to ensure hazards are identified and communicated to units that use the tactical vehicles' training ranges. The Army will evaluate current levels of resources and determine if current resources are adequate or if additional resources are needed to fulfill these risk management responsibilities.

RECOMMENDATION 8: The Secretary of the Navy, in consultation with the Commandant of the Marine Corps, should ensure that the Marine Corps evaluate the extent to which its ranges and training areas are fulfilling responsibilities to identify and communicate hazards to units. If the responsibilities are not being carried out, the Marine Corps should determine if existing workarounds are adequate or if additional resources should be applied to fulfill these responsibilities.

DoD RESPONSE: Concur. Marine Corps Order 3550.9 (range certification/recertification) tasks Commanding General (CG) Training and Education Command (TECOM) with the certification of base / station / installation range control equipment, facilities, operations, and organization every three years. As part of the certification process CG TECOM certifiers are to perform a certification of the installation range control utilizing the Range Control Operations checklist. TECOM Range and Training Area Management (RTAM), as the range certification process manager, will add a checklist item to MCO 3550.9 that states "Is the installation range control communicating hazards in the ranges and training areas to the Range Officer In Charge (OIC) and Range Safety Officer." In addition, MCO 3570.1 (range safety) will clarify the requirement to communicate hazards to units under the Installation Range Control Officer responsibilities (para 1-9,c,9). There are adequate resources available to promulgate current range and training area hazards to range OICs and range safety officers.

**Appendix VII: Comments from the Department
of Defense**

4

RECOMMENDATION 9: The Secretary of the Army, in consultation with the Chief of Staff of the Army, and the Secretary of the Navy, in consultation with the Commandant of the Marine Corps, should establish a formal collaboration forum among Army and Marine Corps range officials that allows them to share methods for identifying and communicating hazards to units with each other on a regular basis.

DoD RESPONSE: Concur. The Army and Marine Corps have quarterly Range Safety Working Group (RSWG) meetings to plan, develop, organize, coordinate, review, and oversee the Department of the Army and U.S. Marine Corps Range Safety programs. During these meetings, the RSWG develops and coordinates Army and Marine Corps range safety policy, procedures, and strategies to resolve range safety hazards. The RSWG also develops, coordinates, and plans the execution of Army and Marine Corps range safety training curricula.

Appendix VIII: GAO Contact and Staff Acknowledgments

GAO Contact

Cary Russell, (202) 512-5431 or russellc@gao.gov.

Staff Acknowledgments

In addition to the contact named above, Matthew Ullengren (Assistant Director), Courtney Bond, William Carpluk, Charles Culverwell, Christopher Gezon, Alexandra Gonzalez, Cynthia Grant, Randy Neice, Patrick Netherclift, Clarice Ransom, Terry Richardson, and Kimberly Schuster made key contributions to this report.

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