

June 2006

# DEFENSE LOGISTICS

## Lack of a Synchronized Approach between the Marine Corps and Army Affected the Timely Production and Installation of Marine Corps Truck Armor



# Report Documentation Page

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Highlights of [GAO-06-274](#), a report to congressional committees

## Why GAO Did This Study

The increasing threat of improvised explosive devices (IED) in Iraq has led to widespread interest by Congress and the public regarding the availability of critical force protection equipment. GAO initiated a series of engagements under the Comptroller General's authority to address these concerns. In March 2006, GAO reported on factors that affected the production and installation of armor for the Army's medium and heavy trucks. This engagement examines issues affecting the production and installation of armor for the Marine Corps' medium and heavy trucks. The objectives were to (1) determine the extent to which truck armor was produced and installed to meet identified requirements, (2) identify what factors affected the time to provide truck armor, and (3) identify what actions the Marine Corps and DOD have taken to improve the timely availability of truck armor.

## What GAO Recommends

GAO is recommending that DOD (1) establish a process for sharing information on developing materiel solutions and (2) clarify the point at which the joint requirements process should be utilized. DOD concurred with the second recommendation but believes communication is sufficient to satisfy the first recommendation. GAO disagrees. DOD also provided comments related to the context and accuracy of the report, which we incorporated as appropriate.

[www.gao.gov/cgi-bin/getrpt?GAO-06-274](http://www.gao.gov/cgi-bin/getrpt?GAO-06-274).

To view the full product, including the scope and methodology, click on the link above. For more information, contact William M. Solis at (202) 512-8365 or [solisw@gao.gov](mailto:solisw@gao.gov).

## DEFENSE LOGISTICS

# Lack of a Synchronized Approach between the Marine Corps and Army Affected the Timely Production and Installation of Marine Corps Truck Armor

## What GAO Found

The Marine Corps met its requirements for the production and installation of add-on truck armor in September 2004—8 months after the requirements were identified in January 2004. In addressing its truck armor requirements, the Marine Corps used a three-phased approach. In the first phase, the Marine Corps validated its initial requirement in January 2004 to armor 1,169 trucks for protection against IEDs and other similar threats. Due to the immediacy of the need to deploy forces to Iraq by March 2004, the Marine Corps installed interim armor that did not provide sufficient IED protection, which Marine Corps officials acknowledged, stating that their intent was to field some level of protection until a more robust armor solution became available. In the second phase, the Marine Corps increased its armor requirement to 1,438 trucks in April 2004 and fully met that requirement in September 2004 with armor that provided enhanced IED protection. In the third phase, the Marine Corps is upgrading to integrated armor for its 7-ton trucks, which provides improved protection because the armor is built into the body of the vehicle. They expect to complete installation by May 2006.

Two factors affected the timely production and installation of Marine Corps truck armor. First, a lack of a synchronized approach between the Marine Corps and the Army on addressing truck armor requirements and solutions resulted in the Marine Corps identifying its truck armor requirements and seeking armor solutions 2 months after the Army. Consequently, this delay may have limited the Marine Corps' ability to field interim armor that met IED protection requirements in the first phase, and may have contributed to the time to provide add-on truck armor to deployed Marine Corps forces in the second phase. The Marine Corps did not officially identify a requirement for truck armor and did not begin seeking out armor materials from industry until January 2004—2 months after the Army began its truck armor program in November 2003. According to Marine Corps officials, the armor-grade steel needed for sufficient IED protection was not available from suppliers in time to meet the Marine Corps' deployment timeline of March 2004. As a result, the Marine Corps fielded the interim armor with only limited IED protection. Second, mission needs restricted the rate at which the Marine Corps could replace its interim armor with add-on armor and install integrated armor.

The Marine Corps and DOD have taken actions to improve the timely availability of truck armor and other critical wartime equipment. For example, the Marine Corps increased the rate of installation for integrated armor by expanding its armor installation capacity. The Marine Corps is also taking longer-term actions, such as developing a plan to address the availability of truck armor for future operations. In addition, DOD established a joint requirements process to improve coordination and accelerate the process of fielding urgent wartime solutions. However, it is unclear whether this process applies to urgent wartime needs such as armor because it excludes the development of new technology solutions.

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United States Government Accountability Office  
Washington, DC 20548

June 22, 2006

The Honorable John Warner  
Chairman  
The Honorable Carl Levin  
Ranking Minority Member  
Committee on Armed Services  
United States Senate

The Honorable Duncan L. Hunter  
Chairman  
The Honorable Ike Skelton  
Ranking Minority Member  
Committee on Armed Services  
House of Representatives

When combat operations were declared over during Operation Iraqi Freedom (OIF), U.S. and coalition forces transitioned to stabilization operations to restore public order and infrastructure in Iraq. Since that time, U.S. forces have come under frequent and deadly attacks from insurgents using a variety of weapons— including improvised explosive devices (IED), mortars, and rocket launchers—and there have been numerous attacks on military convoys as they carry supplies and equipment throughout the region. The threat of IEDs, in particular, has become increasingly frequent and has been ranked as the number one killer of U.S. troops in Iraq. The explosives used in IEDs consist mainly of dynamite, land mines, old artillery shells, or other types of military ordnance. Many IEDs are hidden and disguised along traffic routes, and are remotely detonated against unsuspecting military personnel.

As a result of experiences in Iraq, the Department of Defense (DOD) and the services have taken several immediate steps to improve the protection of military forces operating in the region. Among these is the fielding of new capabilities to counter emerging threats encountered in Iraq, to include such improvements as add-on and integrated armor for trucks, body armor, and systems for detecting and defeating IEDs.

In response to increasing widespread interest by Congress and the public regarding the availability of critical force protection equipment for deployed troops, such as body armor and armor for high-mobility multipurpose wheeled vehicles (HMMWV) and other vehicles, we initiated

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a series of engagements under the authority of the Comptroller General of the United States to examine this issue. In April 2005 we reported on shortages of a number of critical items during OIF, to include certain protective items such as body armor and armored HMMWVs.<sup>1</sup> We identified a number of systemic causes for these shortages, including inaccurate requirements, delayed funding, and ineffective distribution processes. As a result, we made several recommendations to the Secretary of Defense calling for actions, such as ensuring the accuracy of Army war reserve requirements and developing and exercising deployable distribution capabilities, to improve DOD's system for supplying items to U.S. forces. In March 2006, we reported on several factors that affected the production and installation of Army truck armor during OIF and other current wartime operations.<sup>2</sup> These factors included the Army's failure to fully capitalize on previously identified truck armor requirements and awarding contracts for amounts less than total requirements due to increasing needs for truck armor and inadequate funding. In our report, we made a recommendation to the Secretary of Defense calling for the Army to establish a process for documenting and communicating all urgent wartime funding requirements for supplies and equipment when they are identified and the disposition of funding decisions.

This current engagement examines issues affecting the production and installation of armor for medium and heavy trucks used by Marine Corps forces during OIF and other ongoing operations in the U.S. Central Command (CENTCOM) area of responsibility.<sup>3</sup> Our objectives were to (1) determine the extent to which Marine Corps truck armor was produced and installed to meet identified requirements, (2) identify what factors affected the time to provide truck armor, and (3) identify what actions the Marine Corps and DOD have taken to improve the timely availability of truck armor.

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<sup>1</sup> GAO, *Defense Logistics: Actions Needed to Improve the Availability of Critical Items during Current and Future Operations*, [GAO-05-275](#) (Washington, D.C.: Apr. 8, 2005).

<sup>2</sup> GAO, *Defense Logistics: Several Factors Limited the Procurement and Installation of Army Truck Armor During Current Wartime Operations*, [GAO-06-160](#) (Washington D.C.: Mar. 22, 2006).

<sup>3</sup> CENTCOM is one of DOD's five geographic combatant commands, whose area of responsibility encompasses 27 countries in Southwest Asia, South and Central Asia, and the Horn of Africa. In addition to Operation Iraqi Freedom, CENTCOM is involved in Operation Enduring Freedom in Afghanistan. The other four geographic combatant commands are U.S. European Command, U.S. Pacific Command, U.S. Southern Command, and U.S. Northern Command.

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In conducting this review, we focused on medium and heavy tactical trucks used by Marine Corps forces in the CENTCOM area of responsibility, which included those in Iraq and Afghanistan.<sup>4</sup> To identify the extent to which truck armor was produced and installed to meet identified requirements and what factors affected the time to provide armor, we visited Marine Corps organizations to obtain data on the requirements, funding, production, and installation of truck armor kits. We considered the armor requirement as met for each type of truck when the quantity of add-on and integrated armor produced and installed on vehicles equaled the requirement. Based on the information gathered, we identified factors that affected the time to provide truck armor to deployed forces. We also identified the Marine Corps' short-term and long-term efforts to improve the availability of truck armor. We assessed the reliability of the data we obtained and determined that they were sufficiently reliable for the purposes of this report. We performed our review from April 2005 to March 2006 in accordance with generally accepted government auditing standards. A more detailed discussion of our scope and methodology is located in appendix I.

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## Results in Brief

The Marine Corps met its requirements for the production and installation of add-on truck armor in September 2004—8 months after that requirement was identified in January 2004. In addressing its truck armor requirements, the Marine Corps used a three-phased approach. In the first phase, the Marine Corps validated its initial requirement in January 2004 to armor 1,169 trucks for protection against IEDs and other similar threats. Due to the immediacy of the need to deploy forces to Iraq by March 2004, the Marine Corps addressed this initial requirement by installing interim armor on all 1,169 trucks. However, the interim armor did not meet requirements because it did not provide sufficient protection from the fragmentation effects of IEDs. Marine Corps officials acknowledged that the interim armor provided protection against the prevalent ballistic threat at the time but offered only limited protection against IEDs. These officials stated that their intent was to field some level of protection until a more robust armor solution became available. In the second phase, the Marine Corps increased its armor requirement to 1,438 trucks in April 2004 and

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<sup>4</sup>The Marine Corps also developed armor for HMMWVs, a light tactical wheeled vehicle. We examined availability of armor for HMMWVs in our prior report on wartime supply availability, so we did not include them in this review. See GAO, *Defense Logistics: Actions Needed to Improve the Availability of Critical Items during Current and Future Operations*, GAO-05-275 (Washington, D.C.: Apr. 8, 2005).

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fully met that requirement in September 2004 with add-on armor that provided the required IED protection. In the third phase, the Marine Corps is upgrading armor protection from add-on armor to integrated armor for 900 7-ton trucks in Iraq and Afghanistan, which were included in the 1,438 trucks armored in the second phase. As of March 2006, 803 integrated armor kits have been installed, and the Marine Corps expects to complete installation of integrated armor by May 2006. The other trucks (5-ton truck and 22-ton bulk hauler) are not receiving integrated armor because they are at the end of their economic life cycle and will be replaced.

Two factors affected the timely production and installation of Marine Corps truck armor. First, a lack of a synchronized approach between the Marine Corps and the Army on addressing truck armor requirements and solutions resulted in the Marine Corps identifying its truck armor requirements and seeking armor solutions 2 months later than the Army. This delay may have limited the Marine Corps' ability to field interim armor that met IED protection requirements in the first phase, and may have contributed to the time to provide add-on truck armor to deployed Marine Corps forces in the second phase. The Marine Corps did not officially identify a requirement for truck armor and did not begin seeking out armor materials from industry until January 2004. According to Marine Corps officials, the armor-grade steel needed for sufficient IED protection was not available from suppliers in time to meet the Marine Corps' deployment timeline of March 2004. As a result, the Marine Corps fielded the interim armor with only limited IED protection. However, the Army identified its initial truck armor requirement in November 2003 and begun developing armor kits using the preferred type of steel at this time. Had the Marine Corps began seeking armor solutions in November 2003, it might have been able to acquire the preferred type of steel in time for its March 2004 deployment to Iraq given the average lead times for this steel during this time and the willingness of industry to work with the Marine Corps to expedite the availability. Second, mission needs restricted the rate at which the Marine Corps could replace its interim armor with add-on armor and install integrated armor. As a result, the fielding of add-on armor and integrated armor was stretched out over a longer period, placing troops at greater risk as they conducted wartime operations in vehicles without the preferred level of protection.

The Marine Corps and DOD have taken several actions to improve the timely availability of truck armor and other critical wartime equipment. For example, the Marine Corps increased the rate of installation for integrated armor by expanding its armor installation capacity. The Marine Corps also is taking longer-term actions, such as developing a plan to

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address the availability of truck armor for future operations. While we did not evaluate this plan, we did note that it is aimed at identifying long-term requirements for truck armor and developing solutions to address these requirements. In addition, DOD established the Rapid Validation and Resourcing of Joint Urgent Operational Needs (JUONS) process to improve coordination of wartime combatant commander requirements, and to accelerate the process of fielding urgent wartime solutions that are outside the services' established requirement processes. However, it is unclear whether this process applies to urgent wartime needs such as armor because it excludes the development of new technology solutions.

To ensure that the services make informed and coordinated decisions about what materiel solutions are developed and procured to address common urgent wartime requirements, we are making recommendations that the Secretary of Defense (1) direct the service secretaries to establish a process to share information on developed or developing materiel solutions and (2) clarify the point at which the JUONS process should be utilized when materiel solutions require research and development. In written comments on a draft of this report, DOD concurred with the second recommendation, but stated it believes that multiple layers of communication already exist between the Marine Corps and the Army to satisfy the first recommendation. However, as evidenced in our report, these various layers of communication were not sufficient to bring the services' two truck armor programs together in a more uniform and coordinated approach from the beginning to ensure that requirements were identified and solutions developed for both services at the same time. DOD also provided additional comments related to the context and accuracy of the report, which we incorporated as appropriate. The department's written comments and our evaluation of them are discussed in appendix III.

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## Background

Marine Corps convoys carrying supplies and equipment in CENTCOM's area of responsibility have been subjected to deadly attacks by insurgents using IEDs and other weapons. In response to these attacks, the Marine Corps has undertaken several force protection measures, such as adding armor to a number of medium and heavy trucks operating in Iraq, Afghanistan, and other CENTCOM locations. The Marine Corps fielded truck armor after identifying requirements and then designing and procuring three different levels of armor and fielding that armor in three different phases.

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## Deployed U.S. Forces Face a Significant Threat from IEDs

Military convoys operating in CENTCOM's area of responsibility have been subjected to deadly attacks by enemy forces. In particular, attacks in Iraq by insurgents using IEDs have placed trucks and personnel at tremendous risk as they carry supplies and equipment throughout the region. In May 2003, U.S. and coalition forces began stabilization operations in Iraq that continue today. However, since that time, the United States has incurred more casualties than during major combat operations, mostly due to ambushes and IED attacks by insurgents operating in Iraq. The threat from IEDs has grown progressively, from single mortar rounds, to multiple explosives linked together, to suicide car bombs. In the spring of 2004, nearly every attack from an IED resulted in a coalition casualty. In particular, U.S. military convoys have been the targets of these types of attacks. In addition to Iraq, U.S. forces operating in Afghanistan also have been subjected to IED attacks.

IEDs take a variety of shapes and sizes and have been employed in a number of different ways. They can contain commercial or military explosives, homemade explosives, or military ordnance and ordnance components. For example, mortar and artillery projectiles have been employed as IEDs in Iraq. In addition, IEDs have been placed in many vehicles—from small sedans to large cargo trucks—stationed along the roadways. Furthermore, “person-borne” suicide bombs have also been used, with explosives contained in a vest, belt, or clothing that is specifically modified to conceal and carry this material.

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## Outfitting Marine Corps Trucks with Armor

In light of the threat posed by IEDs and other weapons, such as mortars and rocket launchers, the Marine Corps has undertaken several force protection measures, including adding armor to a number of medium and heavy trucks operating in Iraq, Afghanistan, and other CENTCOM locations.<sup>5</sup> The trucks being armored by the Marine Corps include the Medium Tactical Vehicle Replacement (MTVR, or 7-ton truck), the multipurpose 5-ton truck, and the 22-ton Logistics Vehicle System (LVS). The MTVR and 5-ton are multipurpose medium trucks that transport all types of supplies. The LVS is a heavy truck that transports a variety of supplies and equipment such as bulk liquids (fuel and water), ammunition, bulk and palletized cargo, and bridging equipment. Appendix II contains a

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<sup>5</sup> Other force protection measures taken include the fielding of personal body armor and electronic IED countermeasures, as well as changes to unit-level training.

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detailed description of each Marine Corps vehicle and a discussion of armor production and installation.

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## Processes for Developing Wartime Requirements and Solutions

The Marine Corps identified wartime truck armor requirements and initiated a procurement program to develop armor solutions, which involved seeking funding from a variety of sources, identifying and contracting with suppliers for armor materials and components, designing and testing armor solutions, and installing armor onto trucks.

### Process for Developing Wartime Requirements

When a need for new equipment is identified by Marine Corps warfighters, units make official requests through the Marine Corps' requirements process by submitting a universal needs statement, which acts as a "work request" for current and future wartime capabilities. For example, the universal needs statements for truck armor described an urgent need to protect all Marine Corps vehicles from the fragmentation effects of IEDs and other threats and specified the numbers and types of trucks to be armored. Universal needs statements are forwarded from units to the Marine Corps Combat Development Command at Quantico, Virginia, where they are validated and approved for funding by the Marine Requirements Oversight Council.<sup>6</sup> Upon validation, the statements are forwarded to the Program and Review office at Marine Corps headquarters to obtain funding and to Marine Corps Systems Command for procurement. The Marine Corps validated its first requirement for truck armor in January 2004 prior to the deployment of the First Marine Expeditionary Force to Southwest Asia.

### Development of Truck Armor Solutions

To address validated requirements for truck armor, the Marine Corps initiated a procurement program to develop armor solutions for its deployed trucks. The Marine Corps obtained funding for its armor program from a variety of sources. While the services can reprogram a

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<sup>6</sup> The Marine Requirements Oversight Council advises the Commandant of the Marine Corps on policy matters related to concepts, force structure, and requirements validation. It is chaired by the Assistant Commandant of the Marine Corps and is composed of permanent and associate members. At the direction of the Commandant, the council is to: (1) conduct comprehensive reviews of critical issues and programs to develop optimal, balanced Marine Corps positions by considering current operational needs, desired future capabilities, and feasible alternatives based on resource constraints; (2) review, prioritize, and approve Mission Need Statements, Operational Requirements Documents, and force structure recommendations; and (3) develop recommendations for Marine Corps requirements, related strategies, and positions that are supported and funded by external agencies and other services.

small amount of funds from one program budget to another, the majority of funding had to be approved by the Office of the Under Secretary of Defense (Comptroller) and, in some cases, Congress. Specifically, to obtain funding for truck armor, the Marine Corps sought approval from the DOD Comptroller and Congress to reprogram funding from other procurement or appropriations accounts,<sup>7</sup> requested funding from the DOD-managed Iraqi Freedom Fund,<sup>8</sup> and requested funding through supplemental appropriations.

The Marine Corps Systems Command was the activity responsible for developing truck armor solutions to address validated Marine Corps requirements. Systems Command’s armoring efforts consisted of a phased approach to develop and field three distinct levels of armor: interim armor components, add-on armor kits, and integrated armor. Table 1 shows the Marine Corps’ armoring phases with the type of armor used in each phase.

**Table 1: Marine Corps Armor Phases and Types of Armor**

Phase I	Phase II	Phase III
Interim armor	Add-on armor	Integrated armor
Kevlar/ceramic and 3/16-inch high hard steel (HHS)	3/8-inch rolled homogeneous armor (RHA)	Armor integrated into the body of the vehicle

Source: GAO analysis of U.S. Marine Corps data.

The phase one interim armor consisted of commercial off-the-shelf and Marine Corps depot-produced armor components, such as 3/16-inch high hard steel (HHS)<sup>9</sup> armor doors, ballistic blankets, and Kevlar/ceramic panels. Recognizing that the interim armor provided limited protection from IED fragments, the Marine Corps subsequently produced a more robust solution of add-on armor for phase two that provided greater

<sup>7</sup> The services are allowed to reprogram, without DOD approval, a total of up to \$20 million per year into the procurement account that includes armor kits. However, because the funding needed for armor kits exceeded this amount, the services had to request approval from the DOD Comptroller for any reprogramming of funds in excess of the \$20 million, which in turn had to be approved by Congress.

<sup>8</sup> The Iraqi Freedom Fund is a special account providing funds for use of military forces in Iraq and those operations authorized by Pub. L. No. 107-40 (2001), Authorization for use of Military Force, and other operations and related activities in support of the global war on terrorism.

<sup>9</sup> High hard steel has a high surface hardness level which provides good protection against projectiles.

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protection against IEDs and roadside bombs. This add-on armor initially included 3/8-inch rolled homogeneous armor (RHA)<sup>10</sup> steel doors and side panels, and ballistic glass. Later, as the threat became more lethal, the Marine Corps began producing and installing additional add-on armor coverage for phase two that included underbodies, roofs, tailgates, rear cab plates, and gunner shields. To produce add-on armor kits, Systems Command used its own Logistics Command to produce and ship the add-on armor kits. The Logistics Command obtained the armor panels and components directly from suppliers and manufactured some parts in its depot, and shipped kits directly to CENTCOM's area of responsibility for installation.

As an improvement over add-on armor already fielded, in phase three the Marine Corps is currently installing an integrated armor kit for the MTVR. Unlike add-on armor, integrated armor is a permanent modification and is designed for the life of the vehicle. Integrated armor provides the greatest level of protection through more comprehensive coverage. The integrated truck armor kits are produced by Oshkosh Truck Corporation. Installing integrated armor is much more complex than add-on armor because it requires stripping the truck to its frame and rebuilding. It takes a five-person crew more than 300 hours per vehicle to complete the installation of integrated armor.

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## Marine Corps Met Truck Armor Requirements in September 2004

The Marine Corps met its requirements for production and installation of add-on truck armor in September 2004—8 months after that initial requirement was identified in January 2004. In addressing its truck armor requirements, the Marine Corps used a three-phased approach. In the first phase, the Marine Corps validated its initial requirement in January 2004 to armor 1,169 trucks for protection against IEDs and other similar threats. Due to the immediacy of the need to deploy forces to Iraq by March 2004, the Marine Corps addressed this initial requirement by installing interim armor on all 1,169 trucks. However, the interim armor did not meet requirements because it did not provide sufficient protection from the fragmentation effects of IEDs. In the second phase, the Marine Corps increased its armor requirement to 1,438 trucks in April 2004 and fully met that requirement in September 2004 with add-on armor that provided the required IED protection. In the third phase, the Marine Corps is upgrading

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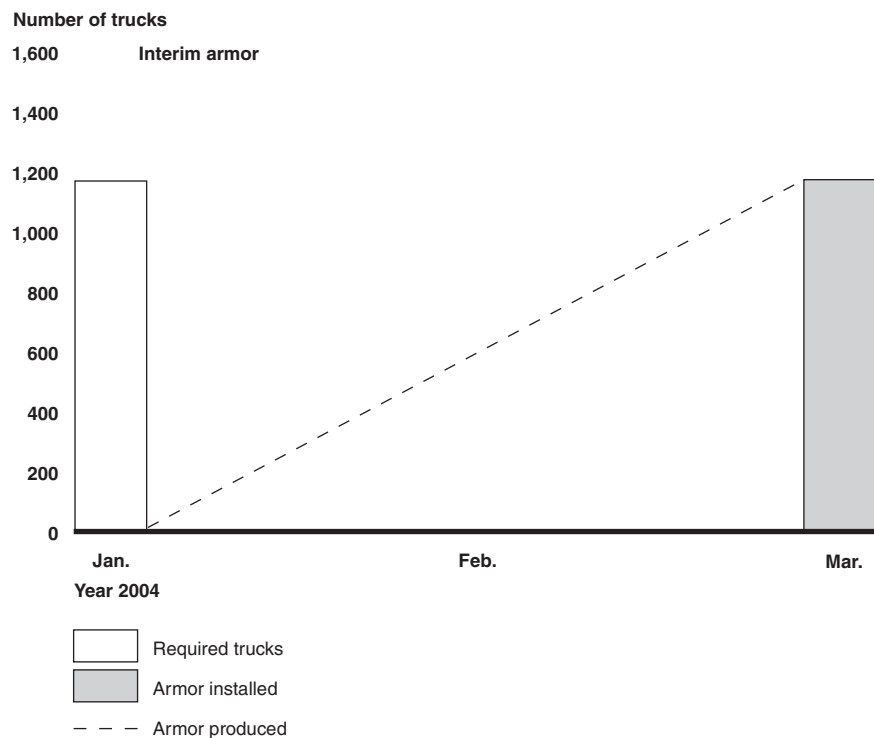
<sup>10</sup> Rolled homogeneous steel has a lower surface hardness than high hard steel and provides good protection against both projectiles and the fragmentation effects of IEDs.

armor protection from add-on armor to integrated armor for 900 7-ton trucks in Iraq and Afghanistan, which were included in the 1,438 trucks armored during the second phase.

### First Phase Requirement Addressed with Interim Armor

In its first phase of truck armoring, the Marine Corps validated its initial requirement to armor 1,169 trucks in January 2004. However, they addressed the requirement by installing interim armor that did not provide sufficient protection against IED fragments. Figure 1 shows Marine Corps production and installation of the interim armor protection over the 2-month period taken to address the initial requirement.

**Figure 1: Requirements, Production, and Installation of Interim Armor Protection**



Source: GAO analysis of U.S. Marine Corps data.

Note: Precise monthly armor production and installation figures were unavailable, so the line in the graph simply indicates that sufficient purchase, production, and installation occurred to meet the requirements.

Due to the immediacy of the need for armor and because forces were preparing to deploy in 2 months, in January 2004 Marine Corps officials purchased truck armor that was readily available, could be quickly

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shipped to CENTCOM's area of responsibility, and was easily installed. This interim solution consisted of a mix of Kevlar/ceramic armor plates purchased off the shelf from commercial companies to protect doors, and 3/16-inch HHS armor plates produced by a Marine Corps depot to protect doors and cargo areas. Officials said the interim armor protected against the prevalent ballistic threat at the time and was readily available off the shelf from industry. However, this interim armor did not meet the validated requirements. Part of this requirement was to address an urgent need to protect all Marine Corps vehicles from the fragmentation effects of IEDs. Marine Corps officials said an integral part of the Marine Corps' armoring strategy was to procure and install armor on all vehicles prior to going to CENTCOM's area of responsibility, using the best materials readily available at the time. According to congressional testimony by the Systems Command's Commanding General, the Marine Corps always made clear the fact that they would pursue a more robust solution as better raw material steel became available.<sup>11</sup> As a result, the interim armor fielded by the Marine Corps offered limited protection from IEDs and troops were placed at greater risk as they conducted operations in vehicles equipped with insufficient protection.

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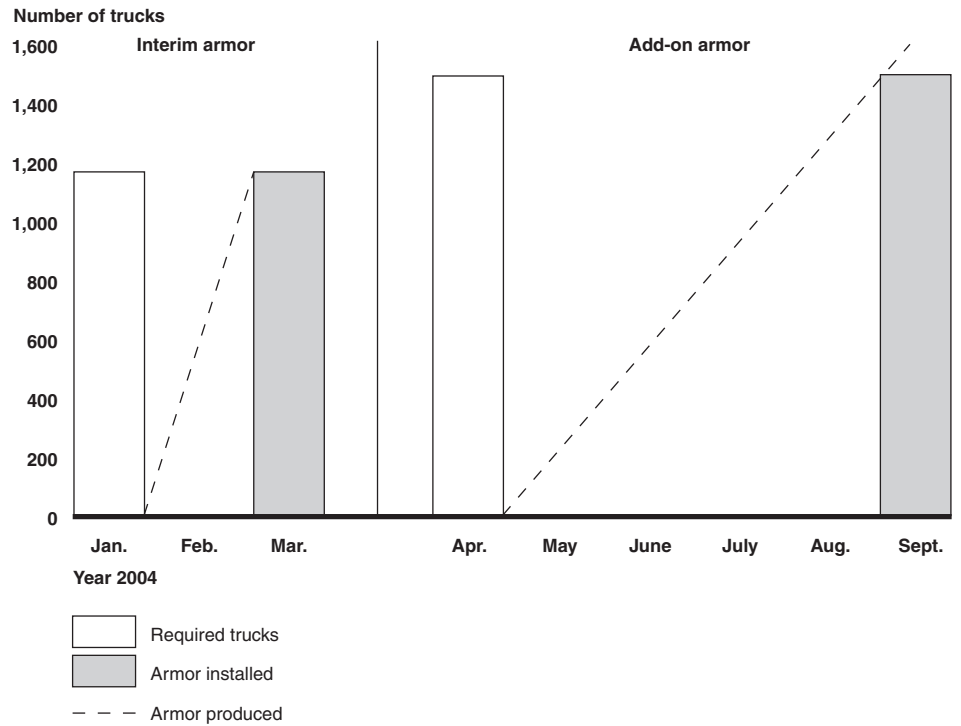
## Second Phase Requirement Met with Add-On Armor

The second phase of truck armoring began in April 2004, when a second requirement to armor 1,438 trucks with 3/8-inch RHA steel was validated and then met 5 months later using add-on armor that provided the required IED protection. To meet this requirement, the Marine Corps had to re-arm the existing 1,169 trucks that had interim armor, plus armor an additional 269 trucks with the required IED protection. Installation of add-on armor on the trucks was completed in September 2004, 5 months after establishment of the April requirement and 8 months after establishment of the initial requirement. Figure 2 shows Marine Corps production and installation of the add-on armor protection over the 5-month period needed to meet the April requirement.

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<sup>11</sup> "Marine Corps Vehicle Armoring," Testimony Before the House Armed Services Committee by Major General (Sel) William D. Catto, Commanding General, Marine Corps Systems Command, May 5, 2005.

**Figure 2: Requirements, Production, and Installation of Interim and Add-on Armor Protection**



Source: GAO analysis of U.S. Marine Corps data.

Note: Precise monthly armor production and installation figures were unavailable, so the line in the graph simply indicates that sufficient production and installation occurred to meet the requirements. Dotted line over the graph indicates some overproduction occurred.

Since the time the Marine Corps met its second phase armor requirement with the installation of 3/8-inch RHA add-on armor, it continued to make improvements to that armor during the second phase to better protect against IED fragments. According to officials, the upgrades included expanding armor coverage to the underbodies, tailgates, roofs, and gunner shields of the trucks. For example, the Marine Corps installed underbodies on 87 of the 5-ton trucks<sup>12</sup> and underbodies on all 235 LVS trucks. Upgraded add-on armor has also been installed on the MTRVs until the MTRVs with integrated armor could be fielded. According to Marine Corps

<sup>12</sup> The Marine Corps has 123 5-ton trucks, but because the 5-ton trucks are being phased out of theater operations, 87 will receive upgraded protection, such as underbody kits, because the remaining trucks will not be used outside the forward operating bases.

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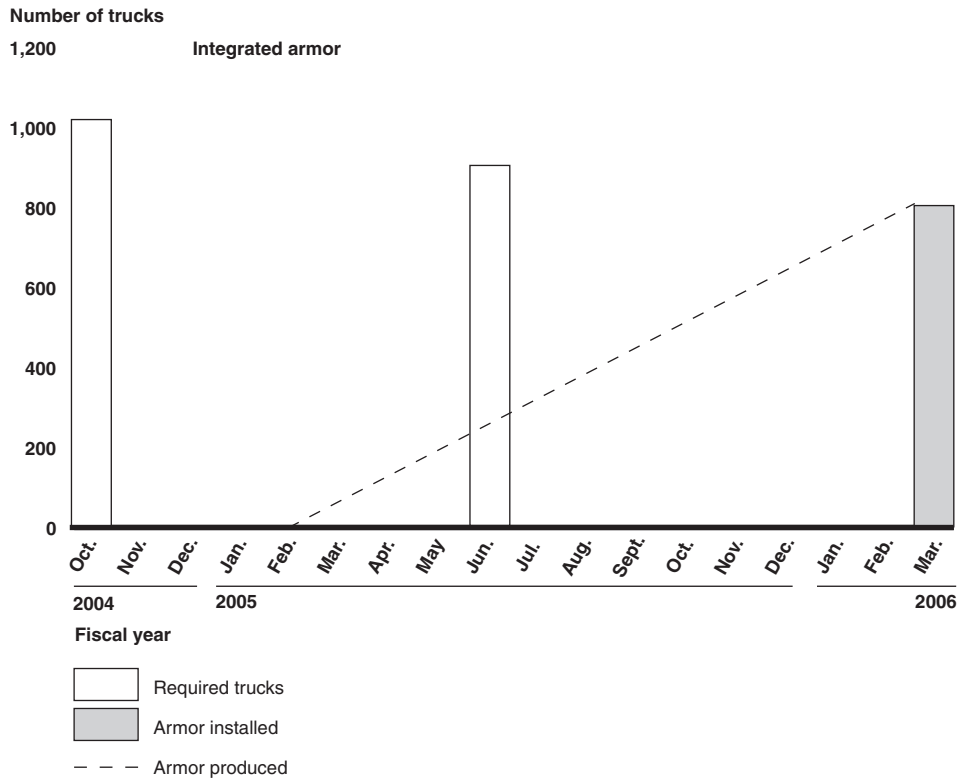
officials, this improved add-on armor offers significant protection of vehicles, including coverage for the seams to better shield against explosive blasts and fragments.

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### Third Phase Requirements To Be Met with Integrated Armor

In the third phase of truck armoring, the Marine Corps established two requirements to armor MTRVs with integrated armor. The first requirement to armor 1,018 MTRVs was validated in October 2004, but was reduced to 900 in June 2005 primarily due to the rotation of fewer troops and trucks in and out of CENTCOM's area of responsibility. The Marine Corps plans to install armor on 900 MTRVs for forces in Iraq and Afghanistan by May 2006. As of March 2006, the Marine Corps had completed installation of integrated armor on 803 MTRVs. Figure 3 shows Marine Corps production and installation of the integrated armor protection.

**Figure 3: Requirement, Production, and Installation of Integrated Armor**



Source: GAO analysis of U.S. Marine Corps data.

Note: Precise monthly armor production and installation figures were unavailable, so the dotted line in the graph simply indicates the amount of armor produced by March 2006 to meet the requirements.

According to Marine Corps officials, since the MTRV is at the beginning of its economic life cycle, the Marine Corps decided to armor this truck with armor that was integrated into the body of the truck. Marine Corps officials said that only the MTRV trucks will receive the integrated armor because both of the other types of trucks used (the 5-ton and 22-ton bulk hauler) are at the end of their economic life cycle and are expected to be replaced over the next 5 years by the MTRVs and the Logistics Vehicle System Replacement (LVSr).

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## Lack of a Synchronized Approach between the Services and Mission Needs Affected the Time to Provide Truck Armor to Marine Corps Forces

Two factors affected the timely production and installation of Marine Corps truck armor. First, a lack of a synchronized approach between the Marine Corps and the Army on truck armor requirements and solutions resulted in the Marine Corps identifying its truck armor requirements and seeking armor solutions 2 months later than the Army. Second, mission needs also affected the Marine Corp's ability to replace its interim armor with add-on armor and to install integrated armor. As a result, the total length of time to field add-on armor and integrated armor was stretched out over a longer period, placing troops at greater risk as they conducted wartime operations in vehicles without the preferred level of protection.

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## Lack of Synchronization between the Marine Corps and Army in Identifying Truck Armor Requirements and Developing Solutions May Have Affected Armor Availability For Deploying Units

A lack of synchronization between the Marine Corps and Army in identifying truck armor requirements and coordinating an armor solution from industry may have limited the Marine Corps' ability to field interim armor that met IED protection requirements and may have contributed to the time to provide the second phase armor protection to deployed Marine Corps forces. The Marine Corps began procuring 3/8-inch RHA armor for effective protection against IED fragments in late February 2004—3 months after the Army identified this armor as a solution for IED protection in November 2003. After testing many types of armor materials to protect against IEDs, the Army subsequently issued armor protection guidance in December 2003 recognizing HHS and Kevlar/ceramic plates, which the Marine Corps purchased for its interim armor solution in January 2004, as ineffective against IED fragments. The guidance also stated that 3/8-inch RHA steel offered good protection against IED blasts and fragments. Marine Corps officials said they were aware of the Army's armor protection guidance and had pursued acquiring 3/8-inch RHA steel in January, but it was not available from industry to meet their needs. As a result, as an interim solution to meet deployment deadlines, they purchased the best armor steel available, although it did not provide sufficient IED protection.

To verify whether a shortage of 3/8-inch RHA steel occurred during the January and March 2004 time frame, we asked several steel suppliers who had supplied steel to an Army and Marine Corps steel distributor whether 3/8-inch RHA was in short supply. Industry officials told us that if the Marine Corps had requested 3/8-inch RHA steel directly from them, they could have made it available sooner despite a lead time that varied from 30

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days to 4 months. In fact, according to industry officials, both the 3/16-inch HHS and 3/8-inch RHA steel required the same amount of lead time. Ultimately, in early February 2004, the Marine Corps approached industry with the assistance of congressional staff, and by the end of February, 3/8-inch RHA steel became available. By March 2004, the Marine Corps began producing 3/8-inch RHA add-on armor for their second phase armor effort.

A formal process did not exist to require the military services to coordinate when developing common wartime requirements, such as truck armor, or share information on research, development, and procurement efforts supporting solutions to those requirements. Both the Marine Corps and Army have separate and distinct requirements determination processes to address their warfighters' urgent needs. The two services share information only through informal communication channels, which may not always occur in the timeliest manner. For example, the Marine Corps validated its first requirement to armor vehicles against IEDs and other explosive devices in January 2004, 2 months after the Army had validated a similar requirement in November 2003. In addition, in November 2003, the Army had built a prototype armor kit for production made out of 3/8-inch RHA steel, which is what the Marine Corps officials said they began seeking 2 months later but were unable to obtain. If both the Marine Corps and Army had coordinated requirements earlier and had worked together to purchase 3/8-inch RHA steel from industry in November 2003, the Marine Corps might have had 3/8-inch RHA available for its first armor phase instead of the 3/16-inch HHS it used for interim armor, or might have completed its second armor phase sooner than September 2004. Without a formal process for coordinating common urgent wartime requirements and the development of materiel solutions across military services, the Army and Marine Corps could continue to develop different solutions with varying degrees of effectiveness in response to the same warfighter needs.

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### Mission Needs Affected Production and Installation of Truck Armor

The production and installation of truck armor was also affected by mission needs. Specifically, mission needs restricted the rate at which armor could be installed onto vehicles in the theater of operations. According to Marine Corps officials, the need to install armor without jeopardizing theater missions limited the number of vehicles that could be taken out of action at any one time. As a result, installation rates for the Marine Corps' add-on and integrated armor were paced with the rotation of trucks into the maintenance area as they returned from missions. In addition, the installation of integrated armor on the MTRV trucks also has been constrained by lengthy installation times—on average it takes a five-

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person crew more than 300 hours per vehicle to install a single kit. As a result of these constraints, the installation of add-on and integrated truck armor was stretched out over a longer period, and the Marine Corps provided funding and set production rates for add-on armor components to match the limited rate of installation. Consequently, troops were placed at greater risk as they conducted operations in vehicles that were equipped with the interim armor that provided limited protection from IEDs.

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## Marine Corps and DOD Took Actions to Improve Truck Armor Availability

The Marine Corps and DOD have taken several actions to improve the timely availability of truck armor and other critical wartime equipment. For example, the Marine Corps increased the rate of installation for integrated armor by expanding its armor installation capacity. The Marine Corps is also developing a longer-term plan to address the availability of truck armor for future operations. In addition, DOD established the Rapid Validation and Resourcing of Joint Urgent Operational Needs (JUONS) process to improve coordination of combatant commander wartime requirements common to multiple services and to accelerate the process of fielding urgent wartime solutions that are outside the services' established requirements processes. However, it is unclear whether this policy applies to urgent wartime needs such as armor because it excludes the development of new technology solutions.

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## Marine Corps Is Taking Short-and Long-Term Actions to Improve Armor Availability

The Marine Corps is taking short-term and long-term actions to improve the availability of truck armor. In the short term, to address current armor needs for deployed forces in Iraq and other CENTCOM locations, the Marine Corps accelerated the rate of installation by increasing the number of installation sites for integrated armor kits. For example, as of August 2005, the Marine Corps had installed integrated armor on 41 MTVRs using one installation site in Iraq, and as of October 2005 it had installed armor on 177 MTVRs using two sites—one in Iraq and one in Kuwait. The Marine Corps opened a third site in November 2005 at the Marine Corps Logistics Command in Albany, Georgia to further increase installation rates. As a result of the increased number of installation sites, total installation of integrated armor increased to 803 MTVRs as of March 2006.

The Marine Corps is also taking longer-term actions to improve the availability of truck armor for future operations. For example, the Marine Corps has developed a strategic plan for tactical wheeled vehicles that addresses future truck armor needs. According to Marine Corps officials, the plan involves ongoing assessments of the Marine Expeditionary Force

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concept of warfare—the need to stay light and expeditionary—and limitations of available airlift and seabasing that impact the amount of armor applied to a vehicle. In addition, the Marine Corps is also investigating future kit-armor strategies with the Army using the “A” kit and “B” kit concept identified in the Army’s long-term strategy. Under this strategy, the Army’s plan for add-on armor for trucks requires two kits. The A kit provides a basic framework of fixtures for all trucks ready to accept armor and includes hard-to-install parts and permanent mounting provisions for the B kit. The B kit contains the actual armor to be applied to all trucks fitted with an A kit and includes modular components that can be installed and removed by two people. The Marine Corps currently plans to incorporate this A kit/B kit armor concept onto its LVSR and MTRV as new vehicles are produced. Marine Corps officials told us that this concept addresses some of the concerns raised by Marine Corps officials, such as wear and tear on the vehicles due to the additional weight of the armor. Other long-term Marine Corps efforts underway include studies on future armoring needs and solutions. These studies are evaluating the ground transportation needs of the Marine Corps in an expeditionary context and will make recommendations regarding the value of current vehicle systems and necessary changes to develop and maintain a tactical wheeled vehicle fleet that meets Marine Corps requirements through 2020. While we did not evaluate these studies, we did note that they are aimed at identifying longer-term requirements for truck armor and developing solutions to address these requirements.

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## DOD Has Taken Steps to Improve Coordination of Requirements across Services

DOD has taken steps to improve coordination of urgent wartime needs across the services by developing the JUONS process. DOD established the JUONS process in July 2005 to improve coordination of combatant commanders’ urgent wartime requirements that are outside the services’ established processes to accelerate the fielding of wartime solutions that may be purchased off the shelf or warrant minor modification. However, according to Army officials, it is not clear whether the JUONS process addresses urgent wartime needs that may emerge in the same fashion as armor. The acquisition of an armor solution was in part an off-the-shelf purchase combined with some level of research and development of new technology. According to the JUONS instructions, solutions that involve the development of a new technology or capability should not be processed under the instruction’s procedures. However, the instruction also allows the minor modification of an existing system to adapt to a new or similar mission. Army officials said they were unclear whether urgent wartime requirements such as armor should be processed under JUONS given that the armor solution can be described as both an off-the-shelf

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solution with minor modification and a solution that required the development of new technology. For example, according to Army officials, the recently fielded armor solutions were readily available off the shelf and required some modification. However, officials also said that the armor solutions can be described as new and developing technology because research was needed to identify effective armor protection standards and new technology was necessary to integrate and apply armor onto vehicles. As a result, it is not clear if similar future requirements are to be processed under JUONS or other requirements generation processes. Until the types of solutions about which the JUONS process applies are more clearly defined, it is uncertain whether this process would apply to joint urgent wartime requirements for items needing some level of research and development, such as truck armor.

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## Conclusions

The results of our work on Marine Corps truck armor indicate a broader systemic problem with a lack of synchronization between the Marine Corps and Army in identifying common urgent wartime requirements and developing solutions to those requirements. Because there was no formal process requiring a synchronized approach between the two services for identifying requirements or developing solutions, the Marine Corps did not identify a requirement for truck armor or begin developing armor solutions until 2 months after the Army had done so. A more unified and coordinated approach between the Marine Corps and the Army might have allowed the Marine Corps to field a better interim armor solution that provided sufficient protection against IEDs. In addition, earlier coordination may also have enabled the Marine Corps to begin developing and fielding its second phase of armor, which provided the required IED protection, sooner. Further, due to the lack of a formal process for sharing requirements information between the services, official documentation was not available to determine whether the Marine Corps made informed decisions about the materials it selected for its interim armor or to assess the basis for these decisions. While the work we performed focused on the Marine Corps and Army, the lack of a DOD-wide framework for coordinating wartime requirements and solutions impacts on all of the military services.

Subsequent to the procurement and installation of Marine Corps add-on truck armor, DOD established a new joint process, called JUONS, to ensure that the development of wartime requirements common to the Marine Corps, Army, and other services are coordinated. However, because this new process does not apply to the development of new technologies, it is not clear whether it will improve interservice

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coordination when solutions involve some level of research and development, like truck armor. Without a formal process for coordinating all common wartime requirements and the development of materiel solutions across military services, the Army, Marine Corps, and other services could continue to develop different solutions with varying degrees of effectiveness in response to the same warfighter needs. It is likely that DOD will again face urgent wartime requirements common to multiple services to rapidly develop materiel solutions to improve force capability or protection of deployed forces. The effective coordination of common requirements and sharing of information on materiel solutions in development are critical to ensure the needs of the warfighter are met in the timeliest and most effective manner possible. Without improved coordination, deployed military personnel and their missions may be placed at significant risk because they lack the appropriate equipment at the critical times it may be needed. Furthermore, until a formal process for coordinating and sharing information on all common urgent wartime requirements and solutions is established, Congress and the Secretary of Defense may be unable to exercise effective oversight of decisions made to address urgent wartime requirements.

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## Recommendations for Executive Action

To ensure that the services make informed and coordinated decisions about what materiel solutions are developed and procured to address common urgent wartime requirements, we recommend that the Secretary of Defense take the following two actions: (1) direct the service secretaries to establish a process to share information between the Marine Corps and the Army on developed or developing materiel solutions, and (2) clarify the point at which the JUONS process should be utilized when materiel solutions require research and development.

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## Agency Comments and Our Evaluation

In written comments on a draft of this report, DOD generally agreed with our recommendations. Regarding the first recommendation that DOD direct the services to establish a process to share information between the services on materiel solutions in development, DOD partially concurred, and stated that it believes that multiple layers of communication already exist between the Marine Corps and the Army. For example, DOD cited the Marine Corps' participation in the Army's armor kit working group. DOD also noted that the Marine Corps coordinated with the Army Research Lab and the Army's Aberdeen Test Center on armor kit design and testing. While we agree that the coordination between the Marine Corps and Army on truck armoring was beneficial to the Marine Corps' program, these processes were generally informal in nature. As evidenced

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in our report, these various layers of communication were not sufficient to bring the services' two truck armor programs together in a more uniform and coordinated approach from the beginning to ensure that requirements were identified and solutions developed for both services at the same time. Instead, the Army identified its first truck armor requirements and began developing solutions in November 2003, while the Marine Corps did not begin its program until January 2004. As we reported, had the Marine Corps began seeking truck armor solutions in November 2003, it might have been able to acquire the preferred type of steel in time for its March 2004 deployment to Iraq given the average lead times for this steel during this time period and the willingness of industry to work with the Marine Corps to expedite its availability.

DOD further stated that it believes it met the intent of our recommendation with the creation of the Army-Marine Corps Board and the Navy-Marine Corps Board. As noted by DOD, these Boards address issues at the 3-star level and provide a means to share information between the services. According to DOD, the Army-Marine Corps Board was not mature enough to influence the initial development of truck armor, but in 2005 it was used to coordinate production delivery priority between the Army and Marine Corps for the up-armored HMMWV. While we agree that these Boards enhance the coordination between the two services, they represent an agreement between the services, initiated by the services. The intent of our recommendation is for DOD to develop a more comprehensive DOD-wide process that requires synchronization and coordination between the services in identifying common urgent wartime requirements and developing solutions to those requirements.

In response to our second recommendation to clarify the point at which the JUONS process should be utilized, DOD concurred, stating that the Joint Staff is working on an update to the JOUNS process instruction. According to DOD, this update will clarify when and if the JOUNS process can be used when materiel solutions require development of a new technology or capability. The update is expected to be completed by September 2006.

DOD provided additional comments related to the context of the report. Specifically, DOD noted that it believes the Marine Corps exhibited due diligence in providing armor protection for its deployed tactical wheeled vehicle fleet. It further described in detail the Marine Corps' approach to first develop an interim solution using commercially available materials, including 3/16-inch HHS, to ensure all vehicles entering Iraq would have at least some protection until armor with a better level of protection could be

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fielded. We agree that the Marine Corps exercised diligence in armoring its trucks for Iraq and other deployed locations given the circumstances and we believe this information is accurately presented in the report. However, as noted in the report, a more unified and synchronized approach between the Army and the Marine Corps may have improved the availability of the preferred 3/8-inch RHA for the Marine Corps' interim armor.

DOD also provided additional comments related to the accuracy of the report which we have incorporated in the report as appropriate. The department's specific comments and our responses to them are discussed in detail in appendix III. In summary, the department disagreed with our statements regarding the (1) lack of coordination between the Marine Corps and the Army on addressing truck armor requirements and solutions, (2) lack of a formal departmentwide process to ensure interservice coordination, and (3) delays in the Marine Corps' identification of the requirement for 3/8-inch RHA and its attempts to acquire and install this improved armor. While we acknowledge that the Marine Corps made attempts to coordinate with the Army through various informal processes, evidence showed that the lack of a synchronized approach between the services led to differing processes within the services for generating armor requirements and solutions. Similarly, while we agree that the department had a number of interservice working groups and committees designed to enhance interservice coordination, we continue to believe that the lack of a more formal interservice coordination process precluded the Marine Corps and the Army from identifying armor requirements and solutions for both services at the same time. Lastly, while the department refuted our evidence that the Marine Corps did not identify a requirement for 3/8-inch RHA until April 2004, it was unable to adequately document its position. See appendix III for a more detailed discussion of these issues.

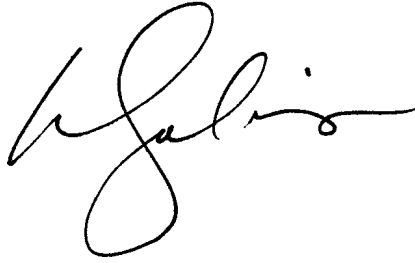
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We are sending copies of this report to the appropriate congressional committees, the Secretary of Defense, the Secretaries of the Army and the Navy and the Commandant of the Marine Corps, and the Director of the Office of Management and Budget. We will also make copies available to others upon request. In addition, the report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

If you or your staff members have any questions regarding this report, please contact me at (202) 512-8365 or [solisw@gao.gov](mailto:solisw@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on

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the last page of this report. GAO staff that made major contributions to this report are listed in appendix IV.

A handwritten signature in black ink, appearing to read "W. Solis". The signature is fluid and cursive, with a large initial "W" and a stylized "S".

William M. Solis, Director  
Defense Capabilities and Management

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# Appendix I: Scope and Methodology

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To address our objectives, we examined the Marine Corps' programs to provide armor for each of its medium and heavy tactical wheeled vehicles, or trucks, operating in the U.S. Central Command (CENTCOM) area of responsibility.<sup>1</sup> The Marine Corps trucks we examined included the 5-ton, Logistics Vehicle System, and Marine Tactical Wheeled Vehicle Replacement. Descriptions of each of these trucks along with detailed information on the availability of armor for each truck are included in appendix II.

To determine the extent to which truck armor was produced and installed to meet identified requirements and the factors that affected the time to provide armor, we interviewed Marine Corps officials involved in identifying armor requirements, providing funding, and acquiring truck armor for deployed forces. We conducted interviews at the Marine Corps Systems Command and Marine Corps Combat Development Command in Quantico, Virginia; the Marine Corps Logistics Command in Albany, Georgia; Army headquarters in Arlington, Virginia; and the U.S. Army Development Test Command at Aberdeen Proving Ground, Maryland. We also collected and analyzed armor supply data such as requirements, funding levels, production levels, and installations for the period between January 2004 (when truck armor requirements were first formally identified) and March 2006, which we obtained from Marine Corps bases or source documents. We considered the armor requirement as met for each type of truck when the quantity of add-on or integrated armor produced and installed on vehicles equaled the requirement. We did not, however, visit CENTCOM's area of responsibility to validate the extent to which armor had been installed and was actually in use by trucks. Based on the information gathered, we identified factors that affected the time to provide truck armor to deployed forces.

To determine what actions the Marine Corps and the Department of Defense took to improve the availability of truck armor for current and future operations, we interviewed Marine Corps and Joint Staff personnel to identify short- and long-term efforts. We also reviewed the service's

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<sup>1</sup> The Marine Corps also developed armor for the high mobility multipurpose wheeled vehicle (HMMWV), a light tactical wheeled vehicle. We examined availability of armor for HMMWVs in our prior report on wartime supply availability, so we did not include them in this review. See GAO, *Defense Logistics: Actions Needed to Improve the Availability of Critical Items during Current and Future Operations*, [GAO-05-275](#) (Washington, D.C.: Apr. 8, 2005).

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studies related to addressing future truck armor needs. However, we did not evaluate the identified solutions' potential for success.

We assessed the reliability of the truck armor supply data we obtained for this review by interviewing agency officials knowledgeable about the data and corroborating them with other information gathered from other Marine Corps organizations. We determined that the data were sufficiently reliable for the purposes of this report. We performed our audit from April 2005 through March 2006 in accordance with generally accepted government auditing standards.

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# Appendix II: Assessment of Marine Corps Truck Armoring Efforts

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We examined the extent to which truck armor was produced and installed to meet identified requirements for the following vehicles: the multipurpose 5-ton truck, the logistics vehicle system (LVS), and the medium tactical vehicle replacement (MTVR, or 7-ton truck). This appendix provides an assessment for each of these three truck types. Each assessment presents a general description of each truck and our evaluation of the extent to which armor kits were produced and installed when required.

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## Multipurpose 5-Ton Trucks

The Marine Corps multipurpose 5-ton trucks provide transportation, hauling, and towing of just about everything in the equipment inventory. These trucks transport troops, supplies, ammunition, construction materials, and other items. These trucks also tow many types of trailers, artillery guns, and vans. Almost all Marine Corps units are equipped with 5-ton trucks. As the primary truck transport asset of the Marine Corps, it is available in cargo, dump, tractor, and wrecker configurations. Figure 4 shows an example of the 5-ton truck in a cargo configuration.

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**Figure 4: Unarmored Marine Corps 5-Ton Multipurpose Truck**



Source: U.S. Marine Corps Systems Command.

To meet requirements, the Marine Corps installed armor protection for the 5-ton trucks in two phases. The first phase of armoring used interim armor, which included 3/16-inch HHS doors, Kevlar/ceramic panels, and ballistic blankets, and offered limited protection against improvised explosive devices (IEDs). The second phase of armoring used add-on armor, which offered better protection against IEDs because it included a better grade steel (3/8-inch rolled homogeneous steel), ballistic glass, and additional protection for the underbody, tailgate, roof, and other components. There is also an additional type of armor protection used by the Marine Corps, called integrated armor. However, integrated armor requirements were not established for the 5-ton truck because the 5-ton truck is at the end of its life cycle and is being replaced by MTVRs, or 7-ton trucks. In addition, according to Marine Corps officials, the 5-ton trucks make poor candidates for integrated armor because the added weight of the armor significantly reduces the payload capacity and usefulness of the trucks.

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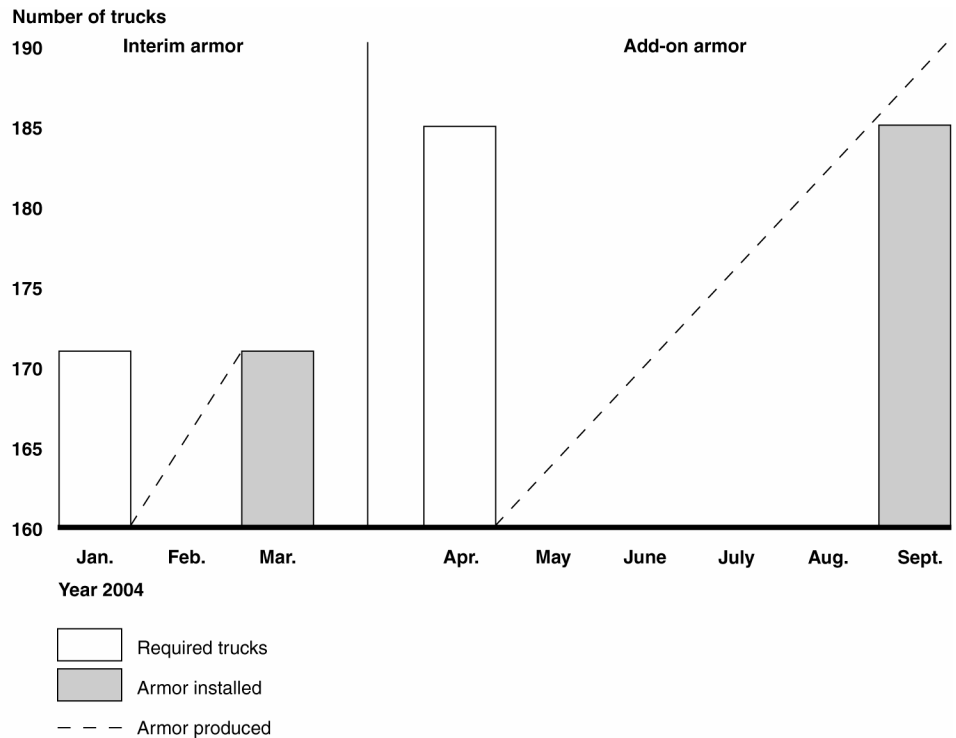
### Extent Truck Armor Was Produced and Installed to Meet Identified Requirements

The Marine Corps armored its 5-ton trucks in two phases, responding to two validated requirements. The requirement addressed in the first phase, to armor 171 trucks, was validated in January 2004. Marine Corps officials said they met this requirement 2 months later, in March 2004, by installing an interim armor solution before the First Marine Expeditionary Force was deployed to Iraq. However, Marine Corps officials were unable to provide monthly data on the number of installations completed. Our analysis showed that, at a minimum, the Marine Corps produced 123 door sets between April and September 2004 at the Marine Corps Logistics Command Maintenance Center in Albany, Georgia, and procured 3,830 Kevlar/ceramic panels from commercial sources to address the requirement. According to Marine Corps officials, some of these Kevlar/ceramic panels were used to armor the 5-ton trucks. Due to the immediate need for armor prior to deployment, the Marine Corp met armor needs with the best available materials at the time—3/16-inch HHS and Kevlar/ceramic plates. However, the armor did not provide sufficient IED protection.

The requirement met in the second phase, to armor 185 5-ton trucks (including re-armoring the 171 trucks with interim armor), was validated in April 2004. Marine Corps officials said they met this requirement 5 months later, in September 2004, by installing add-on armor kits that met requirements for IED protection, but they were unable to provide monthly data on the number of installations completed. Our analysis showed that, at a minimum, the Marine Corps produced 199 5-ton armored door sets

between April and September 2004 to meet the requirement. Figure 5 shows the requirements and installation levels for both interim armor and add-on armor for the 5-ton truck over time. As of September 2005, the Marine Corps had 123 add-on armored 5-ton trucks operating outside forward bases in CENTCOM's area of responsibility. Eighty-seven of them also received underbody armor.<sup>1</sup>

**Figure 5: 5-Ton Truck Requirements, Production, and Installation of Interim and Add-on Armor**



Source: GAO analysis of U.S. Marine Corps data.

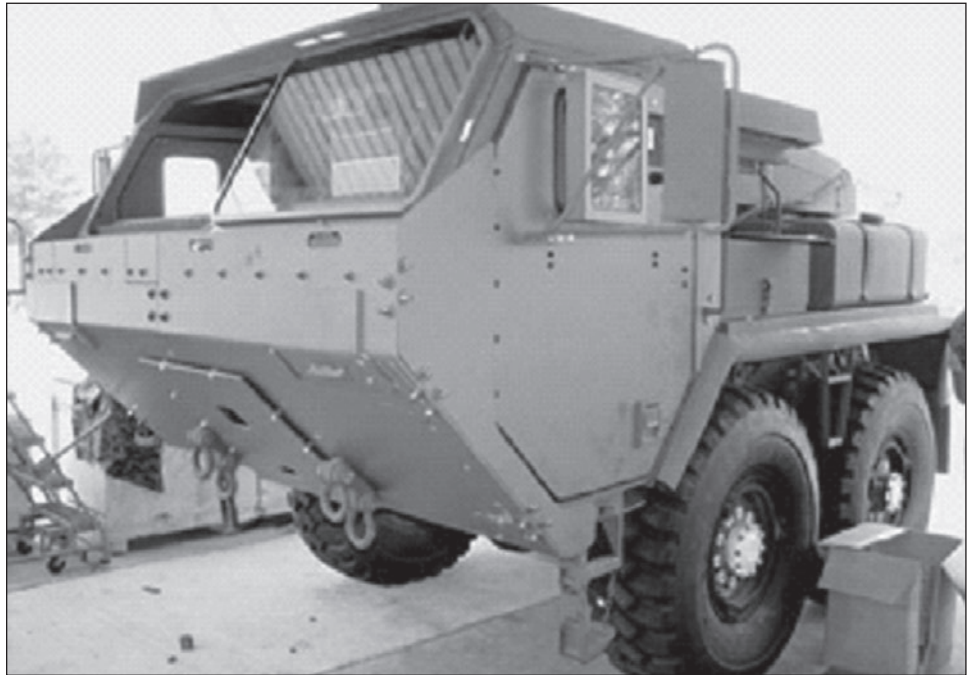
Note: Precise monthly armor production and installation figures were unavailable, so the dotted line in the graph simply indicates that sufficient production and installation occurred to meet the requirements, but is not representative of actual production quantities at given points in time. Dotted line over the graph also indicates some overproduction occurred.

<sup>1</sup> The Marine Corps has 123 5-ton trucks in theater, but because the 5-ton trucks are being phased out of theater operations, 87 received upgraded protection such as underbody kits while the rest will not be used off the forward operating bases.

## Logistics Vehicle System

The Logistics Vehicle System (LVS) is a heavy tactical transport vehicle system for fuels and bulk cargos that was first fielded in the mid-1980s. It is a modular system consisting of a front power unit (cab) that is designed to have interchangeable rear body units. The truck has an off-road payload of 12.5-tons and an on-road payload of 22.5-tons. Figure 6 shows the front body unit, which can tow five different rear body units. Rear body units include a wrecker, a fifth-wheel semitrailer adapter, a dropside cargo unit, a self-loading container, and bridge transporter.

**Figure 6: Armored Cab of the Marine Corps Logistics Vehicle System**



Source: U.S. Marine Corps Systems Command.

The Marine Corps installed armor protection on the LVS in two phases to meet requirements. The first phase of armoring used interim armor, which included Kevlar/ceramic panels, 3/16-inch HHS doors, and ballistic blankets, and offered limited protection against IEDs. The second phase of armoring used add-on armor, which offered better protection against IEDs because it included a better grade (3/8-inch rolled homogeneous) steel, ballistic glass, and additional protection for the underbody, tailgate, roof, and other components. There is an additional type of armor protection established by the Marine Corps, called integrated armor, but, as with the 5-ton truck, a requirement for this type of protection was not established

for the LVS because it will ultimately be replaced by a new truck called the Logistic Vehicle System Replacement during the 2008–2009 time frame.

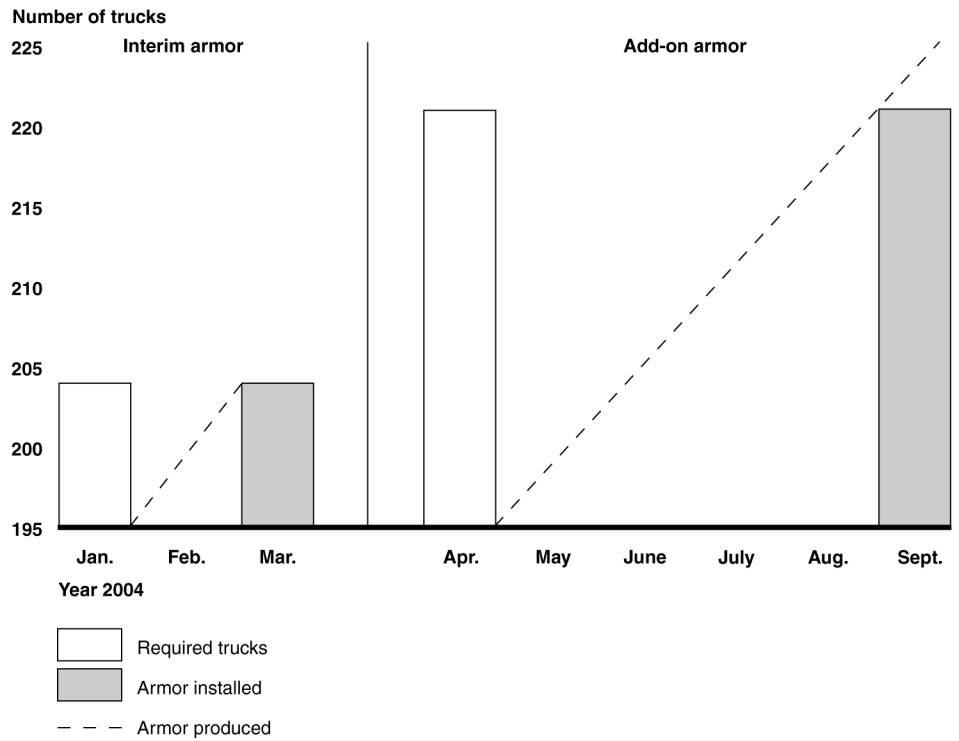
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### Extent Truck Armor Was Produced and Installed to Meet Identified Requirements

The Marine Corps armored the LVS in two phases, responding to two requirements. The requirement addressed in the first phase, to armor 204 trucks, was validated in January 2004. Marine Corp officials said they met this requirement by installing an interim armor solution 2 months later, in March 2004, before the First Marine Expeditionary Force was deployed to Iraq. However, Marine Corps officials were unable to provide monthly data on the number of installations completed. Our analysis showed that, at a minimum, the Marine Corps produced 105 armored door sets at the Marine Corps Logistic Command Maintenance Center between April and September 2004 and procured 3,830 Kevlar/ceramic panels from a commercial company, some of which were used to armor the LVS. Due to the immediate need for armor prior to deployment, the Marine Corps met armor needs with the best available materials at the time—3/16-inch HHS and Kevlar/ceramic plates. However, this armor did not provide sufficient protection against the fragmentation effects of IEDs.

The requirement met in the second phase, to armor 221 trucks (including re-armoring the 204 trucks with interim armor), was established in April 2004. Marine Corps officials said they met this requirement 5 months later, in September 2004, with add-on armor kits that met the validated requirements for protection from IEDs, but they were unable to provide monthly data on the number of installations completed. Our analysis showed that, at a minimum, the Marine Corps produced 261 armored door sets between April and September 2004 at the Marine Corps Logistic Command Maintenance Center and procured 3,830 Kevlar/ceramic panels from a commercial company to meet the requirement. According to Marine Corps officials, some of the Kevlar/ceramic doors were used to armor the LVS. As of January 2006, Marine Corps fielding data revealed that 235 LVS trucks operating outside forward bases in CENTCOM's area of responsibility had add-on armor. Figure 7 shows the requirements, production, and installation levels for both interim armor and add-on armor for the LVS over time.

**Figure 7: LVS Requirements, Production, and Installation of Interim and Add-on Armor**



Source: GAO analysis of U.S. Marine Corps data.

Note: Precise monthly armor production and installation figures were unavailable, so the dotted line in the graph simply indicates that sufficient production and installation occurred to meet the requirements, but is not representative of actual production quantities at given points in time. Dotted line over the graph indicates some overproduction occurred.

## Medium Tactical Vehicle Replacement

The Marine Corps Medium Tactical Vehicle Replacement (MTVR) is designed to replace the existing fleet of 5-ton trucks with a new and more robust fleet of 7-ton trucks. Figure 8 shows the MTVR as a troop carrier; however, it is also used as a wrecker, dump truck, cargo carrier, and convoy escort. According to a Marine Corps official, the service needed to replace its existing medium 5-ton truck fleet with a vehicle capable of carrying larger payloads, at a faster speed, over more difficult terrain, and that can be airlifted. A contract was awarded to Oshkosh Truck Corporation in December 1998, and production is underway.

**Figure 8: Armored Medium Tactical Wheeled Vehicle Replacement**



Source: U.S. Marine Corps Systems Command.

To meet requirements, the Marine Corps installed armor protection for the MTVR in three phases. The first phase used interim armor, which includes Kevlar/ceramic panels, 3/16-inch HHS doors, and ballistic blankets, and offers limited protection against IEDs. The second phase used add-on armor, which provides greater protection from IEDs than the interim armor because it included 3/8-inch rolled homogeneous armor, ballistic glass, and additional protection for the underbody, side panels, tailgate, and other components. The Marine Corps continues to design and produce improvements to this add-on armor. The final armor phase used integrated

armor that is installed on the vehicle chassis and provides overlapping seams that prevent penetration from ballistics and IEDs. Figure 9 shows the requirements, production, and installation of each type of armor on the MTRV.

---

### Extent Truck Armor Was Produced and Installed to Meet Identified Requirements

The Marine Corps is armoring the MTRV in three phases, responding to four requirements. The requirement addressed in the first phase, to armor 794 trucks, was validated in January 2004. Marine Corps officials said they met this requirement by installing an interim armor solution 2 months later, in March 2004, before the First Marine Expeditionary Force was deployed to Iraq. However, Marine Corps officials were unable to provide data on the number of installations completed. Our analysis showed that, at a minimum, the Marine Corps produced 174 doors between April and September 2004 and procured 3,830 Kevlar/ceramic panels from a commercial company for the requirement. An unspecified number of these Kevlar/ceramic panels were used to armor the MTRV. Due to the immediate need for armor prior to deployment, the Marine Corp met armor needs with the best available materials at the time—3/16-inch HHS and Kevlar/ceramic plates. However, this armor did not provide sufficient protection against the fragmentation effects of IEDs.

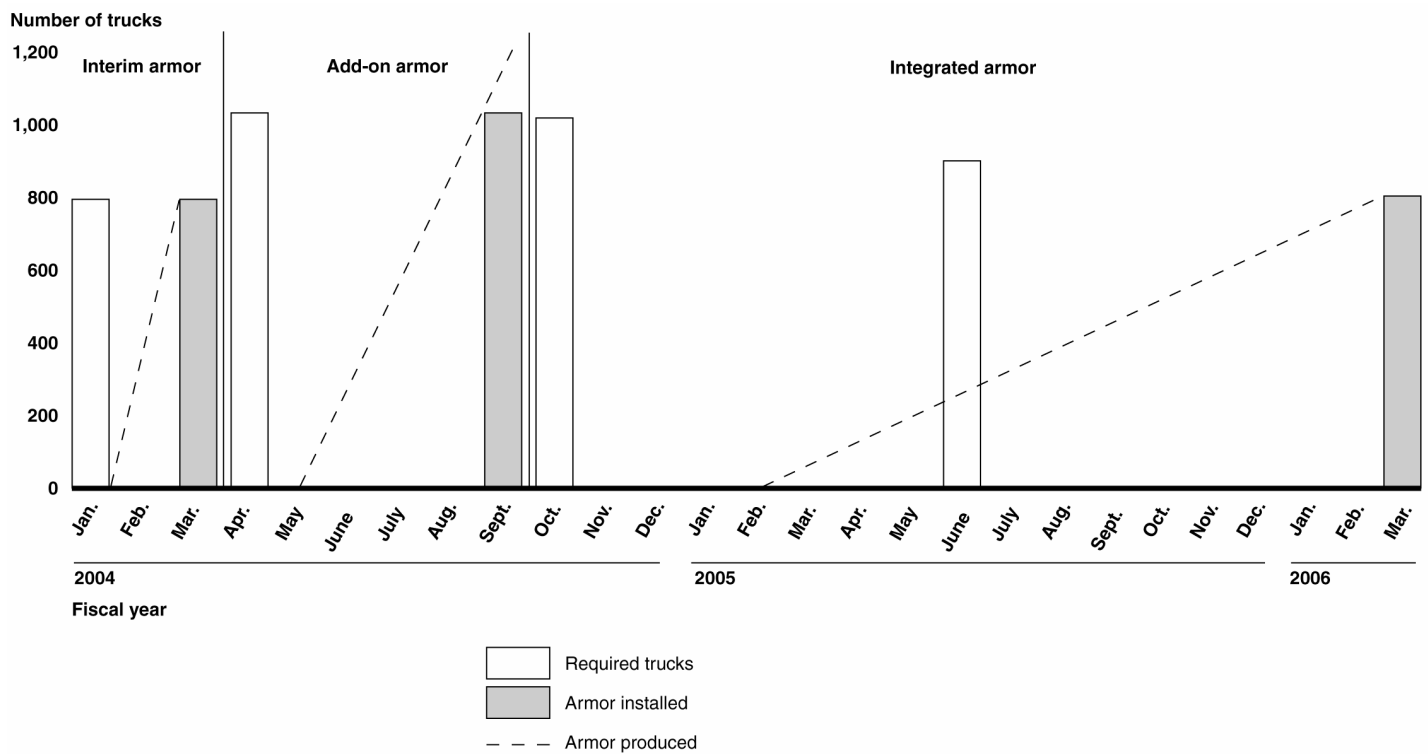
The requirement met in the second phase, to armor 1,032 MTRVs (including re-armoring the 794 trucks armored with interim armor), was validated in April 2004. Marine Corps officials said they met this requirement 5 months later, in September 2005, by installing add-on armor kits that met the validated requirements for protection from IEDs. However, they were unable to provide data on the number of installations completed. Our analysis showed that, at a minimum, the Marine Corps produced 1,966 armored doors between April and September 2004 to meet the requirement. The Marine Corps also produced 962 cargo panel sets (i.e., which were steel plated to protect the sides of the cargo unit) to protect transported troops.

The armor protection installed in the third phase had two requirements. The first requirement, to armor 1,018 MTRVs (trucks that were already provided with add-on armor) with integrated armor, was validated in October 2004. However, in June 2005 this requirement was reduced to installing integrated kits on 900 MTRVs by May 2006, because fewer trucks than initially anticipated will be rotated into theater in Iraq and Afghanistan. Since the MTRV is at the beginning of its economic life cycle, the Marine Corps made the decision to armor this truck with armor that was integrated into the body of the truck. Integrated armor is a permanent

**Appendix II: Assessment of Marine Corps  
Truck Armoring Efforts**

modification that requires stripping the truck to its frame and rebuilding. It takes a five-person crew more than 300 hours to complete a single installation. As of March 2006, the Marine Corps has installed 803 integrated kits on the MTVRs.

**Figure 9: MTVR Truck Requirements, Production, and Installation of Interim, Add-on, and Integrated Armor**



Source: GAO analysis of U.S. Marine Corps data.

Note: Precise monthly armor production and installation figures were unavailable, so the dotted line in the graph simply indicates that sufficient production and installation occurred to meet the requirements, but is not representative of actual production quantities at given points in time. Dotted line over the graph indicates some overproduction occurred.

# Appendix III: Comments from the Department of Defense



ACQUISITION,  
TECHNOLOGY  
AND LOGISTICS

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WASHINGTON, DC 20301-3000

MAY 26 2006

Mr. William M. Solis  
Director, Defense Capabilities and Management  
U.S. Government Accountability Office  
Washington, D.C. 20548

Dear Mr. Solis:

This is the Department of Defense response to the GAO draft report, DEFENSE LOGISTICS: Lack of Coordination between Marine Corps and Army Affected the Timely Production and Installation of Marine Corps Truck Armor, dated April 25, 2006 (GAO Code 350785/GAO-06-274).

The Department partially concurs with the recommendations in the draft report. Our comments concerning the recommendations, context and accuracy of the report are provided in the enclosure.

The Department appreciates the opportunity to comment on the draft report.

A handwritten signature in cursive script that reads "Darlene J. Costello".

Darlene J. Costello  
Acting Director  
Portfolio Systems Acquisition

Enclosure:  
As stated



**GAO DRAFT REPORT – DATED APRIL 25, 2006  
GAO CODE 350785/GAO-06-274**

**“DEFENSE LOGISTICS: Lack of Coordination between Marine Corps and Army  
Affected the Timely Production and Installation of Marine Corps Truck Armor”**

**DEPARTMENT OF DEFENSE COMMENTS  
TO THE RECOMMENDATIONS**

**RECOMMENDATION 1:** To ensure that the services make informed and coordinated decisions about what materiel solutions are developed and procured to address common urgent wartime requirements, the GAO recommends that the Secretary of Defense direct the service secretaries to establish a process to share information between the Marine Corps and the Army on developed or developing materiel solutions.

**DOD RESPONSE:** *Partially Concur.* Multiple layers of communication already exist between the Marine Corps and the Army. For example, the Marine Corps Systems Command (MCSC) Armor Project Officer joined the Army’s Armor Kit Working Group Integrated Process Team in early December 2003. This working group was a pivotal link between the services in coordinating initial efforts. Additionally, all the Marine Corps vehicle hardening tests were conducted at the Army’s Aberdeen Test Center (ATC). The ATC Test Director ensured that Marine Corps efforts received priority placement (a result of close, continuous coordination). Further, the Marine Armor Kit (MAK) designs were based on technical drawings and engineering calculations from the Army Research Lab (ARL) designs.

As appropriate, Major General Catto (CG, MCSC) maintained close contact with his counterpart at the Army’s Program Executive Office Combat Support & Combat Service Support (PEO CS & CSS), Brigadier General O’Reilly.

At the Service level, the Army-Marine Corps Board (AMCB) and the Navy-Marine Corps Board (NMCB) address issues at the 3-star level. While the AMCB was not mature enough during the winter 2003/spring 2004 to influence the initial up-armor issue, it provides a suitable venue for similar topics, provides a means to share information, and meets the "spirit and intent" of the GAO recommendation. For example, in the fall of 2005, the AMCB was used to establish an equitable production delivery priority between the two Services for the Up-Armored Humvee M1114.

**RECOMMENDATION 2:** To ensure that the services make informed and coordinated decisions about what materiel solutions are developed and procured to address common urgent wartime requirements, the GAO recommends that the Secretary of Defense clarify the point at which the JUONS process should be utilized when materiel solutions require research and development.

**DOD RESPONSE:** Concur. The Joint Staff, J8 is currently working on an update to CJCSI 3470.01, "Rapid Validation and Resourcing of Joint Urgent Operational Needs (JUONS) in the Year of Execution". This update will clarify when and if the JUONS process can be used when materiel solutions require development of a new technology or capability. The update is expected to be complete by September 2006.

**Additional Comments:**

**REPORT CONTEXT:** The Department offers the following additional comments in response to the draft report: The Marine Corps exhibited due diligence in providing armor protection to its tactical wheeled vehicle fleet in Operation Iraqi Freedom (OIF), Operation Enduring Freedom (OEF), and the Horn of Africa (HOA).

In January 2004, the Marine Requirements Oversight Council (MROC) validated the requirement to armor all I Marine Expeditionary Force's (MEF) tactical wheeled vehicles before entering Iraq for OIF II. The Marine Corps tackled this task with a dual prong approach.

They worked with industry to identify all readily available solutions, i.e., Simula half doors (HHS), Foster-Miller appliqué panels, O'Gara Hess (OGH) kits. Since procurement of readily available industry solutions alone would not meet the total I MEF requirement of 3,049 vehicles (trucks included), a concurrent augmenting approach was begun. In order to provide the best armor protection available in time to meet the March 2004 OIF II deployment timeline, Marine Corps Logistics Command (MCLC) and Marine Corps Systems Command (MCSC) teamed together to field the MCLC 3/16" HHS armor. The combination of OGH kits, Simula half doors, Foster-Miller panels, and MCLC 3/16" armor was our 1st generation approach to the vehicle armor solution. During the development of the first generation approach, they sought 3/8" RHA as the preferred armor solution for IED blast/fragmentation protection. However, 3/8" RHA was NOT available from industry in order to meet the I MEF March 2004 timeline. Nonetheless, there was some level of IED protection afforded to 100% of the Marine Corps' vehicles entering to Iraq when involvement with OIF II began.

Working with industry and the assistance of senior HASC staffers, in late spring of 2004, the Marine Corps were able to procure 3/8" RHA, beginning the transition from the first generation solutions to the second generation, i.e., MCLC 3/8" RHA zonal armor. They completed fielding the second generation armor in August 2004. They completed the fielding of our third generation or integrated solutions (Marine Armor Kit (MAK) and MTRV Armor System (MAS)) in November 2005 for our HMMWVs, in December 2005 for the Logistics Vehicle System (LVS), and as of 11 May, have completed the Medium Tactical Vehicle Replacement (MTRV) nearly five months ahead of schedule.

In addition, every generation of vehicle armor was subjected to blast tests, to the requirements, before MCSC would approve fielding solutions. Their motto was to be sure that we "do no harm" when trying to address the armoring situation.

See comment 1.

**REPORT ACCURACY:** In general the information in the report is accurate, however, we do not agree with the following statements for the reasons stated:

*Page 2 - We identified a number of systemic causes for these shortages, including inaccurate requirements, delayed funding, and ineffective distribution processes.*

1) “.inaccurate requirements..” is misleading; it implies that the Marine Corps did not consider the current threat analysis. Armor protection requirements increased quickly over time, measured in weeks and months. The predominant threat migrated from a predominantly small arms ballistic focus to a fragmentation focus, as the lethality of IEDs encountered increased. In December 2003, both the Army and Marine Corps recognized that IEDs, RPGs, 7.62mm projectiles, and mines were the predominant threats; however, there was not a consensus among the users as to the proper tradeoffs and specifications to counter the threat. In addition, specific testing data formulated from in-theater operational scenarios did not yet exist, making it very difficult to articulate specific and emerging requirements. Without such specific data, it was difficult to arrive at a production solution that would meet emerging requirements in the timeframe required.

*Page 4 - Due to the immediacy of the need to deploy forces to Iraq by March 2004, the Marine Corps addressed this initial requirement by installing interim armor on all 1,169 trucks. However, the interim armor did not meet requirements because it did not provide sufficient protection from the fragmentation effects of IEDs. Marine Corps officials acknowledged that the interim armor provided protection against the prevalent ballistic threat at the time but offered only limited protection against IEDs.*

See comment 2.

2) “.did not meet requirements..” As mentioned previously, armor protection requirements increased quickly over time, measured in weeks and months. The predominant threat migrated from a small arms ballistic focus to a fragmentation focus, as the lethality of IEDs encountered increased. As both the Marine Corps and Army experienced, when a vehicle armor solution was developed and fielded, the enemy changed tactics, techniques, and procedures to mitigate the protection level just fielded. We are in an environment in which we have to continually validate and re-define requirements.

*Page 4 - Two factors affected the timely production and installation of Marine Corps truck armor. First, a lack of coordination between the Marine Corps and the Army on addressing truck armor requirements and solutions caused the Marine Corps to make decisions about the types of armor to use without having all the information that was available on the protective capabilities of various types of armor.*

See comment 3.

3) “.lack of coordination..” The Army and Marine Corps shared information and coordinated efforts between the services in several different ways, most often via working groups, PHONCONs, VTCs, and e-mails. In the October/November 2003

timeframe the Army stood up its Armor Kit Working Group Integrated Process Team (AKWG IPT). The Marine Corps Systems Command Armor Project Officer joined the AKWG IPT in early December 2003. This working group was a pivotal link between the services in coordinating initial efforts. Marine Corps Logistics Command (MCLC) Maintenance Center Albany and Contracts personnel attended the AKWG IPTs starting in the spring of 2004.

Additionally, all the Marine Corps vehicle hardening testing efforts were conducted at Aberdeen Test Center (ATC) in Maryland. The ATC Test Director personally ensured that Marine Corps efforts received priority placement (a result of close, continuous coordination).

Further, the Marine Armor Kit (MAK) designs were based on technical drawings and engineering calculations based on the Army Research Lab (ARL) designs. MCLC was provided the Technical Design Package (TDP) of the Army Add on Armor (AoA) door and rocker panel kits in January 2004. The TDP was used in the design and development of the MCLC first generation and subsequent generations of armor kits. The TDP reduced the design effort required to develop doors and underbodies to meet Marine Corps operational requirements. Without the sharing of information and coordination received from the Army, the Marine Corps vehicle hardening efforts would not have progressed rapidly.

*Page 5 - The Marine Corps did not officially identify a requirement for 3/8-inch rolled homogeneous armor (RHA) steel until April 2004, which it determined was necessary for effective IED protection.*

4) "The Marine Corps did not officially identify a requirement for 3/8 RHA until April 2004..." As the Marine Corps developed interim solutions in coordination with efforts undertaken by the Army, they recognized the need for 3/8 RHA in December 2003. Participation in the AKWG IPT in early December 2003 was critical to this recognition. The Marine Corps first tried to order 3/8" RHA with Clifton steel in January 2004, but lack of supply prevented order completion and delivery. In addition, Contracts (MCLC) queried all known vendors, distributors and steel mills in North America for availability of all types and thickness of armor plate starting in January 2004 and throughout armor production.

*Page 5 - Because there is no formal process in place to ensure interservice coordination on the development of materiel solutions such as truck armor, the Marine Corps was not aware of the Army's identification of the type of steel needed for effective IED protection when it developed its interim armor. Instead, the Marine Corps fielded an armor solution of 3/16-inch steel and Kevlar/ceramic plates that did not adequately address the IED threat.*

See comment 4.

See comment 5.

5) “..no formal process..” Though no standing joint activity addressed specific service wide vehicle hardening requirements at the time, as previously mentioned, participation on the AKWG IPT and formal coordination with ATC and ARL to facilitate testing and design proved instrumental in the incorporation of RHA into our vehicle hardening kits. The Marine Corps continues to use the Army-Marine Corps Board (AMCB) and the Joint IED Defeat Organization (JIEDDO) as forums to work vehicle hardening issues and requirements in the development of solutions. As noted previously, they processed the first purchase order for 3/8” RHA on January 12, 2004. They developed and fielded vehicle hardening kits in successive generations for two primary reasons; 1) availability of RHA ballistic steel was in limited supply, and 2) upon validating current and emerging requirements, they developed successive material solutions as the threat changed and migrated to a focus on fragmentation and mines (over ballistic projectiles). The decision to field 3/16” ballistic steel and commercial-off-the-shelf (COTS) solutions was made deliberately, given the less than optimum options available to meet the current timelines of the warfighter.

*Page 5 - Second, mission needs restricted the rate at which the Marine Corps could replace its interim armor with add-on armor and install integrated armor. As a result, the fielding of add-on armor and integrated armor was stretched out over a longer period, placing troops at greater risk as they conducted wartime operations in vehicles without the required level of protection.*

See comment 6.

6) “..placing troops at greater risk..” Operational Commanders in-theater made the ultimate decision as to when they could afford to place vehicles out of service in order to install armor. It was a decision based on combat needs in a combat environment, not on production timelines in a benign environment. It’s misleading to state that Marines were placed at greater risk. For example, if the Operational Commanders placed a large preponderance of vehicles out of service at one time, it would leave the remaining forces engaged in combat operations without a significant proportion of their combat assets, which represents an inherent high risk. Without addressing the specific combat needs in theater during the timeframe mentioned, it is misleading to state that Marines were placed at greater risk.

*Page 11 - However, the interim armor did not meet requirements because it did not provide sufficient protection from the fragmentation effects of IEDs.*

See comment 7.

7) “..did not meet requirements..” See note (1) and note (2).

*Page 13 - As a result, the interim armor fielded by the Marine Corps offered little protection from IEDs and troops were placed at greater risk as they conducted operations in vehicles equipped with limited protection.*

See comment 8.

8) “..offered little protection..” See note (6).

See comment 9.

Page 17 - *Lack of Coordination between the Services and Mission Needs Affected the Time to Provide Truck Armor to Deployed Forces.*

9) "Lack of Coordination.." See note (3) and note (5).

See comment 10.

Page 18 - *However, Marine Corps officials said they were not aware of the Army's armor protection guidance or what type of armor was needed for IED protection when they began purchasing truck armor in January 2004.*

10) "...not aware of the Army's armor protection guidance.." See note (3) and note (4).

See comment 11.

Page 18 - *However, these information sessions were not well attended by Marine Corps officials, and Army acquisition and laboratory officials said they were not sure whether information about 3/8-inch RHA armor was shared in late 2003 or early 2004 because no official records were kept or were readily available.*

11) "...information sessions were not well attended.." Information sharing between the Army and Marine Corps regarding vehicle hardening programs has been well established and well documented through participation in working groups, IPTs, PHONCONs, VTC's, and e-mails. In particular, e-mail traffic is well-documented, from the Commanding General of MCSC on down.

See comment 12.

Page 18 - *One Marine Corps Systems Command official estimated that the Marine Corps learned about 3/8-inch RHA in February 2004 but no documentation was available to substantiate this estimate.*

12) "...Marine Corps learned about 3/8" RHA in December 2003.." See note (4).

See comment 13.

Page 20 - *In addition, the Marine Corps is also investigating future kit-armor strategies with the Army using the "A" kit and "B" kit concept established in the Army's long-term strategy. Under this strategy, the Army's plan for add-on armor for trucks requires two kits. The A kit provides a basic framework of fixtures for all trucks ready to accept armor and includes hard- to-install parts and permanent mounting provisions for the B kit.*

13) "...A kit and B kit concept.." The Marine Corps Logistics Vehicle Replacement (LVSr) will be the first military vehicle to incorporate the A and B kit concept into the design and production of the vehicle. Source selection for the LVSr will be completed in May and a production contract will be awarded in the May/June timeframe. This survivability requirement was not identified in the original requirement for the vehicle; however, it has been introduced into the design and production plan as requirements changed and migrated. We have developed and will produce MTRVs "ready-to-accept" armor in the 1st and 2nd quarter FY07. These MTRVs will have the critical armor components installed and all suspension upgrades completed, coming off the production line.

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## GAO's Responses to DOD's Technical Comments

1. DOD stated that our statement identifying a number of systemic causes for shortages in armor such as inaccurate requirements is misleading and that it implies that the Marine Corps did not consider the current threat analysis. However, this statement does not refer to the Marine Corps's truck armor program. Rather, the statement is from the introduction of the report, where we discussed our prior work leading up to this review. Specifically, we noted that in April 2005 we reported on a number of critical supply shortages during OIF—including armored HMMWVs, body armor, and other items—and inaccurate requirements was one of the systemic causes identified in the April 2005 report.
2. DOD disagreed with our statement that the Marine Corps' interim armor did not meet requirements, noting that armor protection requirements changed quickly over time and migrated from a small arms ballistic focus to a fragmentation focus, as the lethality of IEDs encountered increased. However, the December 2003 requirement document that the Marine Corps provided to us during our review clearly stated the need to protect all vehicles from improvised explosive devices, mines, and other explosive ordnances. Documents we obtained from both the Marine Corps and Army recognized IEDs as a significant threat at the time. In fact, in DOD's comments to this report, it noted that "in December 2003, both the Army and Marine Corps recognized that IEDs, RPGs, 7.62mm projectiles, and mines were the predominate threats." Further, in November 2003, the Army had identified a requirement to protect vehicles from IEDs and recognized a need to purchase rolled homogenous armor (RHA), a type of armor that proved effective against both the ballistic and IED threat after testing many armor types.
3. DOD disagreed with our statement that a lack of coordination between the Marine Corps and Army on addressing truck armor requirements and solutions caused the Marine Corps to make decisions about the types of armor to use without having all the information that was available on protective capabilities of various armor types. We acknowledge that the Marine Corps made attempts to coordinate through various informal processes, such as the Armor Kit Working Group Integrated Process Team. However, evidence showed that a lack of a synchronized approach among the services was due to each service having separate and distinct processes that generated the requirements to armor vehicles. The individual requirements processes led to the Marine Corps validating a requirement to armor vehicles 2 months after the Army validated a similar requirement to armor its vehicles.

Ultimately, the Marine Corps began seeking RHA armor in February 2004—3 months after the Army began producing armor kits made out of RHA armor. Marine Corps officials told us that they began seeking RHA armor from industry earlier—in January 2004—but were told it was in short supply. However, Marine Corps officials have not provided documentary evidence to substantiate this claim. For example, in DOD’s comments to this report, it stated that the first purchase order for 3/8-inch RHA was on January 12, 2004. However, when we subsequently requested to see the purchase order, the Marine Corps noted that it was actually an Army purchase order. According to the Marine Corps, they made a phone inquiry to a steel vendor in January 2004, but have not provided documentation to support this assertion. In addition, we spoke with other steel suppliers about the availability of RHA during the January and March 2004 time frame. These industry officials told us that despite lead times for RHA that ranged from 30 days to 4 months, they could have made RHA available to the Marine Corps quicker if the Marine Corps had approached them directly. Moreover, although we agree that formal processes are in place for the Marine Corps to test armor types through the Army’s Testing Center (ATC), the Marine Corps coordination with the Army to install RHA armor kits on vehicles did not occur until the Marine Corps’ second phase of armoring. Furthermore, while the Marine Corps cited the Army-Marine Corps Board (AMCB) and the Joint IED Defeat Organization (JIEDDO) as other examples of Army and Marine Corps coordination in the development of armor solutions, these additional avenues for communication were not sufficient to bring the services’ two truck armor programs together in a synchronized approach to ensure that requirements were identified and solutions developed for both services at the same time. We further clarified this position in the report.

4. DOD disagreed with our statement that the Marine Corps did not identify a requirement for 3/8-inch RHA until April 2004. It stated that the need for RHA armor was identified earlier but was in short supply from industry. While some Marine Corps officials told us that the Marine Corps was not seeking 3/8-inch RHA for its interim armor, other Marine Corps officials subsequently told us they became aware of the need for 3/8-inch RHA in December 2003 and first inquired about the availability of RHA steel with industry in January 2004. However, these officials have not provided adequate documentation to support the assertion or that RHA was not available from industry (see note (3) above). Further, a Marine Corps Logistics Command report on its armoring efforts indicated that the Marine Corps did not make the decision to use 3/8-inch RHA until March 2004. However, it was not

until April 2004 that the Marine Corps officially identified a need for 3/8-inch RHA when it validated the requirement for the second armor phase. Due to the conflicting information, it remains unclear exactly when the Marine Corps became aware of the need for RHA.

5. DOD disagreed with our statement that no formal process was in place to ensure interservice coordination. DOD acknowledged that there was no standing joint activity that addressed specific servicewide vehicle hardening requirements at the time, and cited participation in and coordination with the AKWG IPT, ATC, AMCB and JIEDDO as instrumental in developing the Marine Corps' truck armor solutions. While we agree that these organizations may have provided valuable information to the Marine Corps, as stated previously, this coordination was not sufficient to bring the services together to identify requirements and develop solutions for both services at the same time.
6. DOD disagreed with our statement that troops were placed at greater risk as a result of the time required to replace the interim armor with add-on RHA armor and integrated armor. It noted that to accelerate the replacement of interim armor by taking a larger amount of vehicles out of service would create inherent risk to the operational commanders. We did not intend to suggest that the Marine Corps should have made this decision or that it could have done anything different given the operational conditions in the theater. Rather, we were simply stating that because of the time needed to replace the interim armor with the second generation RHA armor coupled with mission requirements, the vehicles were operating with less than the preferred armor solution.
7. See note (1) and note (2).
8. See note (6).
9. See note (3) and note (5).
10. See note (3) and note (4).
11. We agree that attempts were made to share information between the Army and Marine Corps, but we recommended a DOD-wide formal process to require interservice coordination (see also note 5).
12. See note (4).

13. In response to our discussion on the Marine Corps' investigating future-kit armoring strategies using the "A" kit and "B" kit concept for armor kits, DOD added that the Marine Corps is now planning to incorporate this concept on its Logistics Vehicle Replacement (LVSr) and the MTrVr. DOD further noted that the LVSr will be the first military vehicle to incorporate the A and B kit concept. We incorporated the current status of this program into the report.

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# Appendix IV: GAO Contacts and Staff Acknowledgments

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## GAO Contact

William M. Solis, (202) 512-8365 or solisw@gao.gov

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## Acknowledgments

In addition to the contact named above, David Schmitt, Assistant Director; Renee S. Brown, Judith C. Collins, Kenneth E. Patton, Richard G. Payne, Maria-Alaina I. Rambus, Paulina T. Reaves, Cary B. Russell, Patricia Sari-Spear, Rebecca Shea, John D. Strong, and Gerald Winterlin also made key contributions to this report.

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