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DEFENSE LOGISTICS

Several Factors Limited the Production and Installation of Army Truck Armor during Current Wartime Operations



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Highlights of [GAO-06-160](#), a report to congressional committees

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Why GAO Did This Study

In April 2005, GAO reported on factors affecting the timely production of up-armored high-mobility multi-purpose wheeled vehicles (HMMWV) and add-on armor kits for HMMWVs, as well as other items critically needed by deployed forces during Operation Iraqi Freedom. Due to high interest by Congress and the public regarding vehicle armor, GAO initiated this subsequent engagement to examine issues affecting the production and installation of armor for 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 Department of Defense (DOD) and the Army have taken to improve the timely availability of truck armor. To address these objectives, GAO collected and analyzed supply data for medium and heavy tactical trucks used by Army forces.

What GAO Recommends

Expanding on one of its April 2005 recommendations, GAO is recommending that the Secretary of Defense direct the Army to establish a process to document and communicate all urgent wartime funding requirements for supplies and equipment when identified and the disposition of funding decisions. DOD concurred with the intent of the recommendation.

www.gao.gov/cgi-bin/getrpt?GAO-06-160.

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

What GAO Found

The Army expects to have met its current requirements for the production and installation of truck armor by the end of January 2006 except for fuel tankers. Completion of armor kit installation for tankers is expected by January 2007. Although the Army first identified a requirement for 3,780 truck armor kits for five types of trucks in November 2003, it did not produce all of the kits until February 2005 and did not install the kits to fully meet the requirement until May 2005 – 18 months after the initial requirement was identified. However, by that time, requirements had increased substantially. As subsequent requirements for an additional 7,847 kits, excluding tankers, were identified, the time lag to meet them lessened.

Time to Meet Initial Truck Armor Requirements by Truck Type

Truck type	Initial November 2003 requirement	Date required quantities produced	Date required quantities installed	Total months to fully meet initial requirement
HEMTT	1,080	January 2005	February 2005	15
HET	500	February 2005	March 2005	16
PLS	800	January 2005	May 2005	18
FMTV	1,150	February 2005	March 2005	16
M915	250	December 2004	March 2005	16

Source: GAO analysis of Army data.

Note: Does not include the 5-ton truck or fuel tankers, which had not been identified at the time of the initial November 2003 requirement.

A number of factors contributed to the time to provide truck armor kits to deployed troops, placing them at greater risk as they conducted wartime operations in vehicles not equipped with the preferred level of protection. For example, the Army missed a valuable opportunity to have substantial numbers of truck armor kits available for Operation Iraqi Freedom by not fully capitalizing on approved operational requirements established in 1996. In addition, production time lengthened because contracts were awarded for amounts less than total requirements due to increasing needs for truck armor and inadequate funding. As was the case for other critical wartime shortages that GAO previously examined, sufficient documentation was lacking to determine why funding was not available when needed, limiting effective oversight over funding decisions. Material shortages and limited tanker kit installation rates also impacted the availability of truck armor.

DOD and the Army have taken a number of short-term actions, such as leveraging available funding, to improve truck armor availability during current operations. The Army is also developing a long-term armoring plan to improve the availability of truck armor for future operations.

Contents

Letter		1
	Results in Brief	3
	Background	6
	Army Expects to Have Met Most Truck Armor Requirements by January 2006	11
	Several Factors Lengthened the Time to Provide Truck Armor Kits	13
	DOD and the Army Took Actions to Improve Truck Armor Availability	24
	Conclusions	28
	Recommendation for Executive Action	29
	Agency Comments and Our Evaluation	29

Appendixes

Appendix I: Scope and Methodology		31
Appendix II: Assessment of Truck Armoring Efforts		34
	Heavy Expanded Mobility Tactical Truck	34
	Heavy Equipment Transporter	38
	Palletized Load System	42
	M939 5-Ton Truck	46
	Family of Medium Tactical Vehicles	48
	M915 Truck Family	54
	Tankers	57
Appendix III: Comments from the Department of Defense		61
Appendix IV: GAO Contacts and Staff Acknowledgements		63

Tables

Table 1: Time to Meet Initial Truck Armor Requirements by Truck Type	12
Table 2: Time to Meet Latest Truck Armor Requirements by Truck Type	13
Table 3: Comparison of Types of Vehicles Requiring Armor Kits in 1996, 2003, and 2005 and Quantities of Kits Needed and Available	16
Table 4: Organizations Interviewed during Review	32

Figures

Figure 1: Production and Installation of Truck Armor Kits to Meet Army Requirements	11
----------------------------------------------------------------------------------------	----

Figure 2: Army Truck Armor Requirements, November 2003 through September 2005	20
Figure 3: Availability of Funding Compared to Truck Armor Requirements	21
Figure 4: Heavy Expanded Mobility Tactical Truck	35
Figure 5: Comparison of HEMTT Armor Kit Requirements to Kits Produced and Installed	36
Figure 6: Comparison of HEMTT Armor Kit Requirements to Kits Funded and Ordered	37
Figure 7: Heavy Equipment Transporter	39
Figure 8: Comparison of HET Armor Kit Requirements to Kits Produced and Installed	40
Figure 9: Comparison of HET Armor Kit Requirements to Kits Funded and Ordered	41
Figure 10: Palletized Load System	42
Figure 11: Comparison of PLS Armor Kit Requirements to Kits Produced and Installed	44
Figure 12: Comparison of PLS Armor Kit Requirements to Kits Funded and Ordered	45
Figure 13: M939 5-Ton Truck	46
Figure 14: Comparison of M939 5-Ton Truck Armor Kit Requirements to Kits Produced and Installed	48
Figure 15: FMTV RACK Truck	50
Figure 16: FMTV LSAC Truck	51
Figure 17: Comparison of FMTV Armor Kit Requirements to Kits Produced and Installed	52
Figure 18: Comparison of FMTV Armor Kit Requirements to Kits Funded and Ordered	53
Figure 19: M915 Truck Tractor	54
Figure 20: Comparison of M915 Family of Trucks Armor Kit Requirements to Kits Produced and Installed	55
Figure 21: Comparison of M915 Armor Kit Requirements to Kits Funded and Ordered	57
Figure 22: An M969 Tanker	58
Figure 23: Comparison of Tanker Armor Kit Requirements to Kits Produced and Installed	59

Abbreviations

AR2B	Army Requirements and Resourcing Board
ASBP	Army Strategic Planning Board
CENTCOM	U.S. Central Command
CFLCC	Coalition Forces Land Component Command
DOD	Department of Defense
FMTV	Family of Medium Tactical Vehicles
GSIE	Ground Systems Industrial Enterprise
HEMTT	Heavy Expanded Mobility Tactical Truck
HET	Heavy Equipment Transporter
HMMWV	High-Mobility Multi-Purpose Wheeled Vehicle
IED	Improvised Explosive Device
LSAC	Low Signature Armored Cab
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
ONS	Operational Needs Statement
ORD	Operational Requirements Document
PLS	Palletized Load System
RACK	Radian Armor Crew Kit
TRADOC	Training and Doctrine Command

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United States Government Accountability Office
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March 22, 2006

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

The Honorable Duncan Hunter
Chairman
The Honorable Ike Skelton
Ranking 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 that include improvised explosive devices (IED), mortars, and rocket launchers. During this situation 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 ordnances. 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-armor for trucks and systems for detecting and defeating IEDs.

Since the onset of OIF, we have reported on several supply chain management issues that have impeded support to the warfighter.¹ For example, after visiting the theater in 2003, we provided our preliminary observations on the effectiveness of logistics support during OIF.² Among the problems we observed were the unavailability of spare parts, hundreds of backlogged shipments, and an inability to track shipments at the distribution centers. 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 high mobility multi-purpose wheeled vehicles (HMMWV).³ 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.

Due to high interest by Congress and the public regarding the availability of armor for HMMWVs and other vehicles, we initiated this subsequent engagement under the authority of the Comptroller General of the United States to examine issues affecting the production and installation of armor for medium and heavy trucks used by Army forces during OIF and other ongoing operations in the U.S. Central Command (CENTCOM) area of responsibility.⁴ Our 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 to

¹DOD relies on a number of individual processes and activities, known collectively as supply chain management, to purchase, produce, and deliver products and services to the warfighter during contingency operations. The goal of supply chain management is to deliver the "right items" to the "right place" at the "right time."

²GAO, *Defense Logistics: Preliminary Observations on the Effectiveness of Logistics Activities During Operation Iraqi Freedom*, [GAO-04-305R](#) (Washington, D.C.: Dec. 18, 2003).

³GAO, *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).

⁴CENTCOM 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 OIF, CENTCOM is involved in Operation Enduring Freedom (OEF) 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.

deployed forces, and (3) identify what actions DOD and the Army have taken to improve the timely availability of truck armor.

In conducting this review, we focused on medium and heavy tactical trucks used by Army forces in the CENTCOM area of responsibility, which included those in Iraq and Afghanistan.⁵ We also reviewed the production and installation of truck armor for Marine Corps forces, which we will report separately. To identify the extent to which truck armor was produced and installed to meet identified requirements, we visited numerous DOD and Army 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 armor kits produced and installed onto vehicles equaled the requirement. Based on the information gathered, we identified factors that affected the time to provide truck armor kits to deployed forces. We also identified DOD's and the Army's 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 January 2006 in accordance with generally accepted government auditing standards. A detailed discussion of our scope and methodology is located in appendix I.

Results in Brief

The Army expects to have met its current requirements for the production and installation of truck armor by the end of January 2006 except for fuel tankers. Completion of armor kit installation for tankers is expected by January 2007. Although the Army first identified a requirement for 3,780 truck armor kits for five types of trucks in November 2003, it did not produce all of the kits until February 2005 and did not install the kits to fully meet the initial requirement until May 2005—18 months after the requirement was identified. However, by that time, requirements had increased substantially. As subsequent requirements for an additional 7,847 kits, excluding tankers, were identified, the time lag to meet them lessened. Until add-on armor kits were installed, units in the theater

⁵The Army also developed armor for HMMWVs, a light tactical wheeled vehicle. We examined issues affecting the production 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).

developed their own interim improvised armor of locally fabricated steel armor plates to obtain some level of protection for their vehicles.

We identified a number of factors that contributed to the time to provide truck armor kits to deployed troops, placing them at greater risk as they conducted wartime operations in vehicles that were not equipped with the preferred level of protection. The factors we identified include:

- The Army did not fully capitalize on approved operational requirements for truck armor that were established in 1996. The 1996 requirements were similar to those developed in 2003 in response to experiences in Iraq and Afghanistan, addressing similar threats for most of the same types of trucks. Generally, official requirements such as these lead to the development and production of new systems to address the specified required capabilities. Production of armor kits based on the 1996 requirements may have increased the availability of truck armor for current operations in Iraq and elsewhere in the Middle East.
- The Army's award of contracts to armor contractors for amounts less than the total requirement caused production schedules to be longer than they might have otherwise been. Instead of awarding contracts in a way that maximized production rates, the Army awarded contracts in amounts less than the total requirement because requirements increased due to operational conditions and the Army received its allocation of funding from DOD at less than the total requirement. Funding was not always available to award contracts at the time requirements were identified, but neither DOD nor Army officials could explain or document why increased funding was not provided earlier or how funding decisions were made. In April 2005, we reported that insufficient and delayed funding also contributed to critical wartime shortages of armored vehicle track shoes, lithium batteries, and tires, and that we could not determine why sufficient funding was not provided earlier because adequate documentation of funding requests was not available. Without formal documentation and communication of urgent wartime funding requirements and the disposition of funding decisions, the rationale for funding decisions and the officials and organizations accountable for making those decisions may not be subject to effective oversight by Congress or the Secretary of Defense.
- Material shortages impacted the availability of Army truck armor. For example, production levels for several Army kits were constrained, in part, by shortages of material and components such as steel and door

handles. Further, competition between the Army and Marine Corps for limited contractors and materials exacerbated problems with limited availability of materials.

- Limited installation rates affected the Army's ability to install armor kits onto tankers. The rotation of fuel trucks into the maintenance area as they returned from missions paced the installation of armor. In addition, unique requirements to coat the tankers with a protective chemical limited the numbers of armor installation sites available for armor installation due to the need for controlled environmental conditions. As a result, the total length of time to field tanker armor was stretched out over a longer period.

DOD and the Army have taken several actions to improve truck armor availability. Several short-term solutions to increase the rate of production were instituted during operations in Iraq. For example, to mitigate the effects of funding requirements at less than the total requirements, the Army used money budgeted for other procurement programs to award contracts for production of armor kits before additional armor funds arrived. In addition, Army headquarters also developed the initial armor kit requirements based on emerging needs 5 months before units in the theater formally submitted their requirements for validation, which allowed it to begin seeking funds for armor kits and award contracts for design and production earlier. The Army also expanded its armor installation capacity to increase installation rates. Further, the Joint Chiefs of Staff (Joint Staff) established a team, called the Joint Armor Fusion Cell, to monitor the progress of armoring trucks as well to provide assistance to the Army to expedite the availability of armor kits. For example, the Joint Armor Fusion Cell helped identify and deploy personnel from the Air Force and Navy to perform armor installations in the theater and in the United States, thereby speeding up the availability of truck armor to the units. The Army is also developing a long-term plan to address future truck armoring needs. While we did not evaluate the plan's potential for success, we did note that it is aimed at identifying long-term requirements for truck armor and developing solutions to address these requirements.

We are expanding upon a recommendation in our April 2005 report that was directed at improving the effectiveness of the Army's wartime supply support—to address a broader systemic problem that affected the availability of truck armor. To ensure that funding needs for urgent wartime requirements are identified quickly, requests for funding are well

documented, and funding decisions are based on risk and an assessment of the highest priority requirements, we are recommending that the Secretary of Defense direct the Secretary of the Army to establish a process to document and communicate all urgent wartime funding requirements for supplies and equipment at the time they are identified and the disposition of funding decisions.

In commenting on a draft of this report, the Department of Defense stated it agreed with the intent of our recommendation but stated that it believes the Army's current requirements validation process conforms to the process described in our recommendation. Our work has demonstrated, however, that once requirements are validated, funding must be made available to execute programs to respond to those requirements. Because, as we noted in this report and in April 2005, funding requests from the Army to DOD to resource validated requirements and the corresponding decisions as to the amount and timing of funding to be provided were not adequately documented, we were unable to determine the reasons why funding was not made available to respond to urgent wartime requirements as needed. We continue to believe these events in the funding process for urgent wartime requirements must be fully documented to provide effective program oversight and to ensure funding decisions are made based on risk and an assessment of the highest priority requirements. The Department's responses are reprinted in appendix III and our evaluation of them appears later in this report.

Background

Army convoys carrying supplies and equipment in the CENTCOM area of responsibility have been subjected to deadly attacks by insurgents using IEDs and other weapons. In response to these attacks, the Army 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.

Deployed Army Forces Face a Significant Threat from IEDs

Army convoys operating in the CENTCOM 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 attacks in Iraq, U.S. forces operating in Afghanistan 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—and 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.

Outfitting Army Trucks with Armor

In light of the threat posed by IEDs and other weapons, such as mortars and rocket launchers, the Army has taken several force protection measures to include adding armor to a number of medium and heavy trucks operating in Iraq, and Afghanistan.⁶ The Army’s medium and heavy tactical trucks that are being armored include: M939 5-ton trucks, family of medium tactical vehicles (FMTV), heavy expanded mobility tactical trucks (HEMTT), heavy equipment transporters (HET), palletized load systems (PLS), the M915 truck family, and tankers. Appendix II contains a detailed description of each Army vehicle in addition to a discussion of the armor kit availability and the significant factors that affected armor availability for each truck.

The Army’s medium tactical trucks include the M939 5-ton and FMTV. The M939 tactical truck is a general-purpose military vehicle, primarily designed for tactical, off-road use. The M-939 is a 5-ton capacity, six-wheel drive cargo truck used for transportation of all types of supplies and comes in various vehicle types, including a cargo truck, dump truck, and wrecker. The Army’s FMTV addresses medium tactical-vehicle requirements for unit mobility and unit resupply, and transportation of equipment and personnel.

⁶Other force protection measures taken include the fielding of personal body armor and electronic IED countermeasures, as well as changes to unit level tactics and training.

The FMTV consists of the light medium tactical vehicle, which has a 2.5-ton capacity, and the medium tactical vehicle, which has a 5-ton capacity.

The Army's heavy tactical trucks include the HEMTT, HET, PLS, M915, and tankers. The Army utilizes the HEMTT to provide transport capabilities for the resupply of various combat vehicles and weapons systems. The HET is used to transport, deploy, recover, and evacuate main battle tanks and other heavy tracked and wheeled vehicles to and from the battlefield. The PLS performs long distance and local hauls and unit resupply in the tactical environment to support combat units. The PLS consists of a truck with self-loading capabilities and a trailer. The Army's family of M915 trucks consists of highway tractors used primarily for the long distance transport of containers, which is similar to commercial tractor-trailer trucks.

The Army uses its tankers to haul and dispense bulk fuel. Four models of fuel tankers are involved in the Army's armoring program: the M967, the M969, the M978, and the M1062. The primary component of the tanker armoring effort is a self-sealing coating material that is sprayed onto the exterior of the fuel tank. When a small arms round penetrates the coating material and the fuel tank, the hole self seals and the fuel leak is stopped within minutes. A secondary component is composed of a set of armor panel kits mounted at select locations on the fuel tanker to protect critical equipment that is not protected by the coating material.

Processes for Developing Truck Armor Requirements and Solutions

The Army identified wartime truck armor requirements and initiated a procurement program to develop an armor solution, 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 in the CENTCOM area of responsibility or other installation sites in the United States and Europe.

Process for Developing Wartime Requirements

When a need for new equipment is identified by Army warfighters deployed to Iraq and other CENTCOM locations in support of the global war on terrorism, official requirements for these items are developed through the submission of the Army's operational needs statement (ONS). Army field commanders prepare an ONS, which documents the urgent need for a materiel solution to correct a deficiency or to improve a capability that impacts mission accomplishment. The ONS is sent forward through the unit's chain of command to the Coalition Forces Land Component Command (CFLCC) for theater-level approval, while an information copy is

provided directly to Army headquarters for an initial check to ensure the requested capability and operational concept are clearly stated.

Once approved by CFLCC, the ONS is forwarded to the Office of the Deputy Chief of Staff G-3 at Army headquarters where it is reviewed and validated by the Army Strategic Planning Board (ASPB).⁷ The ASPB is chaired by the G-3, with representatives from other Army headquarters staff offices and major Army commands. In the case of truck armor, once the requirement is validated by the ASPB, it is transmitted to the Program Executive Office-Combat Support and Combat Service Support, which manages the procurement of truck armor through its Project Manager for Tactical Vehicles (Project Manager). Validated requirements are also passed to the Office of the Deputy Chief of Staff G-8 and the Army Budget Office to obtain the necessary funding.

Development of Truck Armor Solutions

To address validated requirements for truck armor, the Army initiated a procurement program to develop an armor solution for its deployed trucks. Procurement is funded through congressional appropriations. However, at the time requirements for current operations were identified in November 2003, there were no truck armor kit procurement programs in place. Consequently, funding for armor kits in the current Army procurement budgets did not exist. Because no funding was available at the time the requirements were identified, the Army obtained funding for its program from a variety of sources. While the Army can reprogram a 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 Army sought approval from the DOD Comptroller and Congress to reprogram funding from other procurement or appropriations

⁷The ASPB was established by the Army on September 14, 2001 in response to the terrorists attacks in New York, Washington, D.C., and Pennsylvania on September 11, 2001. The charter of the ASPB is to manage the Army's rapid transition to a wartime focus as well as sustain the Army's continuing contribution to homeland security and the war against terrorism.

accounts,⁸ requested funding from the DOD-managed Iraqi Freedom Fund,⁹ and requested armor funding through supplemental appropriations.

The Army's approved armor protection for medium and heavy tactical vehicles consisted of add-on armor kits to be installed on vehicles already in use in the theater of operations or prior to deployment. These kits included armor panels and ballistic glass, as well as other components such as air conditioners. For all trucks except the M939 5-ton, the Army awarded contracts to armor companies to produce add-on kits for each type of truck. According to Army officials, as needed production quantities increased, the Army modified these contracts to reflect the additional quantities and revised prices. In the case of the 5-ton truck, the armor kits were produced by the Ground Systems Industrial Enterprise (GSIE), an Army organization of depots and other facilities.¹⁰ Instead of a contract, agreements on quantities and costs for work were provided through Military Inter-departmental Purchase Requests (MIPR), which were issued to GSIE for each new production order. Once armor kits were produced by contractors or Army depots, they were shipped to installation sites in the United States, Middle East, and Europe, where they were installed onto trucks by military or contractor personnel.

⁸The 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 for any funding reprogramming in excess of the \$20 million from the DOD Comptroller, which in turn had to be approved by Congress.

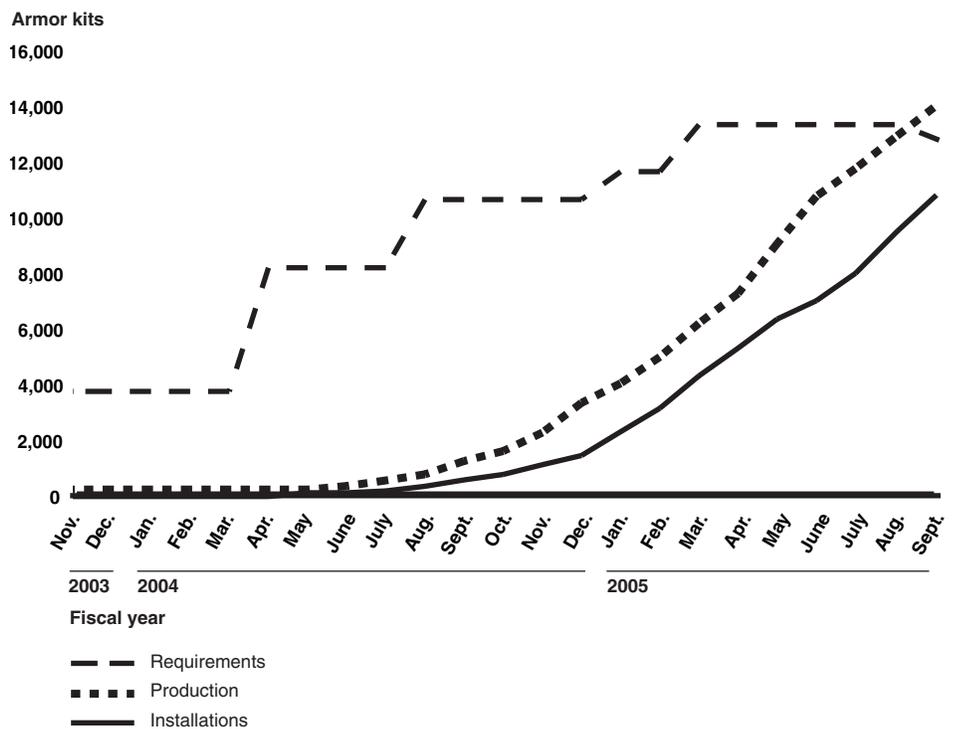
⁹The Iraqi Freedom Fund is a special account providing funds for additional expenses for military forces in Iraq and those operations authorized by Pub. L. No. 107-40 (Sept. 13, 2001), Authorization for Use of Military Force, and other operations and related activities in support of the global war on terrorism.

¹⁰GSIE comprises Anniston Army Depot, Red River Army Depot, Sierra Army Depot, Rock Island Arsenal, Watervliet Arsenal, the Lima Tank Plant (a government-owned, contractor-operated facility), and a business center staff located at Rock Island Arsenal. GSIE's objective is to operate as a single business unit, efficiently using the industrial capabilities of each installation while simultaneously transforming those capabilities to meet the needs of Army forces. GSIE's goal is to continuously improve support to the soldiers and reduce the cost of GSIE products and services.

Army Expects to Have Met Most Truck Armor Requirements by January 2006

The Army expects to have met its current requirements for the production and installation of truck armor by the end of January 2006 except for fuel tankers. Completion of armor kit installation for tankers is expected by January 2007. Figure 1 shows the overall production and installation quantities of truck armor as compared to requirements. The Army's solution to addressing truck armor requirements focused on developing add-on armor kits to be attached to the vehicles. These add-on armor kits included armor panels and ballistic glass, as well as other components such as air conditioners.

Figure 1: Production and Installation of Truck Armor Kits to Meet Army Requirements



Source: GAO analysis of Army data.

Although the Army first identified a requirement for 3,780 truck armor kits for five types of trucks in November 2003, it did not produce all of the kits until February 2005 and did not install the kits to fully meet the initial requirement until May 2005, or 18 months later. As shown in table 1, the

time to produce and install armor kits to meet initial requirements varied by truck type, and ranged from 15 to 18 months. However, as shown in figure 1, by that time requirements had increased substantially. More detailed information on requirements, production, and installation times for each specific truck is provided in appendix II.

Table 1: Time to Meet Initial Truck Armor Requirements by Truck Type

Truck type	Initial November 2003 requirement	Date required quantities produced	Date required quantities installed	Total months to fully meet initial requirement
HEMTT	1,080	January 2005	February 2005	15
HET	500	February 2005	March 2005	16
PLS	800	January 2005	May 2005	18
FMTV	1,150	February 2005	March 2005	16
M915	250	December 2004	March 2005	16

Source: GAO analysis of Army data.

Note: Does not include the 5-ton truck or fuel tankers, which had not been identified at the time of the initial November 2003 requirement.

As subsequent requirements for an additional 7,847 kits, excluding tankers, were identified, the time lag to meet them lessened. The Army now estimates that the total demand for all 11,627 required truck armor kits, excluding tankers, will have been met in January 2006, or 10 months after the latest requirements increase was validated in March 2005.¹¹ Table 2 shows the time needed to complete production and installation of armor kits to meet the latest validated requirements increase from March 2005. The Army estimates that production of a sufficient number of tanker kits to meet requirements will be completed by May 2006, but does not expect to complete installation of tanker kits until January 2007.

¹¹In March 2005 the Army validated a requirement for 13,377 trucks and tankers, which was the last validated requirement for truck armor. However, in September 2005, the total requirement decreased slightly to 12,819 based on revised nonvalidated needs from units in the theater.

Table 2: Time to Meet Latest Truck Armor Requirements by Truck Type

Truck type	Current requirement as of September 2005	Date required quantities produced	Date required quantities installed	Total months to fully meet requirement from March 2005 increase
HEMTT	2,246	September 2005	December 2005	9
HET	663	August 2005	September 2005	6
PLS	944	March 2005	July 2005	4
FMTV	3,377	August 2005	December 2005	9
M915	1,805	December 2005	January 2006 (estimated)	10

Source: GAO analysis of Army data.

Note: Does not include the 5-ton truck, for which requirements decreased in March 2005 or tankers, for which requirements did not increase in March 2005. As of September 2005, the current 5-ton truck armor requirement was 2,592 and the tanker requirement was 1,192.

Before armor kits were available, units operating in the CENTCOM area of responsibility developed their own interim improvised armor, consisting of locally fabricated steel armor plates, to obtain some level of protection for their vehicles. As a result, interim armor with minimum protection standards in accordance with Army policy was in place on some vehicles by the time the preferred add-on armor kits were available for installation. In addition, CFLCC issued a directive in February 2005 stating that no unarmored vehicles would be allowed to operate in Iraq outside of secured forward operating bases. During congressional testimony held in the spring and summer of 2005, Army officials confirmed that this policy had been fully implemented with use of approved interim improvised armor or add-on armor kits.

Several Factors Lengthened the Time to Provide Truck Armor Kits

We identified a number of factors that contributed to the time to provide truck armor to deployed troops. First, the Army did not fully capitalize on a requirement for truck armor that had been identified prior to operations in OIF. Second, availability of armor kits was constrained by the Army's funding of contracts at less than the total requirement. Third, material shortages also affected the availability of armor kits. Finally, limited installation rates lengthened the time to provide armor kits for tankers. As a result, troops were placed at greater risk as they conducted wartime operations in vehicles not equipped with the preferred level of protection.

Army Did Not Fully Capitalize on Truck Armor Requirements Identified Prior to Operations in Iraq

The Army did not fully capitalize on an earlier operational requirement for truck armor that was identified several years before current operations in Iraq began, which caused the Army to lose an opportunity to have a significant number of armor kits already available when operational needs arose in Iraq for this capability. An official requirement for truck add-on armor kits was identified and approved by the Army in 1996 to address threats similar to what deployed forces are currently facing in Iraq. On January 19, 1996, the Army's Training and Doctrine Command (TRADOC) issued an operational requirement document (ORD) for the tactical wheeled vehicle crew protection kit.¹² Generally, official requirements documents lead to the development and production of new systems to address the specified required capabilities.

According to Army officials, the Army developed this ORD because officials recognized that operations in Haiti, Rwanda, and Somalia exposed troops to a civilian threat and led to concerns over countermine protection for supply and troop transport vehicles. The crew protection kit was to provide increased crew survivability in tactical wheeled vehicles against small arms fire, artillery/mortar fire, mines, submunitions, and IEDs where needed while operating throughout an area of operations. The ORD described the threat against U.S. forces usually consisting of small arms, hand portable antitank weapons such as light antitank weapons and rocket propelled grenades, and IEDs. According to the document, tactical wheeled vehicles at that time lacked armor protection to provide crew survivability against these threats. No existing ballistic protection systems had met this requirement, with one exception of the Up-Armored Heavy HMMWV. According to the ORD, the kit's capabilities would enable all units to provide ballistic protection to crews of tactical wheeled vehicles, including most of the same types of trucks being armored today in the Middle East.

Once the ORD was approved, the Army Tank-Automotive Research, Development and Engineering Center built prototype armor kits for the HMMWV and 5-ton truck, and blast testing was also done at Fort A.P. Hill.

¹²During this time, the need for and operational capabilities required of new systems were documented in an ORD, which is a statement containing operational effectiveness, suitability, and related operational parameters for a proposed concept or system. ORDs were approved by the Commander of TRADOC. In 2003, the ORD was replaced by the Capability Development Document and the Capability Production Document in accordance with a new joint requirements determination process as part of the Joint Capabilities Integration and Development System.

The ORD specified a number of kits to be built and available to add on to vehicles as operations dictated the need for them. However, the Army never fully addressed this requirement. The need for armor kits after Somalia never materialized, and, according to Army officials, the ORD was not completed because funding was not available to fully meet the 1996 requirement due to other higher funding priorities in the Army. According to one Army official, given the amount of effort expended to develop and approve the ORD, it is relatively uncommon for an ORD not to be funded through production, especially when research and development funds had been spent, prototypes developed, and blast testing performed.

Even though the 1996 requirement was not fully addressed, a small number of armor kits were produced around this time period for two types of trucks, the HEMTT and the PLS, to support operations in Bosnia.¹³ According to the Army's Project Manager, development of these kits was initiated in response to an ONS from units deployed to Bosnia. The ONS was submitted prior to completion of the ORD. However, these kits did not meet all the protective requirements specified in the ORD, such as providing blast protection. The Bosnia kits were never installed on vehicles and were placed into storage because the need for them was never realized.

The Army's November 2003 armor requirement, developed in response to experiences in Iraq and Afghanistan, addressed the same vehicles confronting similar threats as those found in the January 1996 ORD. This November 2003 requirement for the crew protection kit validated an operational wartime need for add-on armor kits for light, medium, and heavy tactical wheeled vehicles in support of OIF and OEF. The requirement cites the January 1996 ORD as providing the basis for add-on armor and extends the requirement to continue identifying alternative capabilities for development, testing, and procurement. The November 2003 requirement noted that the armor kits are necessary to provide a capability to protect against small arms fire, IEDs, mine blast protection, and artillery fragmentation; and to minimize degradation of the vehicle mission. Army officials in theater modified the November 2003 requirement by changing the distribution of armor and prioritizing armor needs; however, the amounts of armor kits required remained the same. Table 3 shows the 1996 and 2003 requirements, as well as the most recent armor requirements.

¹³These kits included approximately 182 kits for the HEMTT and 32 kits for the PLS.

Table 3: Comparison of Types of Vehicles Requiring Armor Kits in 1996, 2003, and 2005 and Quantities of Kits Needed and Available

Types of vehicles	Quantities of armor kits			
	1996 ORD requirement	Kits available as of November 2003	Initial 2003 requirement	Current 2005 requirement
5-Ton	750	0	0	2,592
HET	50	0	500	663
PLS	50	32	800	944
HEMTT	450	182	1,080	2,246
M915	200	0	250	1,805
FMTV	500	0	1,150	3,377
Tanker	0	0	0	1,192

Source: GAO analysis of Army data.

NOTE: The kits for the HEMTT and PLS were not developed in response to the 1996 ORD. Rather, they were developed in response to anticipated needs for operations in Bosnia and did not meet the blast protection requirements specified in the ORD.

Because not all the kits required under the 1996 ORD were developed, the Army went into Iraq with less protective capability than it might otherwise have done. However, the Army's work done in support of the ORD and the Bosnia kits laid a foundation to meet future truck armor requirements. For example, the limited number of kits developed for military operations in Bosnia was pulled from storage and used in Iraq. Furthermore, according to Army officials, the knowledge gained and the processes for design, research, development, and testing of these kits, as well as the kits themselves, were used to address and meet the need for armor during current operations. Based on these efforts, the Army's Project Manager for truck armor in 2003 had knowledge of the concepts of designing and building armor kits, the necessary materials in terms of weight and protective capabilities, and system performance requirements and technical specifications for ballistic protection. In addition, the 2003 requirement for kits cites the January 1996 ORD as providing the basis for add-on armor.

Army's Awarding of Contracts for Less Than the Total Requirement Constrained Armor Kit Production

The Army's award of armor contracts for quantities less than the total requirement constrained the production of armor kits. The award of contract quantities in amounts less than the total requirements instead of all at one time affected production rates and caused production schedules to be longer than they might otherwise have been. The award of contracts in this manner was, in part, a result of several increases in requirements over time due to changing operational conditions. Another factor that contributed to obtaining less than the total requirement was the delayed flow of funding available for armor kits.

Awarding Contracts at Less Than the Total Requirement Lengthened the Time to Meet Requirements

For all of the Army trucks we reviewed except for the 5-ton truck, the Army's award of contracts for quantities less than the total requirement instead of all at one time caused production schedules to be longer than they might otherwise have been. Contractors tend to size their production levels to the contract orders they have on hand. Thus, larger contract quantities generally mean increased production rates. Larger up-front contracts can affect a contractor's production capacity for a number of reasons. For example, according to one contractor producing armor kits for all four of the Army's heavy trucks, ordering smaller quantities of armor kits caused a lack of continuity for its supply base and fluctuations in kit deliveries. More specifically, the contractor experienced (1) a lack of supplier commitment, which wavered with the uncertainty of future orders; (2) fluctuations in its labor force; (3) constrained ability to make process improvements to expedite production, such as the creation of specialized tooling, due to a short-term focus of work; and (4) insufficient support for investment and facility decisions that would have resulted in more efficient production operations for the contractor and its supply base.

In some cases, increases in requirements caused contracts to be awarded in an intermittent fashion. In other cases, funding was not available to award complete contract quantities to meet requirements at the time requirements were identified. Although it is difficult to determine the exact effects of intermittent contracting on the availability of armor kits, we identified a number of specific cases where it lengthened the production schedule. For example, there were breaks in production for three different types of truck kits (the FMTV, HEMTT, and HET) because the contractors had completed their current contract orders and new orders were not placed early enough to maintain continuous production. In one of these cases regarding an armor kit for the FMTV, the contractor received an additional contract from the Army in December 2004 for 1,049 kits as it neared completion of its current requirement of 771 kits. Although the new

requirement for additional kits was validated by the Army in April 2004, funding was not available to award the new contract until December 2004, which was not early enough to overcome the required 15-week material lead time. As a result, production stopped and new production did not resume until 2 months later. According to the contractor, production could have been maintained or even accelerated if the new contract had been awarded in time to meet the long lead time item requirements.

In the cases of the HEMTT and the HET armor kits, the production lines stopped when the contractor completed the current contract quantities of 1,598 and 665 armor kits respectively. The contractor did not receive additional contract awards of 791 HEMTT kits and 131 HET kits until April 2005, or about a month after completion of the previous contract quantities in March 2005. By that time, production had already stopped, employees and subcontractors were released, and equipment and facility space were given up for other uses. As a result, there was a two and a half month break in production. The reason the additional production quantities were not awarded earlier was that validated requirements did not increase until March 2005, which, according to Army Project Manager officials, was too late to avoid a production stoppage.

In another example of the impact of intermittent contract awards, the initial armor kit production contract for the M915 was awarded in April 2004 for 250 kits, which was based on the validated Army requirement at the time. However, when subsequent contracts for 240 and 136 kits were awarded in September and October 2004 respectively, due to increasing Army requirements, the manufacturer, an Israeli subcontractor to the primary contractor, did not have sufficient capacity to keep up with the demand. This was due, in part, to other commitments the manufacturer already had for producing Marine Corps truck armor. As a result, the production levels for M915 kits were lower than desired based on the new requirements and remained so until July 2005 when the contractor was able to transition production from the Israeli subcontractor to its own facilities in the United States. According to contractor officials, if they had known in the beginning that the total quantities needed by the Army would have been as high as they were, they would have proceeded differently from the outset, such as using a different manufacturer.

In one instance, the quantities of contracts also adversely affected the costs of armor kits. Specifically, the first contract for the FMTV armor kits was awarded in February 2004 for 270 kits. Subsequently, in March 2004, a second contract was placed for 501 kits. According to the contractor, the

Truck Armor Requirements Increased Due to Changing Operational Conditions

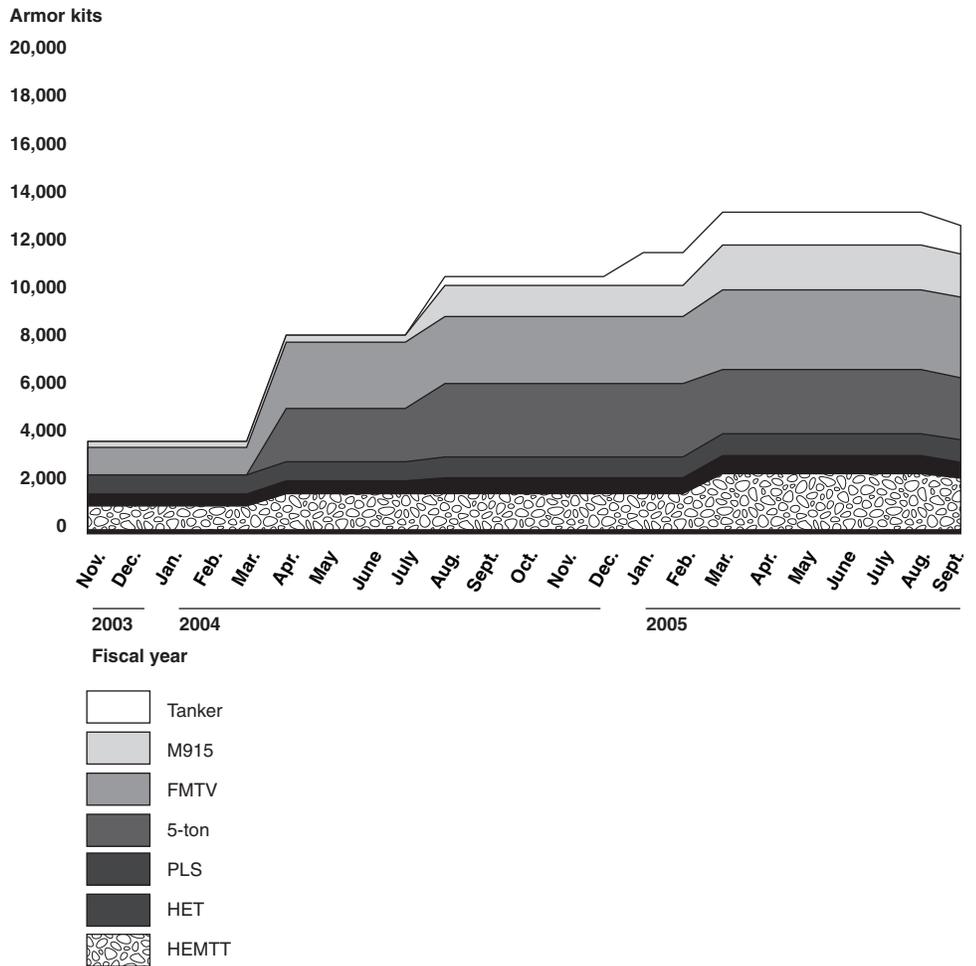
quantity in the initial contract was too low for the Army to receive the highest price break, which was received for the second contract. As a result, the first 270 kits cost the Army over \$1.7 million more than if the two production quantities had been combined. The Army made the two orders separately because funding was not available to award all quantities at one time.

The Army's requirements for truck armor increased numerous times since November 2003 due to changing operational conditions. Army headquarters developed and approved the first requirement for truck armor kits in November 2003 in consultation with Army officials from the theater of operations. Army headquarters validated an operational wartime need for kits in support of OIF and other CENTCOM operations, and approved 3,780 armor kits for medium and heavy tactical wheeled vehicles. According to Army officials, this requirement arose based on an identification of the need for truck armor and an August 2003 requirement from Army units in the theater for additional up-armored HMMWVs. All subsequent requirements for specific numbers of armor kits have been generated by Army theater commanders in the field and forwarded to Army headquarters for approval and funding.

The Army has continued to validate additional requirements for truck armor as the need has evolved and increased over the course of operations to the present, with March 2005 being the most recent date for validated requirements increases. In September 2005, the total requirement for truck armor decreased slightly based on revised unit needs.¹⁴ Army theater level commanders have requested additional kits by documenting their requirements in ONSs. Army headquarters validated these requirements on several occasions between April 2004 and March 2005. Figure 2 illustrates the increases in the Army's requirements for truck armor according to the approval of the multiple ONSs.

¹⁴In March 2005 the Army validated a requirement for 13,377 trucks and tankers, which was the last validated requirement for truck armor. However, in September 2005, the total requirement decreased slightly to 12,819 based on revised nonvalidated needs from units in the theater.

Figure 2: Army Truck Armor Requirements, November 2003 through September 2005



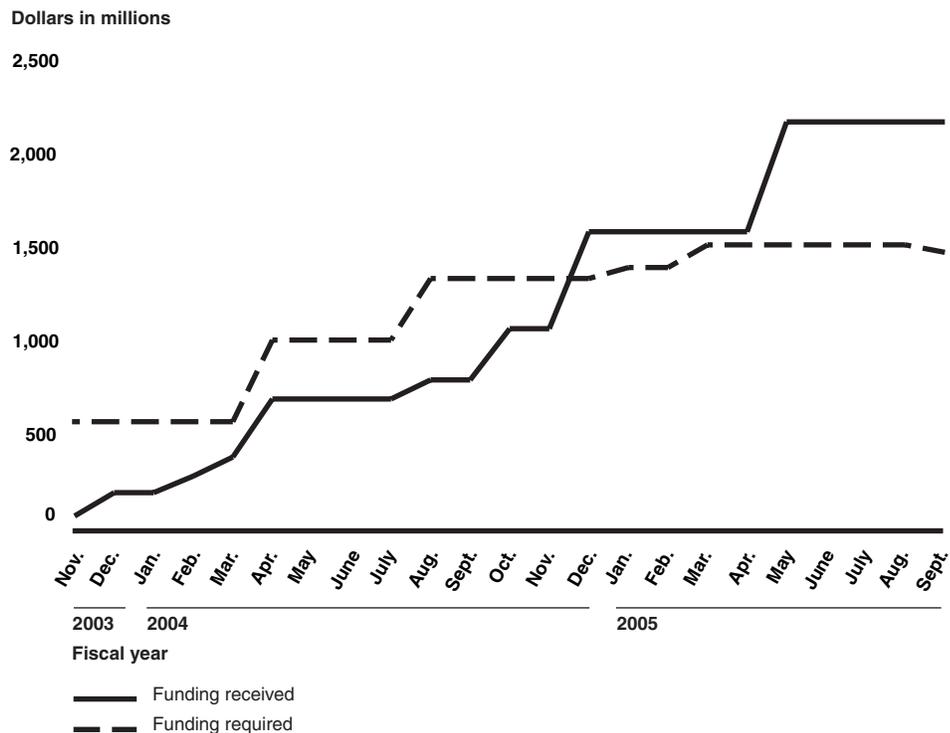
Source: GAO analysis of Army data.

Increasing requirements for truck armor from the first requirement in November 2003 were a direct result of operational conditions. Army officials from the theater of operations attributed these increasing requirements to the enemy’s changing tactics and the increase in frequency and lethality of IEDs. In addition, the number of trucks in Iraq increased over time, which drove a corresponding increase in truck armor requirements. As noted previously, changing requirements necessitated the Army awarding production contracts in an intermittent manner; and, in some cases, led directly to gaps in production levels.

Incremental Funding Lagged Behind Requirements, Delaying Contract Awards

The flow of funding for truck armor kits was initially provided in amounts less than total requirements and lagged significantly behind validated requirements. As a result, the Army could not award contracts for the full required quantities of armor kits at the time requirements were validated. Instead, the Army awarded contracts as funding became available. Figure 3 shows the availability of funding for truck armor kits as compared to armor kit requirements.¹⁵

Figure 3: Availability of Funding Compared to Truck Armor Requirements



Source: GAO analysis of Army data.

Although funding was not always available to award contracts at the time requirements were identified, the Army did provide some advanced funding to the contractors to buy items with long lead times, such as steel and ballistic glass, to mitigate some of the effects of delayed production

¹⁵Funding requirements and availability data provided includes armor kits for HMMWVs as well as medium and heavy tactical trucks.

contracts. To do this, the Army Project Manager used funds designated for the installation of armor kits already under contract until sufficient armor kit production funding was made available. However, according to Army Project Manager officials, they only used this advanced funding approach when they were certain additional funding would be administratively approved, because of the risks associated with using these installation funds and not being able to replace them.

We could not specifically determine why the required funds for armor kits were not made available when the Army first identified the requirements because neither the Army nor DOD could provide us with sufficient records to track when the Department of the Army requested funding from the DOD Comptroller. Special funding requests from the Army to the DOD Comptroller were required because funding for armor kits was not available in the Army's procurement budget. According to Army officials, the Army requested full funding for the truck armor requirements when first identified, but the DOD Comptroller denied the requests and provided only a limited amount of funding over several months. However, the Army was not able to document these funding requests.

Additionally, DOD Comptroller officials were unable to verify or document how much funding the Army asked for and when it was requested. DOD Comptroller officials further noted that although there was sufficient funding available in the Iraqi Freedom Fund to fund all of the truck armor requirements at the time they were initially identified by the Army, there were other competing funding priorities that would have prevented DOD from fully funding the entire truck armor requirement at once. Examples of these competing priorities include other force protection requirements such as the procurement of up-armored HMMWVs and night vision equipment, IED countermeasures, reimbursements to other coalition forces for logistics support, operational costs associated with deploying a Marine Expeditionary Force to Iraq, financing clearance of captured munitions, and funding for various classified programs.

In April 2005, we reported that insufficient and delayed funding also contributed to critical wartime shortages of armored vehicle track shoes, lithium batteries, and tires. However, we could not determine why sufficient funding was not provided earlier because adequate documentation was not available to track when the Army requested the

additional funding from DOD.¹⁶ Without formal documentation and communication of urgent wartime funding requirements and the disposition of funding decisions, the rationale for funding decisions and the officials and organizations accountable for making those decisions may not be subject to effective oversight by Congress or the Secretary of Defense.

Material Shortages Affected Availability of Army Truck Armor Kits

Material shortages negatively impacted the Army's ability to meet requirements for all of its vehicles except for the FMTV and tankers. For example, the contractor producing armor kits for the Army's heavy trucks stated that shortages of armor-grade steel and aluminum constrained production rates for the HEMTT, HET, PLS, and M915 armor kits between July 2004 and November 2004. The shortage was alleviated through Army, Joint Staff, and congressional efforts to work directly with material suppliers to increase the amount of armor plates for the military.

In addition, shortages of material negatively impacted the production of M939 5-ton armor kits, which were produced by the Army depots. According to GSIE officials, the production capacity for 5-ton truck armor kits was established based on the availability of material and components that are used to build the armor kits. When GSIE was asked to accelerate the production of M939 5-ton kits, the lack of availability of certain materials limited GSIE's ability to increase production levels. Examples of items that were difficult to obtain included several sizes and types of steel, door handles, and wiper components.

Army and Marine Corps officials also found themselves in competition for armor contractors and materials, which exacerbated the problems with material shortages. For example, as mentioned previously, the initial manufacturer for the Army's M915 armor kits did not have sufficient capacity to meet needed production levels as requirements increased. This was due, in part, to the fact that the company had committed most of its capacity to producing Marine Corps truck armor by the time additional Army requirements were identified. Although minor schedule improvements were achieved as a result of discussions and agreements on joint schedules between the two services, it was still insufficient to meet the Army's needs. As a result, the Army moved production of the M915 to another company in the United States, which created further delays.

¹⁶GAO, *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).

Limited Installation Rates Constrained the Availability of Tanker Armor Kits

A significant factor that affected the availability of armor kits for tankers was a limited installation rate. For example, the installation of add-on armor kits was slowed by the rate of rotation of trucks into the in-theater installation facilities as they returned from missions. Operational constraints limited the number of vehicles that could be taken out of use at any one time. In addition, unique requirements to coat the tankers with a protective chemical prior to installing armor panels also limited the installation rate. The primary component of the tanker armoring effort is a self-sealing coating material that is sprayed onto the exterior of the fuel tank. When a small arms round penetrates the coating material and the fuel tank, the hole self-seals and the fuel leak stops. The proper application of the chemical coating requires controlled environmental conditions, such as humidity and temperature, which has led to a limited number of spray locations accessible to the Army. Thus, although production of armor kits for tankers is expected to be completed by May 2006, because of these constraints, installation of enough kits to meet requirements is not expected to be finished until 8 months later in January 2007.

DOD and the Army Took Actions to Improve Truck Armor Availability

DOD and the Army have taken a number of actions to improve the timely availability of truck armor. Some of the actions were short-term and were meant to address the immediate armor need for deployed forces in Iraq and other CENTCOM locations. Other efforts are long-term plans designed to improve the overall availability of truck armor for future operations.

DOD and the Services Took Actions to Improve Availability of Truck Armor during Current Operations

DOD and the Army have taken a number of short-term actions to improve the availability of truck armor to meet the needs of forces deployed for OIF and other CENTCOM operations. Examples of these efforts include the following:

- **Leveraging of available Army funds.** The Army's Project Manager for Tactical Vehicles took a number of steps to leverage available funding in an attempt to mitigate the effects of an inadequate funding flow for truck armor. For example, it used funding designated for future armor kit installations to buy long lead time materials and award some contracts for armor kits until additional armor kit funding could be made available. In addition, when the Project Manager received funding for armor kits from Army headquarters, it allocated the funding among all the armor kit contracts to maintain sufficient work flow to keep all

production lines open, rather than fund some truck kits to the full level of requirements. While these efforts may have improved the timely availability of armor kits, as we noted earlier, the inadequate availability of funding still contributed to a longer schedule in many cases.

- **Early identification of Army requirements.** Army headquarters developed the initial requirements for truck armor based on emerging needs before formal requirements were submitted by units in the theater. As noted earlier, the first requirement for truck armor was developed and validated by Army headquarters in November 2003, while the first requirements submitted from units in the theater were not actually validated until April 2004. As a result, the Army was able to begin seeking funding and awarding contracts for design and production of armor kits earlier than if it had waited for an official request from units in the theater.
- **Addition of armor installation sites.** To reduce armor installation time, as requirements and production levels for truck armor increased, the Army expanded its installation capacity in the CENTCOM area of responsibility through the addition of installation sites, going from one initial facility in Kuwait to nine facilities in Kuwait, Iraq, and Afghanistan between August 2004 and July 2005. As indicated in figure 1, during this period, production levels increased dramatically from 220 kits per month in August 2004 to a peak level of almost 1,800 kits per month by May 2005. After increasing the numbers of installation facilities, according to Army officials, total installation capacity has grown from approximately 50 kits per week to more than 350 kits per week.
- **Establishment of Joint Staff fusion cell.** In December 2004, the Joint Staff's Directorate of Logistics established a team, called the Joint Armor Fusion Cell, to monitor the progress of the services' armoring efforts to enhance visibility of the program to DOD and congressional leadership. In addition, the armor fusion cell was established to accelerate the availability of armor kits by identifying and fixing gaps in the supply chain. For example, the Joint Staff armor fusion cell, working with the Army, helped identify and deploy certified welders from the Air Force and Navy to assist with production and installation of armor in the United States and in the CENTCOM area of responsibility, thereby speeding up the availability of truck armor to the units. The cell also worked with the U.S. Transportation Command to increase the use of airlift for armor kits within the CENTCOM area of operations, which

reduced the need for ground transportation and increased the speed of deliveries to armor installation sites.

Army Has Developed a Long-term Plan to Address the Availability of Truck Armor for Future Operations

The Army is taking long-term actions to improve the availability of truck armor for future operations through the development of a long-term armoring plan. While we did not evaluate the plan's potential for success, we did note it is aimed at identifying long-term requirements for truck armor and developing solutions to address these requirements.

The Army's long-term plans, designed to improve the overall availability of truck armor for future operations, are outlined in the Army Tactical Wheeled Vehicle Long Term Armoring Strategy. The Army's G8 division for programming, analysis, and materiel integration tasked TRADOC to develop this plan in January 2005. The Long Term Armoring Strategy incorporates the Army's plan to provide add-on armor to its tactical wheeled vehicle fleet. Under the plan, add-on armor will consist of two kits, one that includes hardware to be placed on the vehicle to receive the armor, and another that contains the actual armor. The plan also includes provisions to facilitate the production and availability of armor. Estimated costs for the armor are based on current armor models that use heavy metals, such as steel and aluminum; however, according to Army program office officials, they are considering the use of lighter metals for greater efficiency but at higher costs.

According to the Long Term Armoring Strategy, its purpose is to demonstrate the Army's deliberate process to outline a path forward and avoid long response times for providing truck armor in the future. The plan further notes that the framework supports a balanced approach for procurement of armoring kits that mitigates risk and enhances safety and force protection. According to the plan, the end state is a tactical wheeled vehicle fleet that provides the commanders with flexibility to increase the protection level when needed and ensures the Army's ability to rapidly acquire additional kits. The initial draft concept was completed in March 2005 and a final plan was presented to the G8 division in June 2005. According to the program office, Army headquarters approved the plan in August 2005 with a few outstanding issues to be resolved. The necessary protection level for trucks is based on the Department of the Army's approved threat assessment, developed by the intelligence community, which spans through 2018. The Long Term Armoring Strategy will be implemented in concert with the Army's Tactical Wheeled Vehicle and

Trailer Modularity and Modernization Strategy,¹⁷ which is aimed at addressing the Army's truck needs through fiscal year 2018.

The Army's long-term 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 to be installed and removed by two crewmen. The B kits will be procured based on operational and training requirements, while all trucks will be outfitted with A kits. The A kits will be installed by 2018 on current trucks during recapitalization and on newly produced vehicles at the factory. The second quarter of fiscal year 2006 is the program manager's proposed deadline to begin installing all trucks with A kits; however, as of September 2005 the date was not finalized. Program officials advocate the use of lighter materials for producing the kits instead of the heavier metals currently being used. According to these officials, lighter materials like ceramics are more expensive but could provide greater efficiencies such as reducing the amount of weight on a vehicle, preventing wear and tear, and allowing for more weight to be apportioned for operational purposes.

The long-term plan includes provisions to facilitate the production and availability of armor in the future. As part of the plan, the Army will own the blueprints for the armor to expand competition from multiple sources and avoid relying on one contractor at critical decision points when more kits are needed. According to Army officials, contractors currently own the blueprints, and the Army's ability to buy quantities on demand could be restricted by the contractors' production capabilities. Technical requirements to facilitate the availability of armor in the future include maximizing the commonality of kit components among vehicles, and ensuring compatibility of the A and B kits with future armor upgrades.

¹⁷The purpose of the Army's Tactical Wheeled Vehicle and Trailer Modularity and Modernization Strategy is to lay out a comprehensive strategy for meeting modularity requirements and modernizing the current tactical wheeled vehicle fleet. The strategy aims to fill shortages of vehicles through new tactical wheeled vehicle procurements; modernize the fleet through recapitalization of existing vehicles and acquisition of new vehicles; conduct future competition for certain trucks in fiscal year 2007; and use advanced concept and technology demonstrations and analysis of alternative results to determine whether to improve the future vehicle fleet by either continuing modernization or beginning a new program.

Army program officials stated that preliminary budget estimates for the armoring plan have been developed and included in the Army's future budget plans for fiscal years 2006 through 2011. However, these estimates are based on the costs of the current armor kits produced with heavy metals and do not include estimates of the costs of lighter armor as advocated by the program office. Final cost estimates and a decision about the types of armor to be used have not yet been finalized.

Conclusions

A number of challenges hindered the Army's ability to provide truck armor in the timeliest manner to its deployed forces operating in the Middle East. While some of these challenges may have resulted from operational conditions in the region that the Army and DOD had little control over, other limitations were a direct result of key decisions and ineffective supply processes within the Army and DOD. The availability of truck armor was limited by the Army's decision not to fully fund previously identified requirements, numerous increases in requirements, the Army's inability to timely obtain funding for current wartime needs from DOD or within its own budget, and limited industrial base resources.

In our prior report examining critical supply shortages during Operation Iraqi Freedom, we recommended that the Army take actions to address two of these same issues.¹⁸ Specifically, we recommended the Army expedite the funding process to support timely and sufficient funding for wartime requirements, and assess the industrial base capacity to minimize acquisition delays. One of these recommendations, to assess the industrial base, would also apply to the Army's approach to armoring trucks. The other related recommendation to improve the timeliness of the funding process was specific to the individual types of supplies we examined, and may not be directly applicable to truck armor as it was written.

The results of both our current and prior work indicate a broader systemic problem of not documenting and communicating urgent wartime funding requirements and the disposition of funding decisions. We reported in April 2005 that funding delays also contributed to critical wartime shortages of armored vehicle track shoes, lithium batteries, and tires, but we could not determine why sufficient funding was not provided earlier because adequate documentation of funding requests was not available.

¹⁸GAO, *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).

Without formal documentation and communication of urgent wartime funding requirements and the disposition of funding decisions, the rationale for funding decisions and the officials and organizations accountable for making those decisions may not be subject to effective oversight by Congress or the Secretary of Defense. It is likely DOD could again face urgent requirements to rapidly develop and produce materiel solutions to improve force capability or protection of deployed forces. Without improving DOD's ability to provide that support to the warfighters in the timeliest manner, deployed military personnel and their missions may be placed at significant risk because they lack the necessary equipment and supplies at the critical times they may be needed.

Recommendation for Executive Action

To ensure funding needs for urgent wartime requirements are identified quickly, requests for funding are well documented, and funding decisions are based on risk and an assessment of the highest priority requirements, we recommend the Secretary of Defense direct the Secretary of the Army to establish a process to document and communicate all urgent wartime funding requirements for supplies and equipment at the time they are identified and the disposition of funding decisions.

Agency Comments and Our Evaluation

In written comments on a draft of this report, DOD agreed with the intent of our recommendation, but stated that it believes the Army Requirements and Resourcing Board (AR2B) process, previously the ASPB process discussed earlier in this report, conforms to the process described in our recommendation. As noted by DOD, the AR2B is a forum where urgent wartime requirements are reviewed, staffed, and validated. However, as demonstrated by our work, once requirements are validated, funding must be made available to execute programs to respond to those requirements. When sufficient funding is not available in the Army's budget for the validated requirement, the Army must seek additional funding through DOD. Because, as we noted in this report and in April 2005, funding requests from the Army to DOD to resource validated requirements and the corresponding decisions as to the amount and timing of funding to be provided were not adequately documented, we were unable to determine the reasons why funding was not made available to respond to urgent wartime requirements as needed. In addition, in April 2005 we also reported that funding requests for critical wartime supplies such as armored vehicle track shoes, lithium batteries, and tires also could not be tracked from the Army Materiel Command, where they originated, to Army

headquarters for validation, which precluded our ability to determine why funding for these items lagged behind the time the need was identified. We continue to believe these events in the funding process for urgent wartime requirements must be fully documented to provide effective program oversight and to ensure funding decisions are made based on risk and an assessment of the highest priority requirements. DOD's comments are reprinted in appendix III. DOD also provided technical comments that have been incorporated where appropriate.

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. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix IV.

A handwritten signature in black ink, appearing to read 'W. Solis', with a long horizontal flourish extending to the right.

William M. Solis, Director
Defense Capabilities and Management

Scope and Methodology

To address our objectives, we examined the Army's programs to produce and install armor for each of its medium and heavy tactical wheeled vehicles, or trucks, operating in the U.S. Central Command (CENTCOM) area of responsibility, which included Iraq and Afghanistan.¹ The Army trucks we examined included the family of medium tactical vehicles (FMTV), heavy expanded mobility tactical truck (HEMTT), heavy equipment transporter (HET), palletized load system (PLS), M915 truck tractor, M939 5-ton tactical truck, and fuel tankers. 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, we interviewed DOD and Army officials involved in identifying armor requirements, providing funding, and acquiring truck armor for deployed forces. We also met with truck armor contractors from the industrial base. A complete list of the DOD and other organizations that we met with during this review is found in table 4. We also collected and analyzed armor supply data such as requirements, funding levels, contract order awards, production levels, and installations for the period November 2003 (when truck armor requirements were first formally identified) through September 2005, which we obtained from the Army based on source documents. We considered the armor requirement met for each type of truck when the quantity of armor kits installed onto vehicles equaled the requirement. We did not, however, visit the CENTCOM area of responsibility to validate the extent to which armor kits had been installed and were actually in use by trucks.

¹The Army also developed armor for HMMWVs, a light tactical wheeled vehicle. We examined issues affecting the timely production 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).

**Appendix I
Scope and Methodology**

Table 4: Organizations Interviewed during Review

Office of the Under Secretary of Defense (Comptroller), Arlington, Va.
Joint Staff, Directorate of Logistics, Arlington, Va.
U.S. Army
Assistant Secretary of the Army for Financial Management and Comptroller, Arlington, Va.
Office of the Deputy Chief of Staff (Logistics), Arlington, Va.
Office of the Deputy Chief of Staff (Operations), Arlington, Va.
Office of the Assistant Secretary of the Army for Acquisitions, Logistics, and Technology, Arlington, Va.
Program Executive Office Combat Support and Combat Service Support, Project Manager Tactical Vehicles, Warren, Mich.
U.S. Army Central Command/Coalition Forces Land Component Command (Logistics), Fort McPherson, Ga.
U.S. Army Materiel Command
Office of the Deputy Chief of Staff (Operations), Fort Belvoir, Va.
Tank-automotive and Armaments Command, Warren, Mich.
Ground Systems Industrial Enterprise, Rock Island, Ill.
U.S. Army Training and Doctrine Command, Fort Monroe, Va.
U.S. Army Transportation Center, Fort Eustiss, Va.
U.S. Army Reserve Command, Fort McPherson, Ga.
National Guard Bureau, Arlington, Va.
Defense Contract Management Agency, District West, Phoenix, Ariz.
Armor Holdings, Inc. and Simula, Inc., Phoenix, Ariz.
Stewart and Stevenson, Inc., Sealy, Tex.
Radian, Inc., Troy, Mich.
VSE Corporation, Alexandria, Va.

Source: GAO.

To determine what factors affected the time to provide truck armor to deployed forces, we analyzed the armor supply data we collected to identify trends and isolate factors that impacted the timeliness of producing and installing armor. We also met with and collected additional information from DOD, Army and armor contractor officials involved with the armor acquisition programs to evaluate the significance of these factors and to determine the extent of their impact on the availability of truck armor.

To determine what actions DOD and the Army have taken to improve the availability of truck armor for current and future operations, we interviewed military service and Joint Staff personnel to identify short- and

long-term efforts to address supply shortages. We also reviewed documentation 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 it with other information gathered from other military service organizations and armor contractors, and by reviewing existing documentation about the data and the sources that produced the data. We determined that the data were sufficiently reliable for the purposes of this report. We performed our audit from April 2005 through January 2006 in accordance with generally accepted government auditing standards.

Assessment of Truck Armoring Efforts

We assessed the armoring efforts for each of the following medium and heavy trucks: heavy expanded mobility tactical trucks, heavy equipment transporters, palletized load systems, M939 5-ton trucks, family of medium tactical vehicles, M915 truck family, and tankers. For these seven types of trucks we reviewed, each assessment provides the status of the armoring efforts at the time of our review. The profile presents a general description of the truck and the approach to developing armor solutions. The assessments also include our evaluation of the extent to which armor kits were produced and installed to meet identified requirements and the significant factors that affected armor availability.

The Army's efforts to armor its heavy and medium tactical wheeled vehicles have been hindered by awarding contracts for quantities less than the total requirement, material shortages, and a limited rate of installation. The Army's efforts to armor its trucks experienced 12 to 18 month delays between when initial requirements were identified and when the initial requirements were met, although requirements for all vehicles increased over time such that by the time the initial requirements were met, the actual requirements were in excess of that initial amount. The schedule for contract orders constrained the Army's ability to meet requirements for all vehicles except 5-ton trucks. Material shortages negatively impacted the Army's ability to meet requirements for all vehicles except for medium tactical vehicles and tankers. Limited installation rates constrained the availability of tanker armor.

Heavy Expanded Mobility Tactical Truck

The Army uses its heavy expanded mobility tactical truck (HEMTT) to provide transport capabilities for the resupply of various combat vehicles and weapons systems. Figure 4 shows an example of a HEMTT. To protect the HEMTT crew from enemy fire in Iraq, the Army contracted with Simula Inc. to develop and build add-on armor kits for installation on HEMTTs. The Army's armoring program involves applying armor kits to 2,705 HEMTTs.

Figure 4: Heavy Expanded Mobility Tactical Truck



Source: U.S. Army.

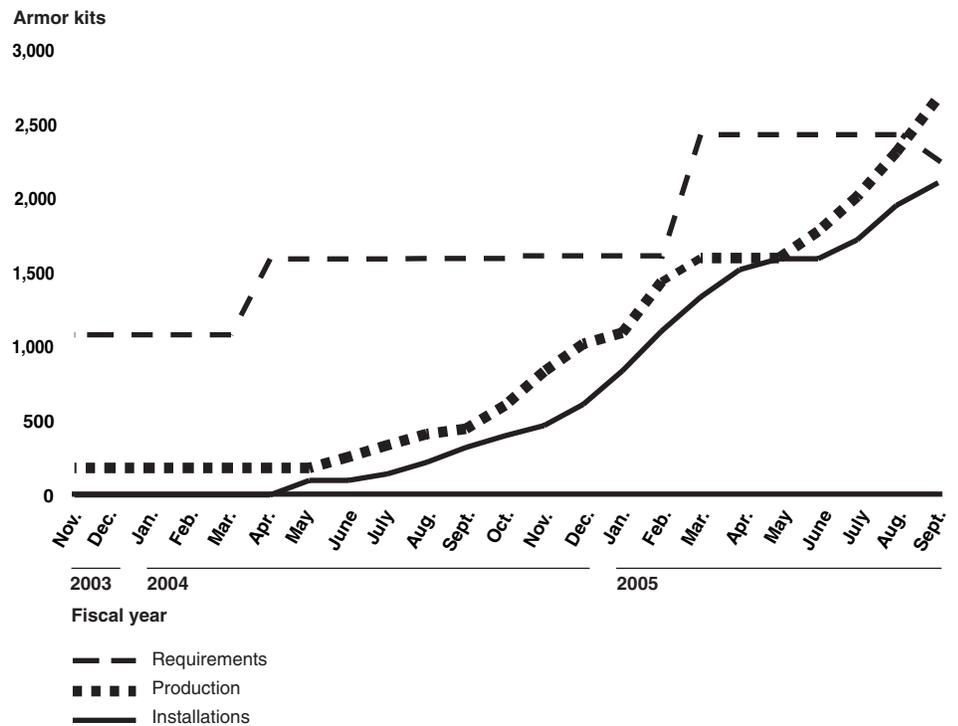
Simula developed about 180 armor kits for the HEMTT in 1996 to support operations in the Balkans. However, the kits were placed in storage and never actually used. When armor requirements were identified for operations in Iraq, the Army and Simula retrieved and tested the stored kits and subsequently shipped them to southwest Asia for use in Iraq. In February 2004, the Army contracted with Simula to begin production of new kits.

Extent Armor Kits Were Produced and Installed to Meet Identified Requirements

Requirements for 1,080 HEMTT armor kits were first identified in November 2003, but a sufficient number of kits to meet that requirement were not installed until February 2005, or 15 months after the first requirement was established. Identified requirements continued to grow to a level of 2,430 armor kits by March 2005, but dropped slightly in September 2005 to 2,246. However, as of September 2005 the total amount of kits installed was 2,088, or 158 fewer than the quantity required. Figure 5 compares the time elapsed from the identification of armor kit requirements to the time when kits were produced and installed. According

to Army officials, the total number of required armor kits was installed by December 2005.

Figure 5: Comparison of HEMTT Armor Kit Requirements to Kits Produced and Installed



Source: GAO analysis of Army data.

Significant Factors Affecting Availability of Armor Kits

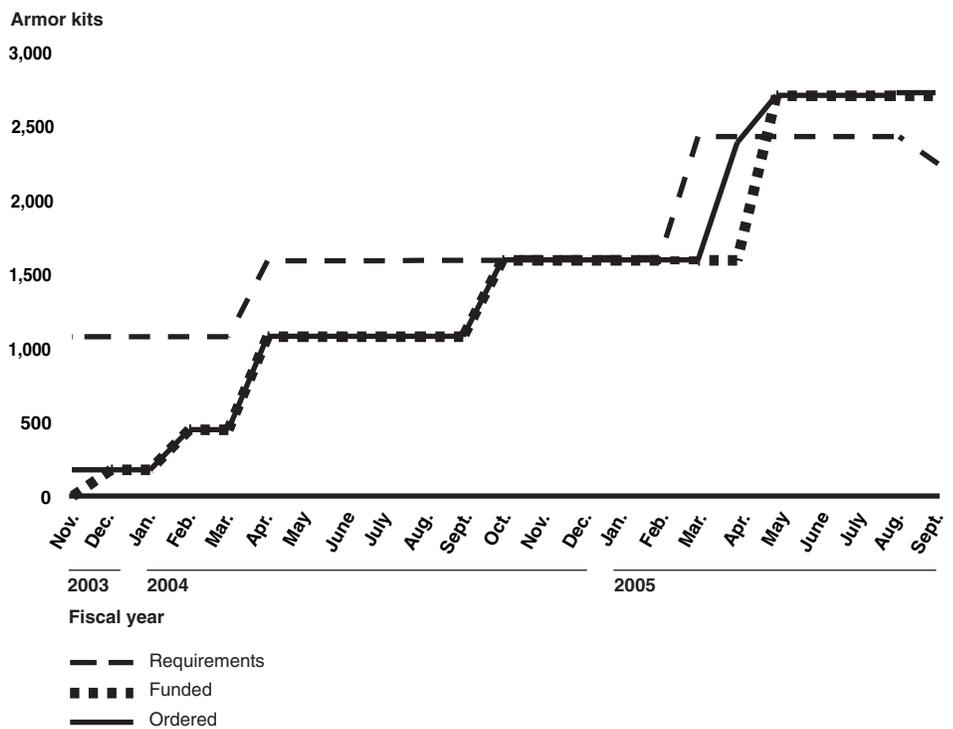
Two significant factors affected the availability of armor kits for the HEMTT. First, the Army's lack of timeliness of contract awards over the life of the program constrained the overall production schedule. Second, a shortage of key materials, specifically steel and aluminum negatively impacted the contractor's ability to maximize production in the early stages of the program.

Contracts Constrained Production

The Army issued five contracts for HEMTT armor kits, which affected the contractor's ability to produce more kits faster. For example, according to contractor officials, they have not had capacity constraints in the building

of HEMTT armor kits; however, they sized production capacity to meet the quantities in the contract that the contractor had been awarded. Therefore, production levels were lower than they could have been if the contractor had received a contract for larger quantities of kits upfront, which prevented production of more of the kits sooner. One reason for the Army's use of a contract in this manner was the fact that funding was received in amounts less than the total requirements and initially lagged several months behind requirements. As shown in figure 6, the availability of funding affected the pace of contract awards.

Figure 6: Comparison of HEMTT Armor Kit Requirements to Kits Funded and Ordered



Source: GAO analysis of Army data.

Another reason for the lower quantity of contract orders was the changing requirements for HEMTT armor kits. For example, armor kit production output for the HEMTT dropped to zero in April and May because the contractor had completed production for the current requirement. However, subsequent contract orders were awarded after the contractor

had ceased production. By the time that the contractor had received the last two contracts for 791 and 319 HEMTT armor kits, respectively, production had already stopped, employees and sub-contractors were released, and equipment and facility space were given up for other uses. Consequently, production of the 791 and 319 kits had to wait about two months until the contractor could restart this industrial base.

Although an additional requirement had been identified in March 2005, a contract to meet this requirement was not awarded until April 2005, which was not soon enough to prevent the stoppage of the production line. According to the Army's program manager, to prevent a production stoppage the requirement would have had to be identified and the contract order issued several months earlier.

Material Shortages Negatively Impacted Production

A shortage of armor materials, specifically steel and aluminum, negatively impacted the HEMTT armor kit program. Shortages of high hard armor steels and aluminum negatively affected the start up and pace of production through the end of 2004. The material shortages were eventually rectified by the intervention of the Army's Tactical Wheeled Vehicle Office to set priorities and by various congressional staff appealing directly to the material suppliers.

Heavy Equipment Transporter

The heavy equipment transporter (HET) is a system used by the Army to transport, deploy, recover, and evacuate main battle tanks and other heavy tracked and wheeled vehicles to and from the battlefield. The HET system consists of a truck tractor and HET trailer, as shown in figure 7. The Army's armoring effort involves applying armor to a total of 796 HETs. In April 2004, the Army contracted with Simula Inc. to begin producing armor kits for the HET.

Figure 7: Heavy Equipment Transporter

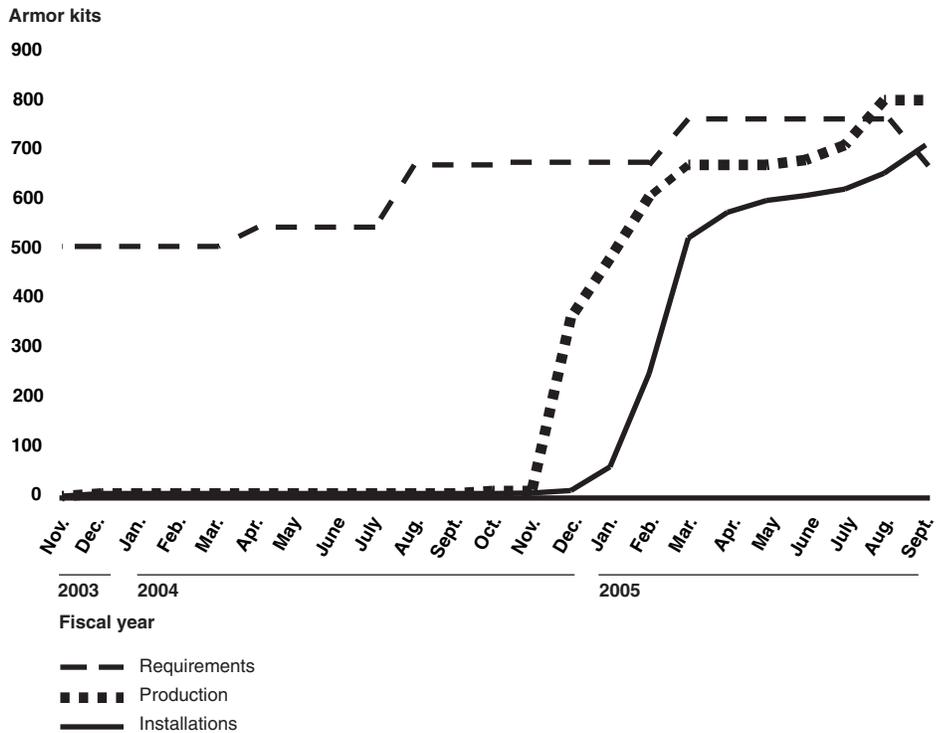


Source: U.S. Army.

Extent Armor Kits Were Produced and Installed to Meet Identified Requirements

Requirements for 500 HET armor kits were first identified in November 2003; however, a sufficient number of kits to meet that requirement were not installed until March 2005, or 16 months after the first requirement was established. Identified requirements continued to grow to 758 by March 2005, but dropped in September 2005 to 663. As of September 2005 the total number of kits installed was 700, or 37 greater than the quantity required. Figure 8 compares the time elapsed from the identification of armor kit requirements to the time when kits were produced and installed.

Figure 8: Comparison of HET Armor Kit Requirements to Kits Produced and Installed



Source: GAO analysis of Army data.

Significant Factors Affecting Availability of Armor Kits

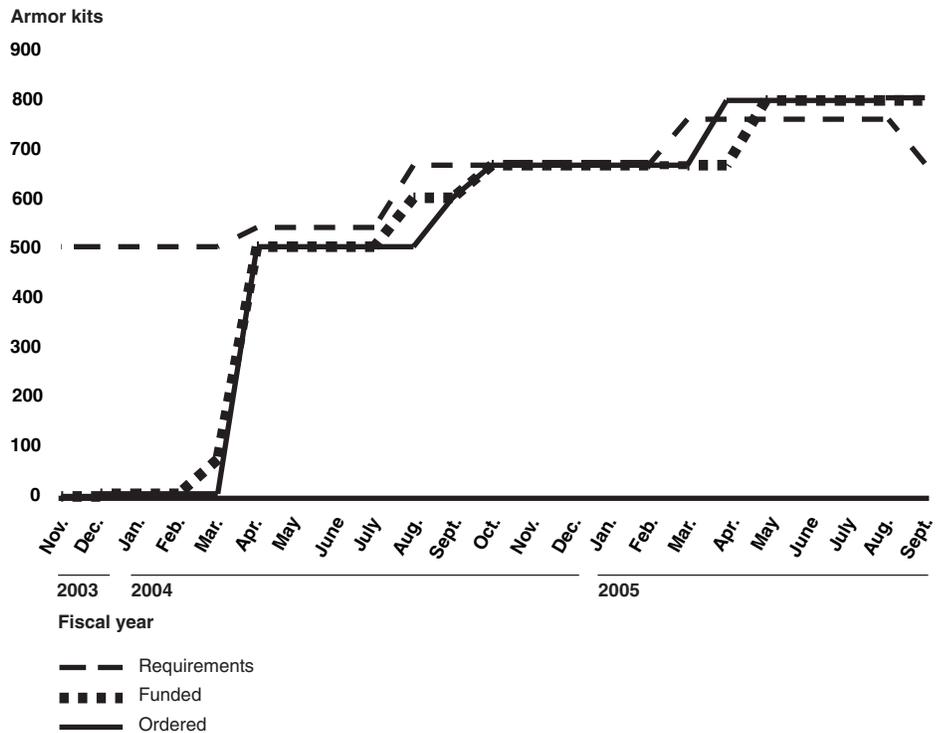
Two significant factors affected the contractor’s ability to produce armor kits for the HET. First, the award of contracts over the armoring program’s life and a lack of contractor visibility into upcoming contracts affected HET production. Second, the HET armoring program was also negatively impacted by a material shortage.

Contracts Constrained Production

The Army issued four contracts for the HET, which lagged behind requirements. This limited the contractor’s ability to maximize production of HET kits. Specifically, contractor officials told us that they did not have capacity constraints in the building of HET armor kits; however, they sized production capacity to meet the quantities in the contract orders that they had been awarded. Therefore, production levels were lower than they could have been if the contractor had received contract orders for larger

quantities of kits upfront, which prevented production of more of the kits sooner. Significant reasons for awarding less than the total requirements were changing requirements and delayed and less than the total funding. Figure 9 demonstrates the relationship among timing of requirements, funding, and contracts.

Figure 9: Comparison of HET Armor Kit Requirements to Kits Funded and Ordered



Source: GAO analysis of Army data.

A lack of contractor visibility into upcoming contract awards also affected HET production. Specifically, the Army awarded a contract for 131 additional HET add-on-armor kits in April 2005. However, in February 2005 the contractor's supply base had completed production for HET components related to the previous contract order for 66 HET kits. Consequently, the supply base required two months to reinitiate production of these components from a cold start. If the contractor had had visibility into the upcoming contract, it could have maintained the needed supply base and reduced production time for the additional 131 HETs by 2 months.

Material Shortages Negatively Impacted Production

The HET armoring program was also negatively impacted by a material shortage. The shortage of materials, specifically of high-hard armor steels and aluminum, affected the start up of heavy tactical vehicle contract orders and the pace of production through the end of 2004. The material shortages were eventually rectified by the intervention of the Army's Tactical Wheeled Vehicle Office to set priorities and by various congressional staff appealing directly to the material suppliers.

Palletized Load System

The Army's palletized load system (PLS) performs long distance and local haul, and unit resupply in the tactical environment to support combat units. The PLS is supposed to facilitate the rapid movement of combat configured loads of ammunition as well as all classes of supplies and containers. The PLS consists of a truck with self-loading capabilities and a trailer, as shown in figure 10.

Figure 10: Palletized Load System



Source: U.S. Army.

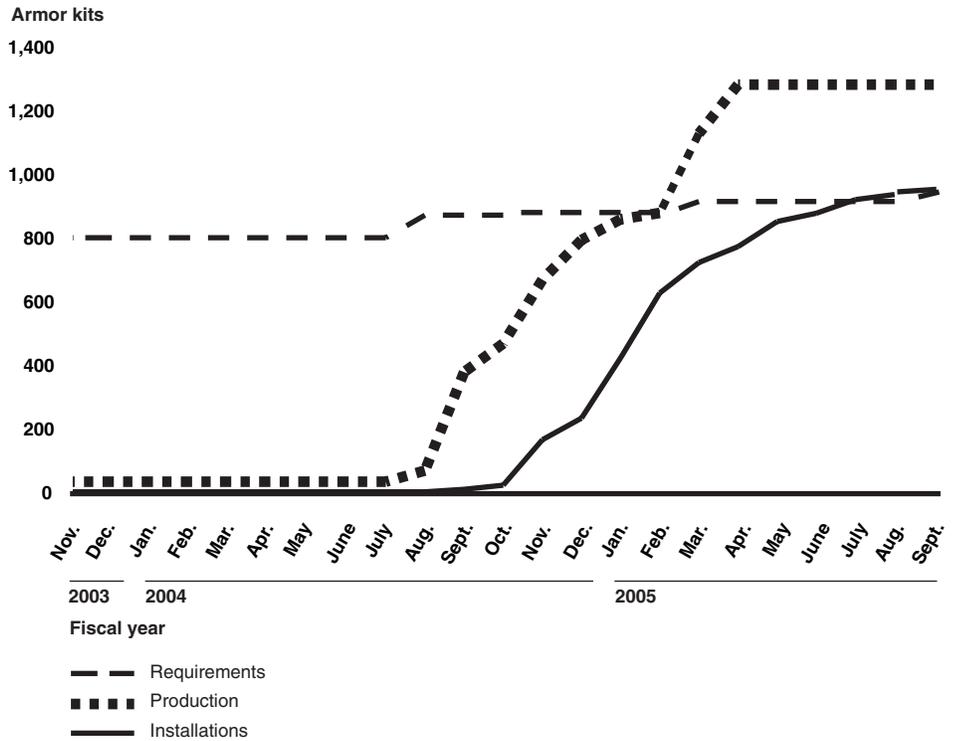
According to contractor officials, the Army's Tank-Automotive Research, Development and Engineering Center had developed and built around 30 armored kits to support operations in the Balkans; however, the kits were placed in storage and never used. Subsequently, when armor requirements

were identified for operations in Iraq, the Army retrieved the kits from storage and shipped them to southwest Asia for use in Iraq. In February 2004, the Army issued contract orders to Simula Inc. to produce additional PLS armor kits. Simula Inc. has completed production of a total of 1,282 armor kits, which satisfies the current requirement for 914 armor kits and provides 368 spare PLS armor kits for future requirements.

**Extent Armor Kits Were
Produced and Installed to
Meet Identified
Requirements**

Requirements for 800 PLS armor kits were first identified in November 2003; however, a sufficient number of kits to meet that requirement were not installed until May 2005, or 18 months after the first requirement was established. By March 2005, the identified requirements had increased by 114, which were met in July 2005. In September 2005, the identified requirements increased again by 30, which were met in September 2005. Figure 11 compares the time elapsed from the identification of armor kit requirements to the time when kits were produced and installed. In anticipation of a greater requirement, the Army program office ordered 338 kits above the Army's current requirement.

Figure 11: Comparison of PLS Armor Kit Requirements to Kits Produced and Installed



Source: GAO analysis of Army data.

Significant Factors Affecting Availability of Armor Kits

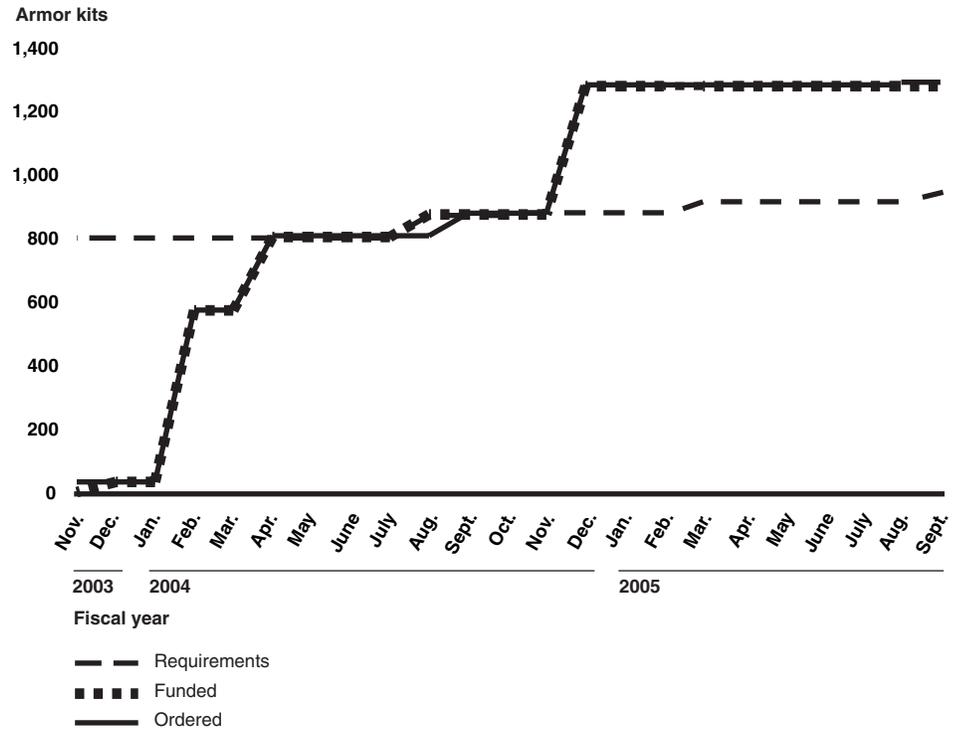
Two significant factors affected the availability of armor kits for the PLS. First, the Army’s use of contracts for quantities less than total requirements over the life of the program constrained the overall production schedule. Second, a shortage of key materials, specifically steel and aluminum, negatively impacted the contractor’s ability to maximize production.

Contracts Constrained Production

The Army issued four contracts for PLS kits, which initially lagged behind requirements and affected the contractor’s ability to maximize the production of PLS kits. According to contractor officials, they have not had capacity constraints in the building of PLS armor kits; however, they sized production capacity to meet the quantities in the contracts that the contractor had been issued. Therefore, production levels were lower than they could have been if the contractor had received contracts for larger quantities of kits upfront, which prevented the production of more of the

kits sooner. Significant reasons for awards for less than the total requirements were changing requirements and delayed and less than total funding. Figure 12 demonstrates the relationship among timing of requirements, funding, and contracts.

Figure 12: Comparison of PLS Armor Kit Requirements to Kits Funded and Ordered



Source: GAO analysis of Army data.

Material Shortages Negatively Impacted Production

The PLS armoring program was also negatively impacted by material shortages. The shortage of materials, specifically of high-hard armor steels and aluminum, affected the start up of heavy tactical vehicle contract orders and the pace of production through the end of 2004. The material shortages were eventually rectified by the intervention of the Army's Tactical Wheeled Vehicle Office to set priorities and by various Congressional staff appealing directly to the material suppliers.

M939 5-Ton Truck

The Army's M939 5-ton tactical truck is a general-purpose military vehicle, primarily designed for tactical, off-road use. The M-939 is a 5-ton capacity, six-wheel drive cargo truck used for transportation of all types of supplies and comes in various vehicle types, including a cargo truck, dump truck, and wrecker. Figure 13 shows an example of an M-939 5-ton truck.

Figure 13: M939 5-Ton Truck



Source: U.S. Army.

The M939 5-ton truck armoring effort includes manufacturing armoring kits for 3,000 5-ton trucks at six army facilities through a program manager agreement with the Army's Ground Systems Industrial Enterprise (GSIE).¹

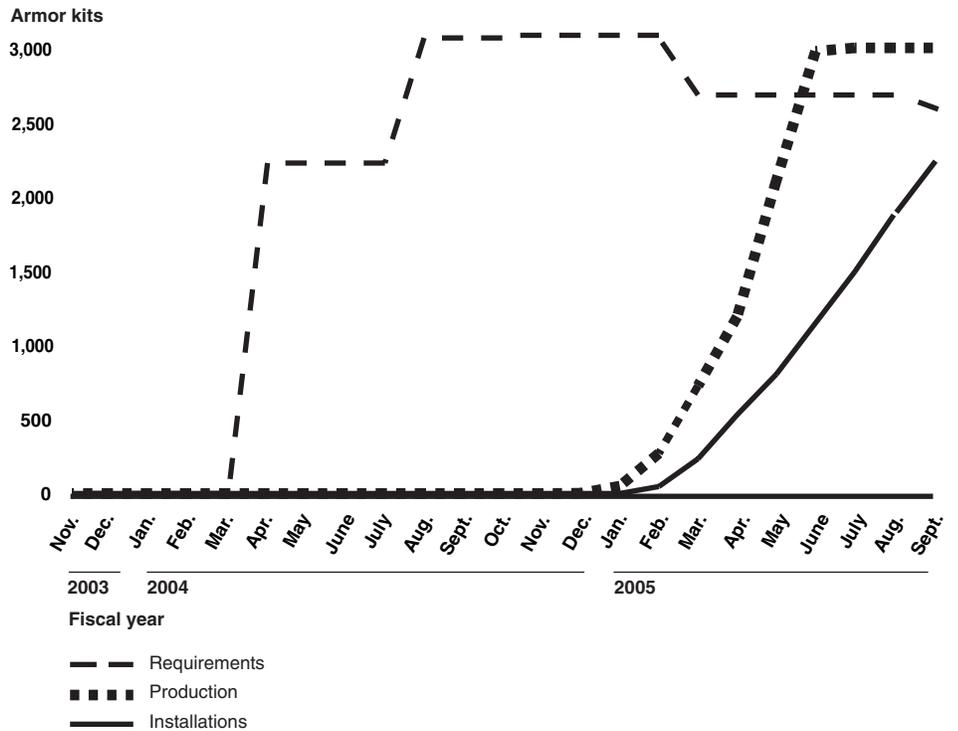
¹GSIE is composed of Anniston Army Depot, Red River Army Depot, Sierra Army Depot, Rock Island Arsenal, Watervliet Arsenal, the Lima Tank Plant (a government-owned, contractor-operated facility), and a business center staff located at TACOM Rock Island. GSIE's objective is to operate as a single business unit, efficiently utilizing the industrial capabilities of each installation, while simultaneously transforming those capabilities to meet the needs of the Army.

GSIE began producing truck kits in December 2004 and completed the last kits in July 2005.

Extent Armor Kits Were Produced and Installed to Meet Identified Requirements

Requirements for 2,229 M939 5-ton truck armor kits were first identified in April 2004; however, a sufficient number of kits to meet that requirement were not produced until June 2005, or 14 months after the first requirement was established. As of September 2005, 2,224 kits had been installed. Identified requirements grew to 3,073 by August 2004, but dropped 2,688 by March 2005, and dropped again slightly in September 2005 to 2,592. By June 2005 a sufficient quantity of kits had been produced to meet those requirements. Figure 14 compares the time elapsed from the identification of armor kit requirements to the time when kits were produced and installed. The Army estimated the required quantity of kits would have been installed by January 2006. According to GSIE officials, GSIE does not anticipate any further production orders for the M939 armor kits.

Figure 14: Comparison of M939 5-Ton Truck Armor Kit Requirements to Kits Produced and Installed



Source: GAO analysis of Army data.

Material Shortages Negatively Impacted Availability of Armor Kits

Shortages of material negatively impacted the production of M939 5-ton armor kits. According to GSIE officials, the production capacity for the 5-ton truck armor kits was established based on the availability of material and components that are used to build the armor kits. When GSIE was asked to accelerate the production of M939 5-ton kits, the lack of availability of certain materials limited GSIE's ability to increase the production quantity of the armor kit. Examples of items that were difficult to obtain included armor grade steel, door handles, and wiper components.

Family of Medium Tactical Vehicles

The Army's family of medium tactical vehicles (FMTV) addresses medium tactical-vehicle requirements for unit mobility and unit resupply, and transportation of equipment and personnel. The FMTV consists of the Light Medium Tactical Vehicle, which has a 2.5-ton capacity, and the Medium

Tactical Vehicle, which has a 5-ton capacity. Variants of the FMTV include cargo trucks and tractor, van, wrecker, and dump truck models. The FMTV armoring effort involves producing a total of 3,890 armor kits.

The FMTV armoring production is split between two separate contractors, Radian Inc. and Stewart and Stevenson Inc. The Army's Tank-Automotive Research, Development and Engineering Center designed and produced a small number (approximately 35) of FMTV armor kits with components that bolt onto the cab. In March 2003, the Army arranged for Radian to help with the installation of these kits onto vehicles. In February 2004, Radian received a contract to produce 270 kits based on the Army design. The kit being produced by Radian is called the Radian Armor Crew Kit (RACK). Figure 15 shows an example of an FMTV RACK truck. Stewart and Stevenson produces an armored cab, called the Low Signature Armored Cab (LSAC), that replaces the FMTV cab in its entirety. Figure 16 shows an example of an FMTV LSAC truck. On its own initiative, in 2002, Stewart and Stevenson developed an FMTV armored cab design to protect against mine blasts. Subsequent to its first armored cab design, Stewart and Stevenson modified its design based on the emerging threats in Iraq, and in October 2004, after completing design and testing, received its initial contract from the Army to produce 385 LSAC cabs.

Figure 15: FMTV RACK Truck



Source: U.S. Army.

Figure 16: FMTV LSAC Truck

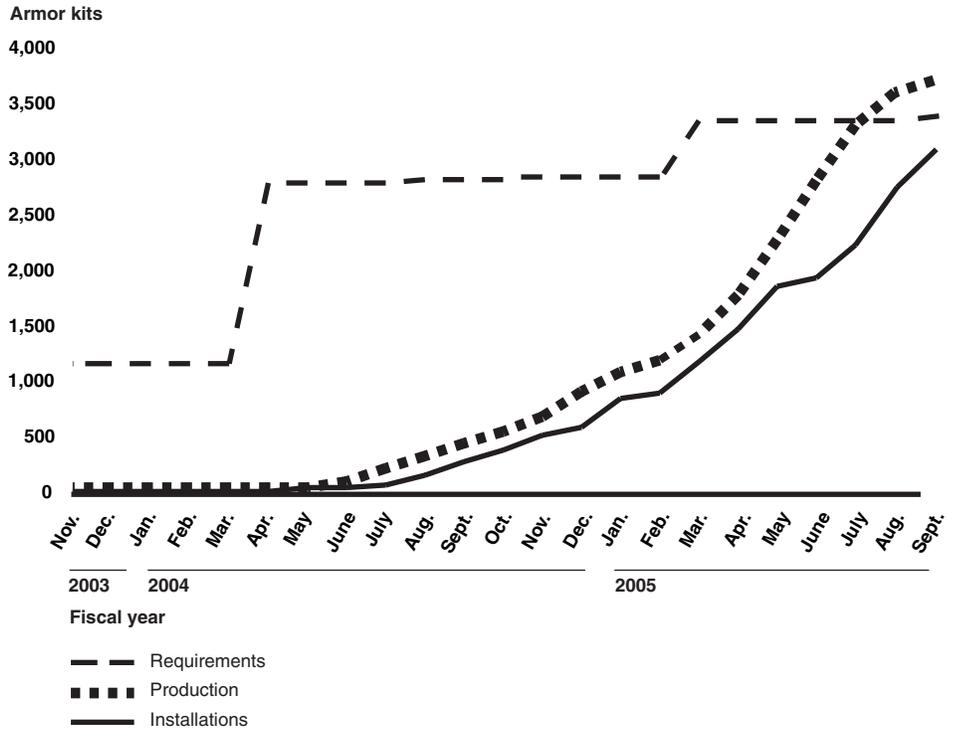


Source: U.S. Army.

Extent Armor Kits Were Produced and Installed to Meet Identified Requirements

Requirements for 1,150 FMTV armor kits were first identified in November 2003; however, a sufficient number of kits to meet that requirement were not installed until March 2005, or 16 months after the first requirement was established. Identified requirements continued to grow to 3,335 by March 2005, and again to 3,377 by September 2005. However, as of September 2005 only 3,053 RACK and LSAC kits had been installed, or 324 fewer than the quantity required. Figure 17 compares the time elapsed from the identification of armor kit requirements to the time when kits were produced and installed. According to Army officials, the total number of required armor kits was installed by December 2005.

Figure 17: Comparison of FMTV Armor Kit Requirements to Kits Produced and Installed



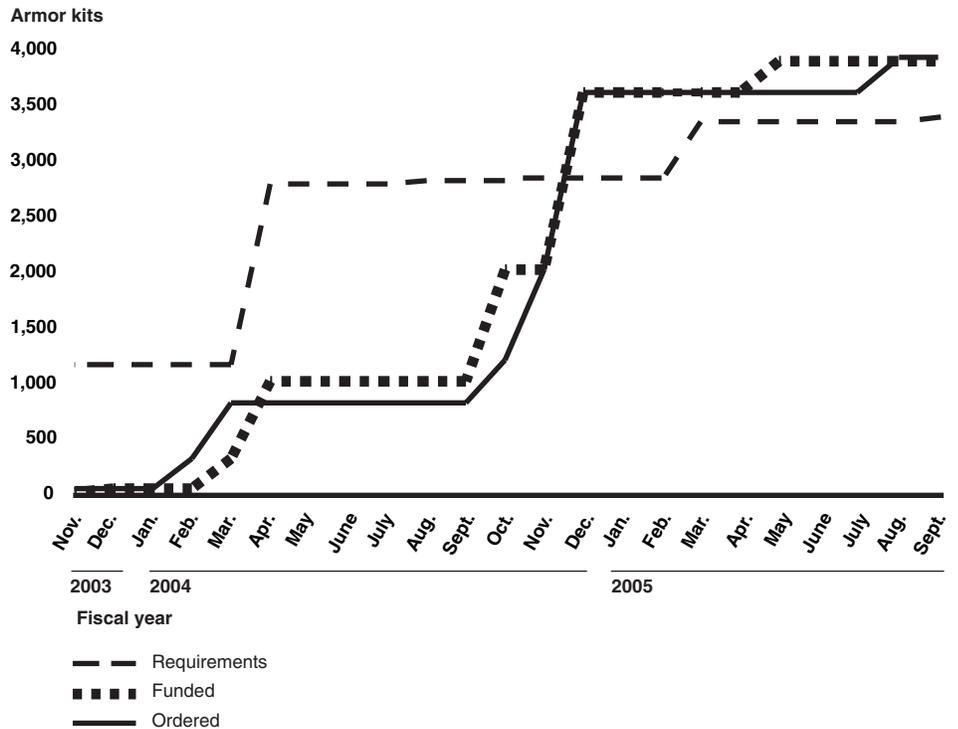
Source: GAO analysis of Army data.

Contracts Constrained Production

Orders for FMTV armor kits were awarded for less than the total requirement and lagged behind requirements. These contracts slowed production of armor kits for both FMTV contractors. For Radian, there was a complete break in production because the final contract for 1,049 FMTV armor kits was received after its long lead time for ordering items needed to maintain continuous production. According to the Radian officials, production could have been maintained or even accelerated if the requirements had been identified and funding provided in time to meet the long lead time. However, the contractor did not have any visibility into the pending requirements and was told by the Army that there would be no further contracts for kits. In addition, according to a Stewart and Stevenson official, if they had been awarded the contract for the final 292 armor kits in the March/April 2005 time frame, they could have finished producing the kits in the July/August 2005 time frame, or 3 months earlier than the October/November 2005 time frame when the kits were estimated

to be completed. Significant reasons for ordering in this manner were changing requirements and delayed and less than total funding. Figure 18 demonstrates the relationship between timing of requirements, funding, and contracts.

Figure 18: Comparison of FMTV Armor Kit Requirements to Kits Funded and Ordered



Source: GAO analysis of Army data.

Contracts Affected Price

The award of contracts in quantities less than total requirements resulted in the Army not receiving the best price available for the RACK. The Army ordered FMTV kits from Radian in increments of 270 and 501 in February 2004 and March 2004, respectively. The 270 kits that the government ordered did not allow for receiving the highest price break for production quantities, while the 501 kits the government ordered allowed for the best price break available. For the 272 kit contract, the cost was about \$51,603 for each kit, and for the 501 kit contract, the cost was \$45,271 for each kit, a difference of \$6,332 per kit. According to the Army program officials, the

reason there were two contract awards was that funding was not available for the full quantity in February 2004.

M915 Truck Family

The Army's family of M915 trucks comprises highway tractors used primarily for the long distance transport of containers. The M915 is very similar to commercial tractor-trailer trucks. Figure 19 illustrates an M915 truck. To protect the M915 crew from enemy fire in Iraq, the Army contracted with Simula Inc., Radian Inc. and Armor Works Inc. to develop and build add-on armor kits. The Army's armoring program involves producing armor kits for 2,026 M915s.

Figure 19: M915 Truck Tractor

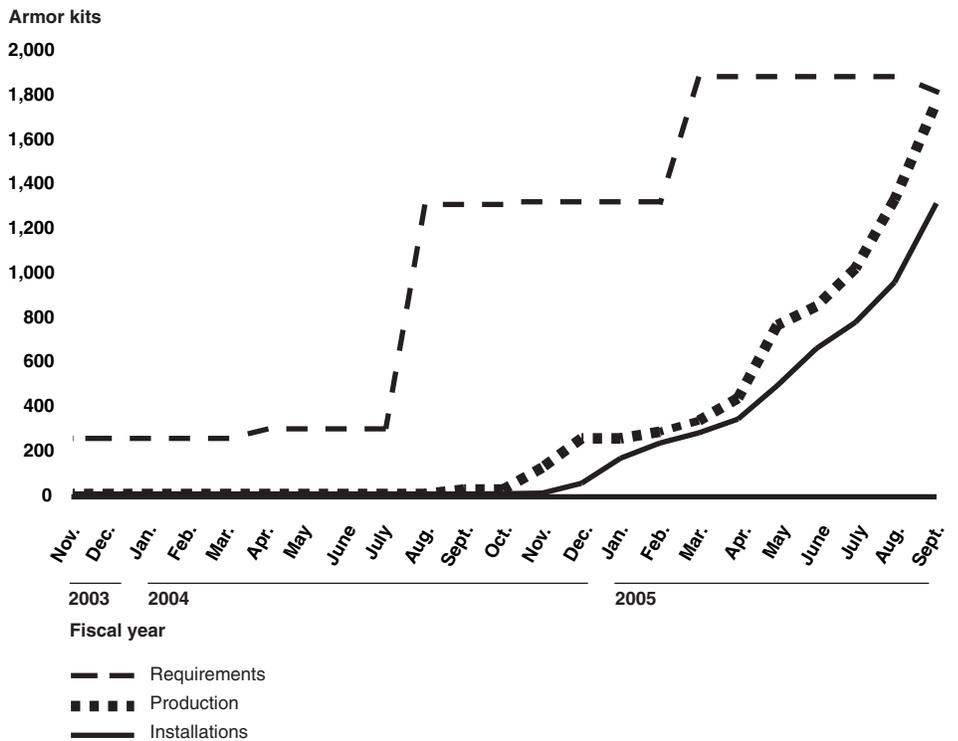


Source: U.S. Army.

Extent Armor Kits Were Produced and Installed to Meet Identified Requirements

Requirements for 250 M915 truck armor kits were first identified in November 2003, but a sufficient number of kits to meet that requirement were not installed until March 2005, or 16 months after the first requirement was established. Identified requirements continued to grow to 1,877 armor kits by March 2005, but dropped slightly in September 2005 to 1,805. However, as of September 2005 the total number of kits installed was 1,295, or 510 fewer than the quantity required. Figure 20 compares the time elapsed from the identification of armor kit requirements to the time when kits were produced and installed. Army officials estimated that the total number of required armor kits would have been installed by January 2006.

Figure 20: Comparison of M915 Family of Trucks Armor Kit Requirements to Kits Produced and Installed



Source: GAO analysis of Army data.

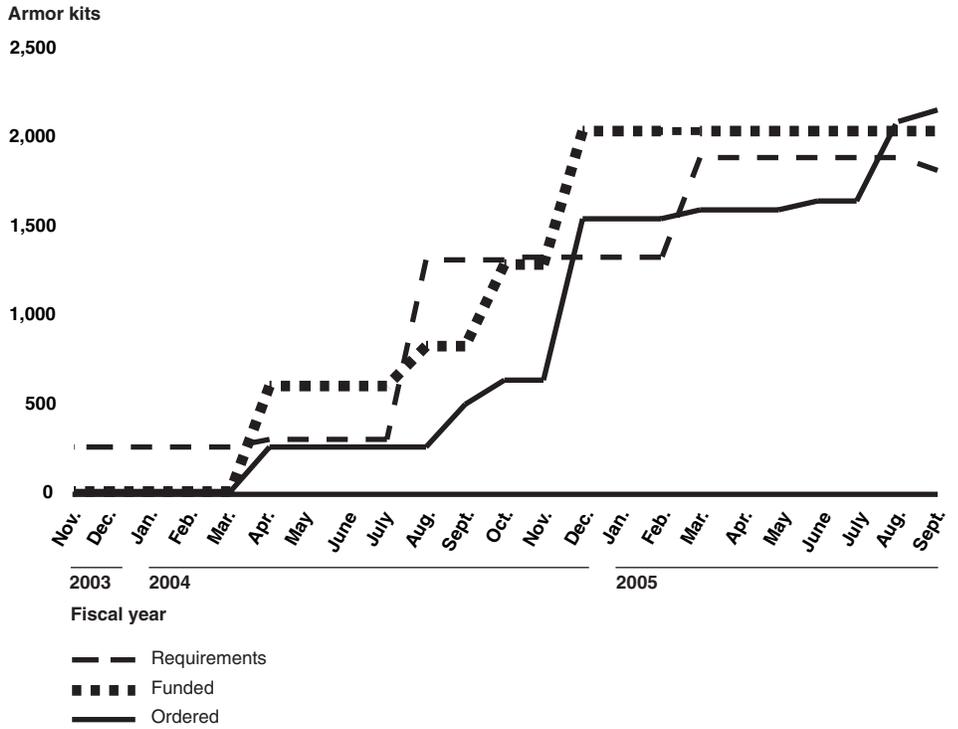
Significant Factors
Affecting Availability of
Armor Kits

Two significant factors affected the availability of armor kits for the M915. First, the Army's award of contracts for less than the total requirement over the life of the program constrained production. Second, a shortage of key materials, specifically steel and aluminum, negatively impacted the contractor's ability to maximize production.

Contracts Constrained
Production

Contracts for the M915 truck armor kits were awarded in quantities less than the total requirement and generally lagged behind requirements. This manner of contracting for M915 armor kits constrained production, particularly for Simula. The Army issued four contracts to Simula for 1,228 of the M915 armor kits over a 9-month period. According to Simula officials, they subcontracted the workload to Plasan Sasa in Israel based on the first contract of 250. However, subsequent to the first contract, the Army validated additional requirements of 1,627 kits between April 2004 and March 2005. However, Simula was not aware when the first contract was awarded that the total quantities could eventually exceed 1,600. Had the contractor been aware of this, it would have proceeded differently from the outset, such as using a different manufacturer. By the time the additional contracts came into Simula, Plasan Sasa was facing capacity constraints in the production of the M915 armor kits. Unable to overcome the capacity constraints at Plasan Sasa, Simula negotiated with Plasan Sasa to bring some of the M915 production to the United States. In total, Simula arranged to complete 738 of the 1,228 M915 armor kits in the United States. Significant reasons for awarding contracts in this manner were changing requirements and delayed and less than total funding. Figure 21 demonstrates the relationship among timing of requirements, funding, and contracts.

Figure 21: Comparison of M915 Armor Kit Requirements to Kits Funded and Ordered



Source: GAO analysis of Army data.

Material Shortages Negatively Impacted Production

Shortages of strategic armor materials negatively impacted M915 armor kit production. Shortages of high-hard armor steels and aluminum affected the start up of contract orders and the pace of production through the end of 2004. The material shortages were eventually rectified by the intervention of the Army’s Tactical Wheeled Vehicle Office to set priorities and by various congressional staff appeals directly to the material suppliers.

Tankers

The Army uses its tankers to haul and dispense bulk fuel. There are four models of fuel tankers involved in the Army’s armoring program: the M967, the M969, the M978, and the M1062. Figure 22 shows an example of an M969 tanker. The primary component of the tanker armoring effort is a self-sealing coating material that is sprayed onto the exterior of the fuel tank. When a small arms round penetrates the coating material and the fuel tank,

the hole self-seals and the fuel leak is stopped within minutes. The second component of tanker armoring comprises armor panel kits mounted at select locations on the fuel tanker to protect critical equipment not protected by the coating material. VSE Corporation is applying the self-sealing coating to the tankers and is manufacturing the armor kit for the M967, the M969, and the M1062 tankers. Oshkosh Truck Corporation is manufacturing the armor kit for the M978 tanker.

Figure 22: An M969 Tanker

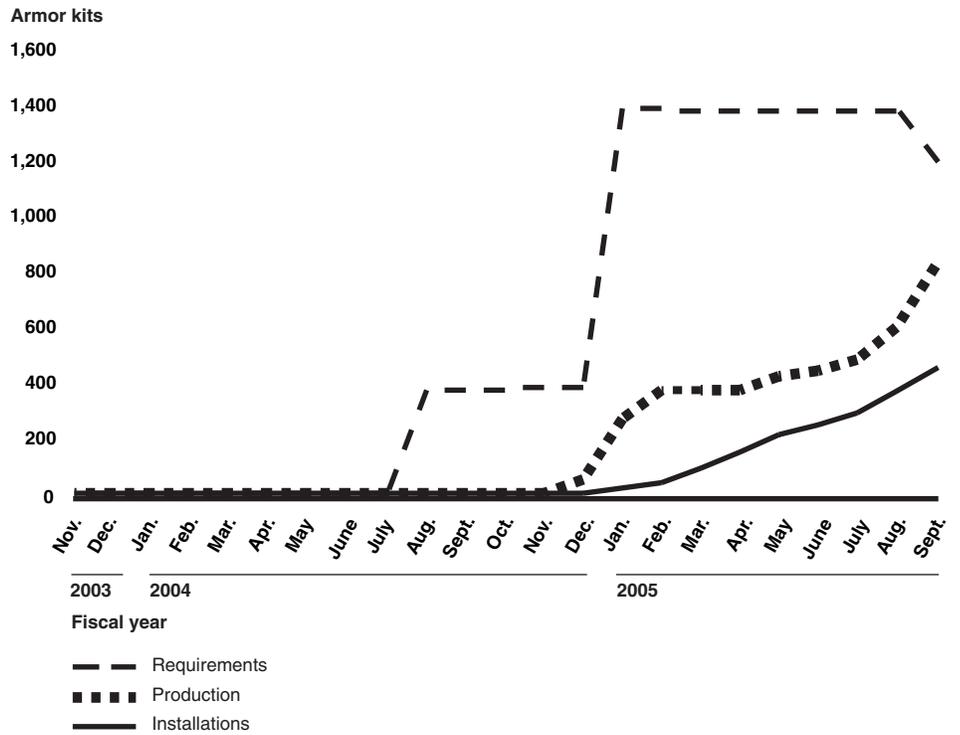


Source: U.S. Army.

Extent Armor Kits Were Produced and Installed to Meet Identified Requirements

Requirements for armoring 371 tankers were first identified in August 2004; however, a sufficient number of kits to meet that requirement were not produced and installed until August 2005, 12 months after the initial requirement was identified. Identified requirements have continued to grow to 1,375 armor kits by January 2005, but dropped in September 2005 to 1,192. However, as of September 2005 the total amount of armor kits installed was 443, or 749 fewer than the quantity required. Figure 23 compares the time elapsed from the identification of armor kit requirements to the time when kits were produced and installed. Army officials estimate that the total number of required armor kits will be produced by May 2006 and installed by January 2007.

Figure 23: Comparison of Tanker Armor Kit Requirements to Kits Produced and Installed



Source: GAO analysis of Army data.

Significant Factors Affecting Availability of Armor Kits

Two significant factors affected the availability of armor kits for tankers. First, the Army's award of contracts for less than the total requirement over the life of the program constrained production. Second, installation of armor kits was constrained by a limited rate of rotation for tankers into installation facilities and unique requirements for applying the protective spray-on coating.

Contracts Constrained Availability of Armor Kits

The production time line for one of the armor kits, for the M967 tanker, is longer than it would have been if contract awards had been for the total requirement. The Army awarded two contracts for M967 armoring with quantities of 171 and 152, with an 8-month interval between the two contracts. According to the contractor, if all 323 tanker kits had been awarded together, the total production time line would have decreased due to production efficiencies. Contracts for the other three tankers, the M969,

the M978, and the M1062, were awarded for the total requirement and, therefore, the contractor stated that production has gone as efficiently as possible.

Limited Installation Rates Paced
Availability of Armor Kits

A significant factor that affected the availability of armor kits for tanker trailers was a limited installation rate. For example, the installation of add-on armor kits was slowed by the rate of rotation of trucks into the in-theater installation facilities as they returned from missions. Operational constraints limited the number of vehicles that could be taken out of use at any one time. In addition, unique requirements to coat the tankers with a protective chemical prior to installing armor panels also limited the rate of installation. The proper application of the chemical coating requires controlled environmental conditions, such as humidity and temperature, which has led to a limited number of spray locations accessible to the Army. Thus, although production of armor kits for tankers is expected to be completed by May 2006, because of these constraints, installation of enough kits to meet requirements is not expected to be finished until 8 months later in January 2007.

Comments from the Department of Defense



ACQUISITION
TECHNOLOGY
AND LOGISTICS

OFFICE OF THE UNDER SECRETARY OF DEFENSE
3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

MAR 01 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: Several Factors Limited the Production and Installation of Army Truck Armor during current Wartime Operations, dated January 30, 2006 (GAO Code 350658/GAO-06-160).

The Department concurs with the intent of the recommendation in the draft report. Our specific comments concerning the recommendation, as well as minor editorial comments, are attached.

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


Mark D. Schaeffer
Acting Director
Defense Systems

Attachment:
As stated



**GAO DRAFT REPORT – DATED JANUARY 30, 2006
GAO CODE 350658/GAO-06-160**

**“DEFENSE LOGISTICS: Several Factors Limited the Production and Installation of
Army Truck Armor during Current Wartime Operations”**

**DEPARTMENT OF DEFENSE COMMENTS
TO THE RECOMMENDATIONS**

RECOMMENDATION 1: The GAO recommended that the Secretary of Defense direct the Secretary of the Army to establish a process to document and communicate all urgent wartime funding requirements for supplies and equipment at the time they are identified and the disposition of funding decisions. (p. 35/GAO Draft Report)

DOD RESPONSE: Concur with intent. The Army Requirements and Resourcing Board (AR2B) conforms to the process described in the GAO recommendation.

As referenced in the report, the Army Strategic Planning Board (ASPB) was established to manage the Army’s transition to a wartime focus in response to the attacks in New York, Washington, DC, and Pennsylvania on September 11, 2001. The ASPB was an element of the Army Strategic Campaign Plan for the War on Terrorism. In December 2004, the ASPB was merged with the Army’s Setting the Force General Officer Steering Committee to form the AR2B.

The AR2B serves as the venue for cross-leveling information and requirements to include urgent wartime requirements for supplies and equipment with corresponding resourcing solutions. AR2B includes representation from all major Headquarters Department of the Army staff sections, Army Material Command, Multinational Force-Iraq, Army European Command, and Army Pacific Command. This process synchronizes Army Staff agency and Major Commands executing war support and reconstitution efforts as they interface with their Joint Staff and Army counterparts. The AR2B is the mechanism for presenting critical information to the Army Senior Leadership for rapid-decision making, through weekly Executive Updates. The AR2B functions as an iterative and adaptive forum to provide an integrating framework to organize and synchronize support for the Army Campaign Plan and the Global War on Terrorism. It provides a bridge between national strategic guidance, national military guidance, and Major Command/Army Service Component Command plans and efforts. The AR2B links near-term demands in the Year of Execution and Budget Year for resource realignment, and provide a framework for future planning and analysis that enables responsive risk mitigation. The AR2B is a forum where numerous urgent wartime requirements are presented as operational needs from Combatant Commanders and are reviewed, staffed, and validated. The AR2B has developed recommendations to the Army Senior Leadership for over 3200 tasks in support of immediate Combatant Commander needs. The accelerated process is completed within 2 weeks to 2 months, as opposed to the normal 12-24 months for routine budget processes.

Attachment 1

GAO Contacts and Staff Acknowledgements

GAO Contact

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Acknowledgements

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