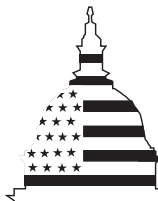
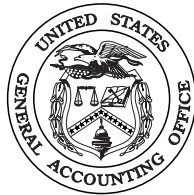


May 2001

# DEFENSE ACQUISITION

## Army Transformation Faces Weapon Systems Challenges



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United States General Accounting Office  
Washington, DC 20548

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May 21, 2001

### Congressional Committees

A decade after the Cold War, the Army recognizes that its combat force is not well suited to perform the operations it must face today and must plan for in the future. The Army's light force can deploy rapidly, but it lacks the firepower, survivability, tactical mobility, and capability for sustained operations against the full range of potential enemy capabilities. Conversely, its heavy force—the force that includes tanks and other armored vehicles—possesses significant firepower, survivability, tactical mobility, and capability for sustained operations, but it, also, requires too much time to deploy and needs extensive materiel support.

To address this mismatch, the Army has decided to radically transform its current Cold War organization. When the transformation is completed, the Army expects to have established a full-spectrum force—a strategically responsive force that provides decisive combat power to operate in the full range of military operations. The Army expects this force to have the lethality, survivability, and tactical mobility of today's heavy force and the responsiveness and deployability of today's light force. Further, it will be more sustainable by requiring less in-theater logistic support than either today's heavy or light forces.

The Army envisions its transformation as a comprehensive change that will affect all aspects of its organizations, training, doctrine, leadership, and strategic plans as well as the types of equipment and technology being acquired by the Army. According to Army staff officials, the transformation will be the most comprehensive change in the Army in over a century. The Army expects the transformation to be a 30-year process and has not estimated its full cost. It is undertaking an aggressive science and technology program to develop future force capabilities. In April 2003, it plans to decide on which enabling technologies can be incorporated into the future force after which it believes that the cost of the transformation can be more accurately estimated. The House Appropriations Committee reported that the Army's transformation could cost at least \$70 billion over the next 12 to 15 years.

Given the magnitude of the transformation effort and its potential costs, we reviewed the Army's plans for transforming its current forces to identify major acquisition challenges that need to be addressed in order to successfully execute the Army's transformation plans. This report is part

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of a planned series of reports on the Army's transformation efforts. In a related review, GAO is assessing the Army's transformation campaign plan.

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## Results In Brief

Changes in the character and conduct of warfighting and in the range and nature of missions call for an Army force that is more responsive and dominant across the full spectrum of operations and requires much less in-theater logistics support. The Army is seeking to meet these new demands by initiating a transformation that calls for the development of a series of systems—vehicles and weapons, called Future Combat Systems—that will rely on technology advances to make them lighter, but just as lethal and survivable as today's heavy force systems. The Army expects that the future combat systems will have networked communications links to other systems throughout the battlespace to allow for the rapid and decisive engagement of targets at significantly longer distances. The Army plans to begin equipping its first future or "objective" force units with such systems in fiscal year 2008.

To meet its immediate needs for a more responsive force, the Army plans to acquire new interim combat vehicles and form five to eight interim brigade combat teams through fiscal year 2010. These vehicles are expected to be significantly lighter and more transportable than existing tanks and armored vehicles. Also, the Army plans to acquire new legacy systems and upgrade and rebuild some of its existing systems to maintain combat overmatch capabilities during the transformation.

The Army's transformation effort will face a number of challenges—primarily related to funding and technology readiness. First, the transformation will place additional funding demands on the defense budget. As such, the Army will be required to balance the demands of maintaining and modernizing its current inventory of weapon systems while developing and acquiring new systems for interim and future forces.

Second, the Army's plans for the transformation assume weapons systems and equipment can be developed and acquired in much shorter time frames than in the past. These systems will include sophisticated communications, robotics, and other advanced technologies. However, some of these advanced technologies have not yet been developed and others have already experienced developmental delays.

Third, the Army needs to update current acquisition plans to reflect transformation priorities and schedules. Doing so is particularly important

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since trade-off decisions will likely need to be made during the transformation.

A key to meeting these challenges will be the Army's ability to manage transformation acquisition efforts as successful commercial firms do. Commercial firms (1) ensure that they have the right knowledge at the right decision points for making trade-offs, especially with respect to the readiness of technology, the maturity of system designs, the realism of cost and schedule estimates, and the availability of funding; (2) keep requirements flexible prior to the start of a program so that its requirements match resources and available technology; and (3) provide top down guidance to ensure that decisions focus on achieving the overall program goals. The Army has already made trade-off decisions to fund its near-term transformation efforts and, in view of risks associated with its tight acquisition schedules, has made adjustments in its plans to procure new interim combat vehicles.

Because the Army is in the early stages of planning for its transformation and recognizes the challenges identified in this report, GAO is not making recommendations.

The Department of Defense generally agreed with the report. It agreed that there are significant challenges in balancing the desired schedule, the required resources, and the necessary maturation of technology to accomplish the Army's transformation goals.

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## Background

Since the end of the Cold War, the pace and type of Army deployments has dramatically shifted toward more frequent, small-scale contingency operations. In the 40 years prior to 1990, the Army had 55 operational deployments, including the Korean Conflict and the Vietnam War. Since 1989, the Army has had 53 operational deployments with a majority being small-scale contingency operations such as Somalia, Bosnia, and Kosovo. Nevertheless, the National Military Strategy requires the services to be prepared for major regional conflicts. Therefore, the Army must maintain forces appropriate for these larger conflicts as well as for smaller contingencies.

On October 12, 1999, the Secretary of the Army and the Chief of Staff of the Army announced plans to radically transform the Army into a lighter, but lethal and survivable, force that can respond to a broad range of operations—from peacekeeping, to regional conflicts, to major theater wars. Specifically, the goal of the Army's transformation plan is to build

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the objective force. This force includes advanced command, control, communications, computers, intelligence, surveillance, and reconnaissance capabilities; future reconnaissance, attack, and lift aircraft; and revolutionary weapon systems—called Future Combat Systems—that are expected to be as lethal and survivable as the current heavy weapon systems and light enough to be transported in a C-130-type aircraft.<sup>1</sup> Objective force units using these systems would be able to engage in the full spectrum of conflicts ranging from various small-scale contingencies to major theater wars.

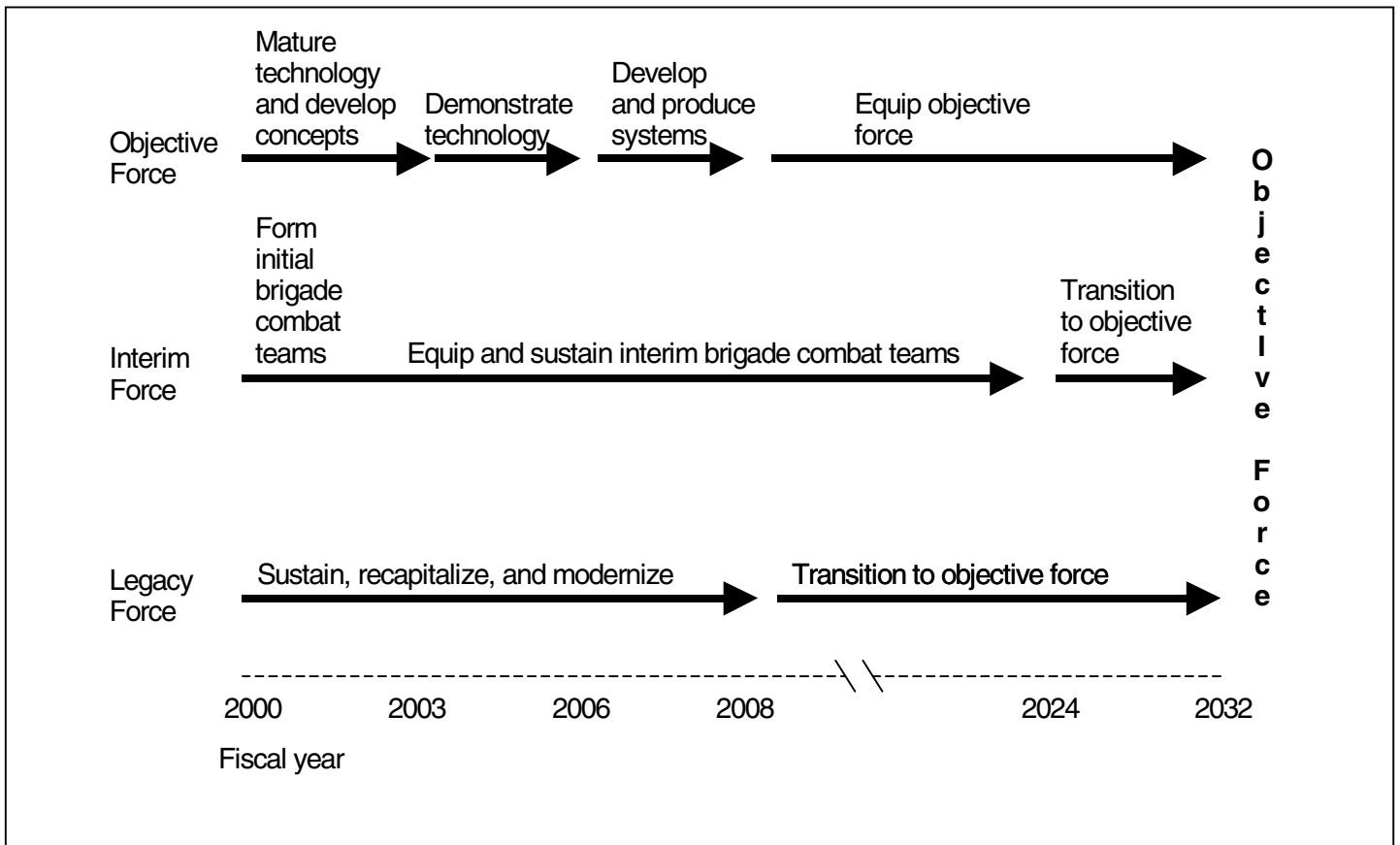
While transitioning to the objective force, the Army believes that it needs to improve the capabilities of its existing force so that it can better respond to small-scale contingencies. As a result, the Army's transformation plans include improving portions of its current force by transforming from five to eight units into Interim Brigade Combat Teams and equipping them with new vehicles that are expected to make the teams more lethal, mobile, and survivable than current light forces while maintaining the current light force's responsiveness and deployability capabilities. The Army calls this force the "interim force" because it is designed to fill a near-term capabilities gap between today's heavy and light forces. The Army intends to phase out the interim force as it fields its objective force.

Also, while it is developing the objective force and establishing the interim force, the Army plans to sustain, recapitalize (upgrade and rebuild), and modernize selected portions of its current heavy force to maintain the force's overmatch capability. The Army calls its current force the "legacy force" in its transformation plan. It expects to phase out the legacy force as it fields the objective force. Figure 1 graphically depicts the Army's approach to its transformation.

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<sup>1</sup> The Army's deployment goals for the objective force is to transport a combat brigade anywhere in the world in 96 hours, a combat division on the ground in 120 hours, and five divisions in 30 days. The Army will need air and sea strategic lift to meet these goals.

**Figure 1: The Army's Approach to Its Transformation**



Source: GAO analysis of Army information.

## Objective Force

Building the objective force will require the Army to first identify and develop the technologies required to produce systems that are as lethal and survivable as the current heavy weapon systems and light enough to be transported in a C-130-type aircraft and then to develop the actual systems. Objective force units using these future combat systems would be able to engage and be successful in the full spectrum of conflicts.

The Army and the Defense Advanced Research Projects Agency (DARPA) have entered into a 6-year collaborative program to explore, design, and test the new and revolutionary technologies that are vital to meeting the requirements of the objective force. Such technologies include robotics,

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sensors, new fuel and power systems, advanced armor, and command and control networks.

DARPA's concept for the Future Combat Systems is a "system of systems" in which a manned command and control vehicle is expected to be networked with and control unmanned ground and airborne reconnaissance vehicles and unmanned weapon delivery vehicles. The unmanned vehicles could be equipped with such weapons as direct- and indirect-fire guns, non-line-of-sight rockets, and antitank missiles. In addition, the manned command and control vehicle would be networked with other reconnaissance systems not under its direct control including other airborne and spaceborne systems. The resulting configuration is expected to allow the commander of the command and control vehicle to operate from a position of concealment and, using the data received from the reconnaissance systems, to

- be aware of the tactical situation,
- identify and target opponent systems,
- select the engagement position and method that best assures success, and
- send unmanned weapon systems to carry out the engagement and destroy the opponent's systems.

This concept's success depends upon mature technologies to allow the Army to design secure networks that cannot be jammed or taken over by the opponent; robotic vehicles that would make some decisions on their own; smaller weapons delivery platforms; and a command and control vehicle that escapes detection.

The Future Combat Systems program is in its initial 2-year concept design phase. On May 9, 2000, DARPA and the Army selected four contractor teams to develop Future Combat Systems design concepts to provide the required objective force deployability, lethality, and survivability. Each team is to develop two design concepts—one based on DARPA's concept for the Future Combat Systems and the other based on its own concept. DARPA and the Army plan to evaluate the concepts using computer modeling and simulations.

In April 2003, DARPA and the Army plan to conduct a program review to determine whether the required technologies are mature enough to proceed to the next level of development. They plan to rely on technology readiness levels as an analytic tool to make this judgment. If they decide to continue, they plan to choose one or more of the concept designs for a

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3-year development phase including construction of a technology carrier to demonstrate the Future Combat Systems' principles.

The Army plans for the program to be transferred to Army control and enter the system development and demonstration phase in fiscal year 2006.<sup>2</sup> It would like to start fielding Future Combat Systems in fiscal year 2008 with the first unit reaching its full capabilities in fiscal year 2010. The entire transformation is not expected to be completed until about fiscal year 2032. By that time, the objective force will have replaced both the interim and legacy forces.

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## Interim Force

The interim force will bridge the gap between the capabilities of today's force and the objective force. The Army intends that this interim force will provide the foundation for the objective force. The Army's new interim force will be made up of five to eight more easily deployable Brigade Combat Teams that are expected to be trained, organized, and equipped to conduct small-scale contingency operations. During a major war, the Army does not expect the Interim Brigade Combat Teams to directly replace heavy combat units for all missions, but rather to perform a broad range of missions suitable to their capabilities and characteristics, thereby supplementing the specialized capabilities of heavy units with their own specialized features and assets when appropriate.

The Army plans to establish the new teams in two phases. Over the next 2 years, the Army plans to form two Initial Brigade Combat Teams using light armored surrogate vehicles on loan from Canada and other countries and other Army vehicles. These brigades are expected to use these vehicles to develop operational and organizational concepts, training needs, and doctrine. In January 2000, the Army began forming the first Initial Brigade Combat Team at Fort Lewis, Washington.

In the second phase, the Army plans to procure "off-the-shelf" vehicles, called the Family of Interim Armored Vehicles, which are to be capable of being transported in C-130-type of aircraft. The Family of Interim Armored Vehicles are required to be no more than 19 tons—about 50 tons lighter than the current Abrams tank—and are to include an infantry carrier with

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<sup>2</sup> The purpose of the system development and demonstration phase of the acquisition cycle is to develop the system; reduce program risk; design for producibility; ensure operational supportability, affordability, and protection of critical program information; and demonstrate system integration, interoperability, and utility.



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eight variants and a mobile gun system vehicle. The Army plans also called for a self-propelled howitzer to be part of the family of interim vehicles; however, due to other funding priorities, the Army is not planning to procure the self-propelled howitzer and plans to use a towed howitzer in its place. Once acquired, the Army plans to modify the vehicles with its most advanced digital communications and information systems. The Army plans to replace the borrowed vehicles in the Initial Brigade Combat Teams with interim armored vehicles once they are available and transform them into Interim Brigade Combat Teams.

On April 6, 2000, the Army issued a request for proposal for the interim armored vehicles. On November 16, 2000, the Army awarded a 6-year contract for the development and production of a wheeled Family of Interim Armored Vehicles. Under the contract all but three of the interim vehicles will go directly into production. The three vehicles requiring development are the fire support, armored gun system, and nuclear, chemical, biological, and chemical reconnaissance vehicles. The contract is worth nearly \$4 billion if all the options are exercised. The Army originally had planned to equip the first Interim Brigade Combat Team with interim vehicles by March 2001 and reach initial operational capability with that team by December 2001. After that and continuing through fiscal year 2010, the Army plans to equip from five to eight interim Brigade Combat Teams with these vehicles. According to Army Staff officials, this could be from 2,131 to 2,791 interim armored vehicles depending on the number of brigades the Army equips.

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## Legacy Force

To ensure near-term warfighting readiness and improve existing warfighting capabilities, the Army has concluded that it must sustain and selectively modernize and recapitalize the legacy force. The Army plans to enhance key armored and aviation systems in both Active and Reserve components. Legacy force systems include those weapon systems that the Army has fielded such as the Abrams tank or Bradley Fighting Vehicle and that were under development before the transformation was announced such as the Crusader artillery system. The Army's transformation plans include legacy force investments to ensure that heavy combat systems can maintain their superiority over potential enemy systems during the transformation period. As the objective force units are equipped, the Army plans to phase out the legacy force units and then the interim force units.

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## Funding Challenges

As noted earlier, the House Appropriations Committee reported that the transformation would require at least \$70 billion over the next 12 to 15 years. A major challenge facing the Army is balancing its transformation plans within the defense budget. The Army has made some difficult trade-off decisions on programs that will and will not be funded and transformation efforts that will and will not be immediately undertaken in order to fit its near-term transformation efforts within available funding. As the transformation proceeds, the Army will likely need to make more trade-offs.

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## Procurement Funds Are Limited

Defense's planned procurement spending has been projected to be considerably less than estimated to sustain its current force—even before transformation plans were announced. In April 1999, the Congressional Budget Office estimated that it would take an average procurement budget of about \$90 billion a year to sustain DOD's current force structure. However, DOD's procurement spending is projected to average a little over \$63 billion over the 2001 to 2005 period—about \$27 billion per year below the Congressional Budget Office's estimated funding requirements. In addition, we recently reported that DOD based its funding projections for fiscal years 2001 to 2005 on optimistic assumptions about operation, maintenance, and procurement costs; as a result DOD's plans require more funding than currently projected.<sup>3</sup> The Army's transformation plans were not included in either of these projections; therefore, the Army's transformation plans may only further increase the gap between funding requirements and available funding.

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## Army Has Already Made Trade-off Decisions

To date, the Army has not submitted a budget that fully reflects its transformation plans. However, in funding near-term transformation-related efforts, the Army has had to make trade-off decisions in terms of restructuring current programs and delaying some transformation-related activities.

The Army's October 1999 transformation announcement was made after fiscal year 2000 had started. As a result, the transformation was not incorporated in the Army's fiscal year 2000 budget. However, about a month after the Army Chief of Staff's transformation announcement, the

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<sup>3</sup> *Future Years Defense Program: Risks in Operation and Maintenance and Procurement Programs* (GAO-01-33, Oct. 5, 2000).

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Congress, on November 29, 1999, added \$100 million to the Army's fiscal year 2000 appropriations to meet readiness needs including funding to initiate the fielding and equipping of two Initial Brigade Combat Teams.<sup>4</sup>

The October 1999 transformation announcement was also too late to be fully reflected in the Army's fiscal year 2001 budget request. However, the Army provided room for its transformation plans within the request by terminating and restructuring ongoing weapon system programs. The Under Secretary of Defense (Comptroller) approved these changes to the Army's budget request on December 27, 1999. The Congress added a total of \$864.5 million to the Army's request for transformation funding, increasing the Army's fiscal year 2001 appropriations to (1) \$259.3 million in research and development funds for the Family of Interim Armored Vehicles, (2) \$937 million in procurement for the Family of Interim Armored Vehicles, (3) \$156.9 million in research and development funds for the Future Combat Systems, and (4) \$268.6 million in procurement funds for other equipment needed for the transformation.

Because of funding constraints, the Army has also changed some of its transformation plans. For example, the Army has reduced the number of units it planned to transform into Interim Brigade Combat Teams from two per year to one per year. Also, it has decided not to procure the planned self-propelled howitzer for the interim force. Further, according to Army Staff officials, the Army has cancelled seven major legacy programs and restructured two others. For example, the Army reduced the planned procurement quantities of the Crusader artillery system from 1,138 to 480 systems.

The first budget request to fully include the transformation will be the Army's fiscal year 2002 budget request. The Army is currently preparing this budget request. It does not plan to release the documents associated with the fiscal year 2002 budget request until the President submits it to the Congress.

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## More Trade-off Decisions Are Likely

Over the long term, the Army may have to make more trade-off decisions because it must continue to balance investments in research and development of objective force systems with investments in legacy and

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<sup>4</sup> Section 218 of title II of appendix E of the Consolidated Appropriations Act of Fiscal Year 2000 (P.L. 106-113, Nov. 29, 1999).

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interim systems. Because legacy and interim systems will ultimately be replaced by future systems, the schedule for such replacements will be critical in making funding trade-offs between legacy, interim, and future combat systems.

The legacy systems will require substantial investment to sustain and modernize. On September 6, 2000, the Assistant Secretary of the Army (Acquisition, Logistics and Technology) said that the Army required \$23 billion to modernize its legacy force in fiscal years 2002 to 2007, but projected that it will only have about \$15.5 billion for that purpose, a \$7.5 billion shortfall.<sup>5</sup>

Additionally, some of the improved legacy systems are scheduled to enter the force about the time the Army plans the Future Combat Systems to begin entering the force in fiscal year 2008. For example:

- The Army currently plans to acquire the Crusader artillery system, which consists of two vehicles that are projected to weigh about 40 tons each when developed. At this weight, the Crusader system will not be transportable in a C130-type aircraft—a key requirement for the Army’s interim and objective forces. The Crusader program is currently in its program definition and risk reduction phase and is not scheduled to be fielded until April 2008.<sup>6</sup> This is the same year that the Army plans to field the Future Combat Systems to its first unit. According to the Crusader project manager, the Army needs to spend over \$2.9 billion in research and development funds from fiscal year 2001 to fiscal year 2008 to redesign and develop the Crusader system. The Army expects to replace the Crusader system with an indirect fire system that is expected to be part of the Future Combat Systems. According to Army officials, Crusader artillery systems will remain in the legacy force until the Army’s conversion to its objective force is complete in 2032 under current plans.
- As part of the modernization of its legacy systems, the Army is also planning to develop a new, more efficient engine for its Abrams tanks. The new engine is needed to reduce the high costs of operating and

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<sup>5</sup> The cost of the Crusader program was not included in these amounts.

<sup>6</sup> The primary objectives of the program definition and risk reduction phase of the acquisition cycle are to define the program as one or more concepts or design approaches; assess the advantages and disadvantages of those concepts or design approaches; and through prototyping, demonstrations, and early operational assessments show that technology, manufacturing, and support risks are well in hand.

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maintaining the current Abrams tank engine. This engine also would be used in the Crusader system. Like the Crusader, the Abrams tank is expected to be replaced once Future Combat Systems are deployed. The total cost of this common engine program has been reported as nearly \$3 billion. On September 20, 2000, the Army awarded a \$195.7 million contract for the development and testing of the common engine. The contract is to continue through March 31, 2004. The Army expects to award a production contract in fiscal year 2003 for 2,845 engines for the Abrams tanks and one in fiscal year 2006 for 755 engines for the Crusader vehicles. According to Army Staff officials, deliveries of engines to support the Crusader low-rate initial production are planned to begin in February 2006.

- The Army plans to procure and use interim armored vehicles until they are replaced by the Future Combat Systems. The actual time the Army will use these systems will depend upon how quickly it develops and fields the Future Combat Systems. It could cost as much as \$5.2 billion to obtain the interim armored vehicles needed to equip eight Interim Brigade Combat Teams.

Although the legacy and interim systems will be replaced, the Army believes it needs to continue investing in some legacy systems to ensure that its heavy combat forces can maintain their superiority over potential enemy systems through the transformation period. Likewise, it believes that the interim systems are required to improve the current light force's ability to respond to current small-scale contingencies until the Future Combat Systems are fielded. Given the magnitude of the Army's plans to both sustain and transform its forces, the Army could be challenged to make investment trade-offs for its legacy, interim, and objective forces.

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## Scheduling Challenges

In order to transform itself as quickly as possible, the Army has set aggressive and challenging schedules for developing and acquiring interim and future combat systems. Its goal is to set the conditions for "irreversible momentum" by 2003 and to fix conditions for achieving the initial operational capability of the objective force this decade. It is unlikely that the Army can meet its schedule for fielding the interim vehicles and will have to adjust milestones and/or priorities. Given the uncertainties associated with the effort to build future systems, it is likely that the Army will need to continue making adjustments. According to Army Staff officials, the Army's Transformation Campaign Plan should provide needed flexibility to make changes as conditions change. The campaign plan is a mechanism for integrating and synchronizing the Army's overall transformation efforts.

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## Interim Systems

The Army originally planned an aggressive interim vehicle acquisition schedule with contract award in August 2000 and the first unit being equipped with 312 interim vehicles by March 2001. The first Interim Brigade Combat Team was to reach its initial operational capability in December 2001. The Army recognized that such a tight schedule would be difficult to meet and took actions to mitigate this risk.

First, it sought to meet the schedule by postponing some interim vehicle requirements. It decided to meet some of the operational requirements through the initial interim vehicle contract and other requirements through a series of follow-on contracts.

Second, the Army identified four key requirements and decided to accept interim vehicles from the contractor as long as they meet the applicable key requirements. All interim vehicle variants have to be (1) transportable on a C-130-type aircraft and (2) capable of effectively integrating existing and planned Army command, control, communications, computers, intelligence, surveillance, and reconnaissance systems. The infantry carrier vehicle also has to be able to carry an infantry squad with its equipment, and the mobile gun system's main gun also has to be able to create an opening in a double reinforced concrete wall.

The Army plans to field substitute vehicles for those variants of the interim vehicles that are not ready in time. While this approach will make it more likely that the Army would meet its fielding schedule, the unit may not meet all of its full operational capability requirements because it may not have all variants of the interim armored vehicles.

Even with these actions, the Army likely will not meet its original interim vehicle acquisition schedule. The November 16, 2000, contract award was about 3 months behind schedule. In the news conference announcing the award of the contract, the Director of the Army Acquisition Corps stated that the Army might have to add up to 16 months to the interim vehicle schedule. The start of work under that contract was delayed until April 9, 2001, by a formal bid protest.<sup>7</sup> Although the Army has not formally changed its March 2001 date for equipping the first interim brigade, the date has passed and the Army did not direct the contractor to produce

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<sup>7</sup> On December 4, 2000, a losing bidder filed a formal protest with the General Accounting Office and the contract performance was suspended pending the outcome of the protest, which was denied on April 9, 2001.

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interim vehicles until after the protest was resolved. According to Army staff officials, the date for equipping the first interim brigade will likely slip to sometime in calendar year 2002 and the date for achieving its initial operational capability will likely slip to sometime in calendar year 2003.

Meeting acquisition and fielding schedules for the interim force will continue to be a challenge for the Army, especially if planned capabilities and/or technologies are not available to support the Army's desired timetable.

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## Future Combat Systems

The Army's foremost challenge in the transformation is to design and equip an objective force with the Future Combat Systems that have the deployability of its current light force and the lethality and survivability of its current heavy force. Developing the revolutionary Future Combat Systems is expected to require a number of significant advances in science and technology. It is uncertain whether the required technologies will mature enough to enable the Army to develop the Future Combat Systems as envisioned or whether they will mature in time to meet the transformation schedule. Army officials agree that maturing the technology required for the Future Combat Systems is high risk and that the Army may not achieve the objective force capabilities as envisioned within the time scheduled.

Specifically, the Army plans to mature technology, develop the Future Combat Systems concepts, design the systems, and field them over an 8-year period. In addition, under the current Army schedule, the Future Combat Systems enter the system development and demonstration phase in fiscal year 2006. The Army plans to equip the first unit with the Future Combat Systems in fiscal year 2008, 2 years later. To meet these dates, the Army projects that in April 2003 it will need to make a decision on whether the key technologies required for the Future Combat Systems will be mature enough to enter systems development in fiscal year 2006. Some of these advanced technologies have not been developed and others have experienced developmental delays. However, in June 2000, the Army Science Board identified 32 key technologies needed for the Future Combat Systems. The Board considered nine of these technologies key pacing technologies. They rated 16 technologies, including the 9 key pacing technologies, as feasible prior to 2006; 13 technologies as feasible between 2010 and 2015; and 3 technologies—autonomous robotics, electromagnetic rail gun, and emulation training—as unavailable until after 2015.

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Historically, DOD has not been able to develop high technology systems within 8 years as is planned for the Future Combat Systems. DOD's average acquisition cycle for all systems has been from 10 to 15 years to develop and produce the system. For the Future Combat Systems, the Army is planning to mature the technologies, develop the systems' concepts, design the systems, and produce them in 8 years. The acquisition cycle for systems requiring advances in technology, like the Future Combat Systems, is likely to be longer than the average. For example, both the Comanche helicopter and Crusader self-propelled artillery system are systems that required significant advances in technology to develop the systems as originally envisioned. The technology did not mature as planned for either system. The Comanche helicopter will be in development for about 23 years and the Crusader system will be in development for over 16 years before their planned fielding dates.<sup>8</sup>

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## Digitizing the Force

A critical requirement for both interim vehicles and Future Combat Systems is the ability to see and understand the battlespace. However, the Army is already facing challenges in developing technologies needed in this area.

The battlefield survivability of both the Family of Interim Armored Vehicles and the Future Combat Systems depends upon situational understanding—that is, the capability to “see” and understand the battlespace in all its dimensions, precisely locate and track critical targets, conduct operations with lethal and non-lethal means, recognize and protect friendly forces, and provide a common operational picture of the situation. Situational understanding is critical to the survivability of the vehicle or system because at 20-tons or less neither the vehicles nor systems would be able to survive a direct confrontation with a main battle tank. They need to know where the enemy is and either hide or select a mode of attack that does not needlessly expose the system to enemy counterfire. This level of situational understanding requires advanced command, control, communications, computers, intelligence, surveillance, and reconnaissance systems.

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<sup>8</sup> We included the interval between the date the Comanche and Crusader programs entered their individual concept development phases and the projected dates for equipping the first unit to calculate the time each program was “in development.” We used this definition only to obtain a level of effort for the two programs comparable to that planned for the Future Combat Systems during its planned 8-year acquisition cycle.



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The key to situational understanding is the application of information technologies to acquire, exchange, and employ timely information on the battlefield. The Army's modernization plans call for the integration of information technologies into the Army force; the Army refers to this as digitization. The Army plans to implement digitization through the development, production, and fielding of over 100 individual systems. In particular, the Army plans to field 16 high-priority systems, generally command, control, and communications systems, and as many as possible of 56 lower priority systems to a corps in December 2004.

Our reviews have shown that the Army is having difficulty developing and fielding these systems as planned. Specifically, in July 1999, we reported that many of the 16 high priority systems would not be fully operationally tested when they were scheduled to be fielded to the digitized division.<sup>9</sup> Therefore, while the Army may have outfitted the digitized division, its operational capability will not have been demonstrated. The most critical of these systems is the Force XXI Battle Command Brigade and Below, which represents an entirely new capability that is intended to accomplish an important digitization objective of sharing battlefield information with thousands of soldiers operating outside of the tactical operations centers. In July 2000, we also reported that by December 2004, 20 percent of the 56 lower priority digitization systems will not be ready for fielding and another 50 percent of them may not be ready.<sup>10</sup>

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## Planning Challenges

Most of the Army's eight combat branches, such as armor and artillery, have yet to issue detailed plans for the transformation. This presents a formidable challenge in the early stages of the transformation because such plans are needed to enable the Army to flesh out its transformation requirements and to prioritize funding for individual system development and modernization efforts.

The branches are responsible for identifying deficiencies in their individual mission areas and methods to correct those deficiencies, including improvements to weapon systems. In doing so, the branches normally develop annual modernization plans. The Army normally

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<sup>9</sup> *Battlefield Automation: Performance Uncertainties Are Likely When Army Fields Its First Digitized Division* (GAO/NSIAD-99-150, July 27, 1999).

<sup>10</sup> *Battlefield Automation: Army Needs to Update Fielding Plan for First Digitized Corps* (GAO/NSIAD-00-167, July 25, 2000).

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publishes annually an Army modernization plan. However, the Army did not publish an Army modernization plan in fiscal year 1999. Instead, in October 1999, the Army announced its transformation. The annual Army modernization plan was, likewise, not published in fiscal year 2000 due to the transformation planning underway within the Army. However, a shorter version of the plan, entitled “The Army Force Modernization and Investment Strategy for the 21st Century—An Assessment,” was provided to the Congress in March 2000.

As a result, most of the individual Army branches have not yet updated their modernization plans to reflect the Army’s transformation plan. For example, the most recent combat maneuver modernization plan, which includes armored and engineering systems, was issued in fiscal year 1998. It has not been updated to reflect the Army’s plans to spend nearly \$4 billion over the next 5 years to develop and acquire interim armored vehicles, which are an integral part of the Interim Brigade Combat Teams. Similarly, the Army’s current digitization plan has not been updated to link current and planned investments in command, control, communications, computers, intelligence, surveillance, and reconnaissance capabilities to the transformation plan.

The Army’s aviation branch’s modernization plan, issued to the Congress in April 2000, considers only some aspects of the transformation. Under the plan, the Army would establish a new force structure for aviation. The new structure would be comprised of multi-function aviation units that include 10 RAH-66 Comanche, 10 AH-64D Longbow Apache, and 10 UH-60 Black Hawk helicopters and could be easily combined and configured to meet the full range of contingencies, including major wars. The aviation plan also calls for retiring obsolete helicopters that are located mainly in the reserve components earlier than previously planned and eliminating plans to develop and acquire a new Light Utility Helicopter. Black Hawk helicopters would be used for all utility or general purpose missions.

The plan contains one new aircraft development—a new high-technology transport aircraft known as the Future Transport Rotorcraft. This aircraft is expected to have the capability of carrying a C-130 equivalent payload and could be a tiltrotor aircraft or a large conventional helicopter. It is projected to be phased into the Army fleet in the 2020 timeframe and would be used for tactical mobility for the Future Combat Systems on the battlefield. Other new aircraft in the aviation modernization plan include potential replacements for the Apache and Black Hawk helicopters as well as several fixed-wing transport aircraft.

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The aviation modernization plan does not fully address the funding necessary to execute this plan. The Army recognizes that the aviation plan's details have not been fully analyzed in regard to its transformation plans; therefore, it expects to make changes not only to the plan itself, but also to the projected funding levels contained in the fiscal year 2002 budget request.

Neither the updated aviation modernization plan nor the current combat maneuver modernization plan addresses the emerging and expanding role of unmanned vehicles in the Army's transformation plans. The fiscal year 2001 Defense Authorization Act establishes a goal for the armed services that one-third of their operational deep strike aircraft be unmanned by 2010 and one-third of their operational ground combat vehicles be unmanned by 2015.<sup>11</sup>

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## Following Best Practices Will Be Critical To The Army's Success

The Army's ability to meet its transformation goals will largely hinge on its ability to manage transformation acquisition efforts as successful commercial firms do. Our best practice reviews show that a commercial firm's success in developing new systems depends a great deal on balancing requirements against available resources and having the right knowledge at the right decision points for making trade-offs. Such knowledge would include the readiness of technology, accurate cost estimates, and the availability of funding.

Specifically, our report on incorporating new technologies into programs indicated commercial firms that demonstrate a high level of maturity before new technologies are incorporated into product development programs puts those programs into a better position to succeed.<sup>12</sup> Key to the Army's implementation of this best practice to develop and acquire objective force weapon systems during its transformation will be its ability to identify the key enabling technologies, determine the current maturity of each key technology, and develop a plan to develop the key technologies and demonstrate that they are at a high level of maturity before entering systems development. If all the key enabling technologies do not reach a high level of maturity when the Army needs to start

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<sup>11</sup> Section 220 of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 (P.L. 106-398, Oct. 30, 2000).

<sup>12</sup> *Best Practices: Better Management of Technology Development Can Improve Weapon System Outcomes* (GAO/NSIAD-99-162, July 30, 1999).

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developing the objective force systems, it may have to consider reaching the planned objective force capabilities in stages. This strategy could provide worthwhile capability increases, but it may also require the Army to continue with its legacy and interim forces longer than anticipated.

Additionally, our report on setting requirements for new products indicated that commercial firms that keep the product's requirements flexible prior to the start of the program enables the matching of the requirements with the user's needs and the developer's resources making it more likely that the product will be successfully developed—products that are delivered within predicted costs and time frames and that meet the needs of the customers.<sup>13</sup> Key to the Army's implementation of this best practice is maintaining flexibility in requirements and schedule to enable it to make needed trade-offs. Also, the Army should be in a better position to make those trade-offs if it prioritizes requirements among and within the three forces and determines the importance of meeting the various force schedules within available transformation resources.

Given the complexity of its organization and its current planning processes, the Army's chance of successfully implementing best practices will be increased if components are provided service-wide guidance that will ensure that decisions focus on achieving overall transformation acquisition goals. According to Army Staff officials, the Army has recognized the complexity of the task and has begun managing the transformation with the Transformation Campaign Plan. The Plan is a comprehensive approach to ensure integration and synchronization of efforts toward the development and fielding of the objective force.

Lastly, the Army recognizes and is addressing many of the risks related to these challenges by making trade-off decisions. As such we are not making recommendations in this report. However, it will be important for the Congress to carefully study the Army's efforts and assess its transformation progress and priorities when deliberating future budget requests and to ensure that the Army is following a knowledge-based approach in making acquisition decisions.

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<sup>13</sup> *Best Practices: Better Matching of Needs and Resources Will Lead to Better Weapon System Outcomes* (GAO-01-288, Mar. 8, 2001).

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## Agency Comments

The Department of Defense generally agreed with the report. It agreed that there are significant challenges in balancing the desired schedule, the required resources, and the necessary maturation of technology to accomplish the Army's transformation goals. The Department's comments are presented in their entirety in appendix I.

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## Scope and Methodology

We assessed the Army's plans for obtaining the weapon systems and other equipment needed for its transformation to a new combat force and developed our observations as to the risks inherent in those plans. To do this, we reviewed assessments of the future threat including, reports of the U.S. Commission on National Security/21st Century and the National Defense Panel, the National Security Strategy, and the National Military Strategy; documents providing guidance to the Army planners such as the Joint Vision 2020, the Army Vision 2010, the Army Plan, and the Army Chief of Staff statements and planning guidance; documents associated with the acquisition of the Family of Interim Armored Vehicle including the Acquisition Strategy Report, Operational Requirements Document, Request for Proposals, and the Brigade Combat Team Organizational and Operational Concept, and budget documents; documents associated with modernizing the legacy force including program budget decision memorandums and other budget documents, previous Army modernization plans, Army Science Board report on Tank Modernization, and the report to Congressional Defense Committees on the Crusader program; and documents associated with the Future Combat Systems development including the concept design solicitation and letter of agreement between the Army and the Defense Advanced Research Projects Agency.

In performing our work, we obtained documents and interviewed officials involved in planning the Army's transition in the Offices of the Deputy Chief of Army Staff for Operations and Plans, Washington, D. C.; U.S. Army Materiel Command, Alexandria, Virginia; U.S. Army Training and Doctrine Command, Fort Monroe, Virginia; U.S. Army Tank-automotive and Armaments Command and the Program Executive Office, Ground Combat and Combat Support Systems, Warren, Michigan; U.S. Army Aviation Center and School, Fort Rucker, Alabama; U.S. Army Field Artillery School and Center, Fort Sill, Oklahoma; and the Defense Advanced Research Projects Agency, Arlington, Virginia.

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We conducted our review between October 1999 and April 2001 in accordance with generally accepted government auditing standards.

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We are sending copies of this report to the Honorable Donald H. Rumsfeld, Secretary of Defense; the Honorable Joseph W. Westphal, Acting Secretary of the Army; and the Honorable Mitchell E. Daniels, Jr., Director, Office of Management and Budget. We will make copies available to others on request.

If you or your staff have any questions concerning this report, please call me on (202) 512-4841. This report was prepared under the direction of James F. Wiggins, Director, Acquisition and Sourcing Management, and Carol Schuster, Director, Defense Capabilities and Management. Major contributors to this report are Robert J. Stolba, Lawrence D. Gaston, John P. Swain, and Stephanie J. May.



Jack L. Brock, Jr., Managing Director  
Acquisitions and Sourcing Management



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List of Addressees

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

The Honorable Ted Stevens, Chairman  
The Honorable Robert C. Byrd, Ranking Member  
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The Honorable John P. Murtha, Ranking Minority Member  
Subcommittee on Defense  
Committee on Appropriations  
House of Representatives

# Appendix I: Comments From the Department of Defense



ACQUISITION,  
TECHNOLOGY  
AND LOGISTICS

## OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON  
WASHINGTON, DC 20301-3000

26 APR 2001

Mr. James J. Wiggins  
Director, Acquisition and Sourcing Management  
U.S. General Accounting Office  
Washington, D.C. 20548

Dear Mr. Wiggins:

This is the Department of Defense (DoD) response to the GAO draft report, "DEFENSE ACQUISITION: Army Transformation Weapon Systems Challenges," dated April 11, 2001 (GAO Code 707563 [formerly 707514]/OSD Case 3031).

DoD generally agrees with the report. There are significant challenges in balancing the desired schedule, the required resources, and the necessary maturation of technology to accomplish the Army's transformation goals.

The Department appreciates the opportunity to review the draft report, and acknowledges that the GAO has been responsive to DoD concerns as the report has been developed. We have provided separately some suggestions for improved clarity.

Sincerely,

A handwritten signature in cursive script that reads "George R. Schneiter".

George R. Schneiter  
Director  
Strategic and Tactical Systems







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