

## An Analysis of the Army's Transformation Programs and Possible Alternatives

In the past decade, the Army initiated two programs designed to dramatically alter the way its combat forces are equipped and organized. The Modularity Initiative would reorganize the Army's warfighting forces from divisions containing 12,000 to 17,000 or more soldiers to a larger number of smaller, interchangeable, and independent brigade combat teams (BCTs) of 3,000 to 4,000 soldiers. Before changes in the program were made on the basis of Secretary of Defense Robert M. Gates's announcement in April 2009, the Future Combat Systems (FCS) program would have, among other things, replaced the Army's heavy tracked armored vehicles developed in the 1960s and 1970s with lighter and more mobile combat vehicles that would be equally as survivable. (See Summary Box 1.) Army leaders have contended that together those two programs would yield an Army that could respond to crises around the world more quickly and that would be more mobile and technically sophisticated—and, hence, more effective—once it arrived.

In this analysis, the Congressional Budget Office (CBO) examines the Army's Modularity Initiative and FCS program as included in the previous Administration's 2009 plan to see if they could have met their initial goals. CBO addresses the question of whether the Army's current combat units are better able than their predecessors to respond to crises overseas. CBO also evaluates the effect that the FCS program included in the previous Administration's 2009 plan would have had on the Army's armored vehicle fleet and the combat units that it was expected to equip. In addition, CBO attempts to identify

the costs through 2030 of the Army's Modularity Initiative and the FCS and related modernization programs in the previous Administration's 2009 plan. Last, the agency examines the advantages and disadvantages of several alternative plans for modernizing the Army's combat brigades, primarily focusing on units equipped with armored vehicles.

As planned, the Army's Modularity Initiative has resulted in the creation of additional combat brigades. However, CBO's analysis of that initiative shows that the program has cost more and yielded fewer benefits than were originally estimated.

- The Army has had to add personnel to support the additional units;
- The planned increases in personnel are unlikely to be sufficient to fully support the force structure of 76 BCTs that was planned at the end of 2008;
- Although modular BCTs might require less time to prepare to respond to an overseas crisis than their pre-modular predecessors, they require roughly the same amount of time to transport their equipment overseas; and
- The costs to carry out the initiative have grown beyond the initial estimate of \$21 billion and may total more than \$140 billion through 2013.<sup>1</sup>

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1. Unless otherwise noted, all costs are expressed in 2009 dollars.

**Summary Box 1.****Implications of the New Administration's Fiscal Year 2010 Plan for the Army's Transformation Programs**

This Congressional Budget Office (CBO) analysis is based largely on modernization plans for the Army's transformation programs as outlined in documents that the Bush Administration submitted to the Congress in conjunction with its fiscal year 2009 budget request. In early April 2009, Secretary of Defense Robert M. Gates outlined changes to plans for both the Army's Modularity Initiative and its Future Combat Systems (FCS) program that he recommended be incorporated into the Obama Administration's fiscal year 2010 defense budget request. Those changes included:

- Reducing the active Army's goal for combat units by 2013 from 48 brigade combat teams (BCTs) to 45 brigade combat teams and
- Canceling the manned vehicle portion of the FCS program and accelerating the "spin-out" of FCS technologies to all of the Army's brigade combat teams, rather than just infantry brigades.

Although the 2010 request was submitted shortly before CBO published this report, that request did not contain sufficient programmatic details to allow CBO to conduct a complete reassessment of either the revised Modularity Initiative or the FCS program. Moreover, the Administration announced that, unlike previous budget requests, the fiscal year 2010

request would not be accompanied by revised and updated Selected Acquisition Reports (SARs), which would have supplied programmatic details for the FCS program for years after 2010. For those reasons, CBO relied on details contained in or accompanying the previous Administration's 2009 plan to conduct its analysis of the Modularity Initiative. In particular, CBO relied on the most recent SAR, submitted in December 2007, to analyze the cost, schedule, and effects of the FCS program on the Army's forces.

Although details concerning the revised FCS program will most likely not be available until the fall of 2009, the general outlines for that program were included in Secretary Gates's announcement. The changes he announced, including the cancellation of the manned vehicle portion of the FCS program and an acceleration of the introduction of spin-out technologies into the Army's BCTs, closely parallel the changes in the previous FCS program that are included in Alternative 1 in this report. Thus, although the program described in Alternative 1 and the FCS program included in the Obama Administration's 2010 budget are most likely not identical, CBO's analysis of the effects of Alternative 1 on the Army's forces should yield some insight into the likely impact of a restructured FCS program that fits the description of the program outlined by Secretary Gates.

CBO's analysis also reaches the following conclusions concerning the Army's FCS program included in the previous Administration's 2009 plan and associated modernization programs:

- The FCS program would have fielded a full set of equipment to less than 20 percent of the Army's BCTs and would not have been completed until 2030;
- Although one of the main goals of the FCS program was to speed the movement of Army combat units overseas, replacing the current armored vehicles with FCS manned vehicles would not have significantly reduced transportation times;
- According to the Army's estimates, the annual costs of the FCS program and its associated Spin-Out program could have approached \$10 billion at their peak, an expenditure that could have been difficult to afford given other demands on the Army's budget;
- Alternative approaches to introducing FCS technologies into the Army's combat units—approaches that would eliminate all or part of the program's ground

vehicles while retaining its communications network and, in some cases, its components with sensors to detect enemy troops and their movement—would yield annual savings of \$3 billion to \$8 billion in the cost of FCS-related programs included in the previous Administration's 2009 plan; and

- Because FCS manned vehicles would not have replaced the armored combat vehicles in all of the Army's BCTs, additional annual funding of \$2 billion to \$4 billion could have been required over the next 20 years to modernize vehicles that the Army will retain indefinitely.

## The Army's Modularity Initiative

In February 2004, the Army announced that it would restructure its combat forces to make them more agile and flexible. Most of the service's combat forces at that time were organized into divisions that could include more than 17,000 personnel, a structure that had not been well-suited to some of the Army's previous operations (such as the one in Bosnia) that called for less than a full division's worth of combat forces. To create a more responsive force, then Army Chief of Staff General Peter Schoomaker introduced the Modularity Initiative, which would reorganize the Army from one based on divisions, several of unique design, to one based on brigade combat teams of 3,000 to 4,000 soldiers, each being one of only three designs. General Schoomaker stated in 2004 that the conversion would be accomplished in three years, without the need for additional military personnel, and at a cost of \$21 billion. Since then, however, the Modularity Initiative has grown in scope, duration, and cost.

### Description of the Modularity Initiative Included in the Previous Administration's 2009 Plan

As described in early 2008, the Modularity Initiative would yield an Army that includes somewhat more combat forces and military personnel in 2013 than it did in 2003 and that is organized differently. The size of the combat force would grow from a total of 71 ad hoc brigade combat teams in the premodular Army in 2003 to 76 in the modular Army in 2013. The number of military personnel would also increase, climbing from 1,035,000 in 2003 to 1,111,000 in 2013. The Army in 2003 included sufficient combat units to make up 71 brigade combat teams, but those teams had to be assembled from individual and separate combat and support units

from within the Army's divisions. In contrast, the new modular BCTs are designed to be stand-alone units, each with some of its own support troops.

Although the overall size of the Army's combat forces—as measured in terms of soldiers or brigade combat teams—would not change substantially as a consequence of the Modularity Initiative, their composition would. In 2003, the majority of the Army's combat forces were in the National Guard and were designed to be mobilized in a few months if needed in the event of a large ground war, such as that envisioned with the Warsaw Pact during the Cold War (see Summary Figure 1). Reflecting a change in national strategy, the structure planned by the previous Administration for 2013 entailed an increase in combat forces in the active Army (from 33 BCTs to 48 BCTs) and a decrease in combat forces in the National Guard (from 38 BCTs to 28 BCTs).<sup>2</sup> (The Army Reserve includes no BCTs.) Other planned changes in combat forces are a decrease in the number of brigade combat teams that contain tanks or other armored combat vehicles, from 50 in 2003 to 33 in 2013—with the largest reduction planned for the National Guard—and a larger increase in the number of BCTs that include no armored vehicles, from 21 to 43.<sup>3</sup> (For a brief description of the three components of the Army and their respective roles, see Summary Box 2.)

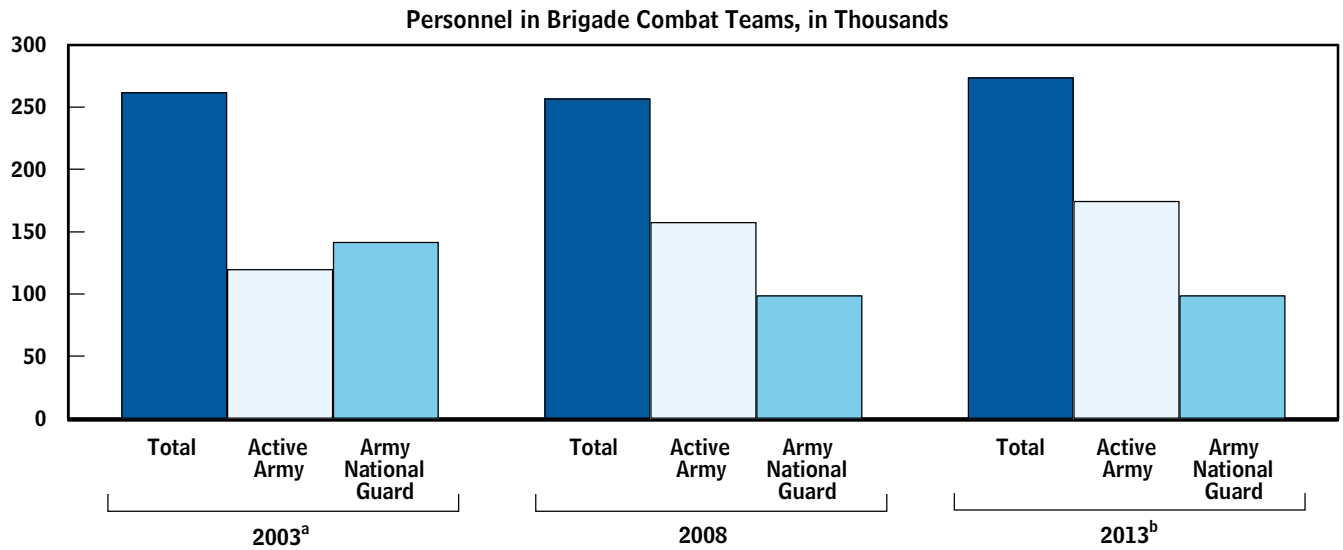
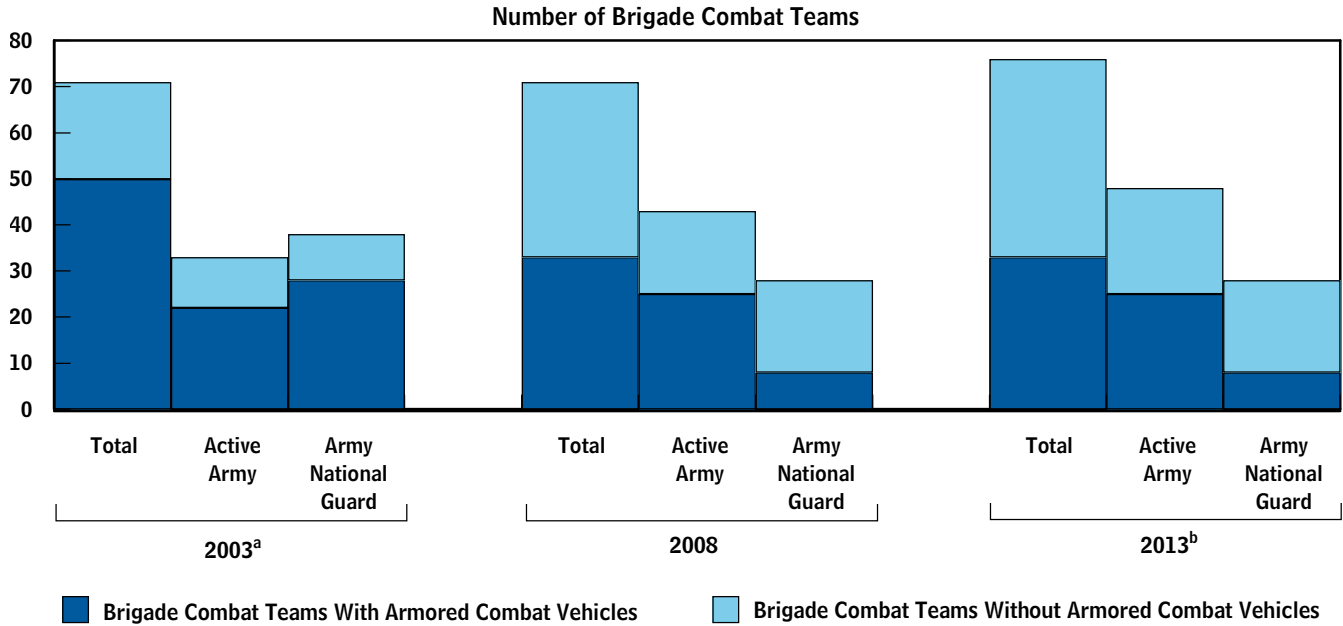
### Costs of the Modularity Initiative

The overall costs through 2030 of the Army's Modularity Initiative included in the previous Administration's 2009 plan, including costs to reorganize units and add brigade combat teams and personnel, could exceed \$250 billion, in CBO's estimation. Costs for the additional personnel included in the initiative would account for the greatest portion of that total—\$118 billion from 2009 through 2030. Costs for operation and maintenance could also be significant—\$79 billion from 2009 through 2030—because the Army might need to hire 16,000 additional civilians to perform administrative tasks previously performed by soldiers. (The Army has stated that it will probably incur additional costs to purchase equipment after 2013 but has not provided specific details of what might need to be purchased. Consequently, CBO did not

2. Changes announced by Secretary Gates in April 2009 would limit the size of the active Army to 45 BCTs.
3. Changes announced by Secretary Gates in April 2009 could limit the number of BCTs with no armored combat vehicles to 40.

**Summary Figure 1.**

**Changes in the Army's Brigade Combat Teams Under the Previous Administration's 2009 Plan, 2003 to 2013**



Source: Congressional Budget Office based on data from the Department of the Army.

Note: The Army Reserve includes no brigade combat teams.

- a. A brigade combat team in 2003 was composed of one maneuver brigade and additional support units.
- b. Does not reflect Secretary of Defense Robert M. Gates's announcement in April 2009 that the active Army would grow to a total of 45 brigade combat teams rather than the 48 included in the previous Administration's 2009 plan.

## Summary Box 2.

### The Active Army, the Army National Guard, and the Army Reserve

The Army is made up of three components, which differ in availability and readiness: the active Army, the Army National Guard, and the Army Reserve. Units in the active Army, the majority of which are combat units, are filled with soldiers on active duty, who are always available to respond to orders from the Commander in Chief. At the end of 2008, the authorized end strength of the active-duty force was 525,000 soldiers. (End strength is the number of personnel authorized to be in the Army at the end of the fiscal year.) By contrast, most members of the Army National Guard and Army Reserve are civilians who practice or drill only part time during peacetime but can be called to active duty in the event of a crisis. The National Guard, with 351,000 members at the end of 2008, reports during peacetime to state governors and forms the state militias mandated in the

Constitution. The National Guard includes a mix of combat and support units and provides a force that governors can call on to meet domestic emergencies and maintain civil order. During a national crisis, the President can call members of the National Guard to federal active duty. Because members have to be activated and units mobilized in response to a call from the President, some units may take months to get ready to deploy to an overseas crisis. The 205,000 members of the Army Reserve are assigned almost exclusively to support units and must also first be called to active duty by the President before they can be assigned to military tasks outside the scope of regular training duty. Since September 11, 2001, members of the Army National Guard and Army Reserve have been used extensively to support long-term operations in the United States and overseas.

include any costs for procurement after 2013.) And the reorganization of the Army's units alone will incur costs because modular units will be equipped differently from the units they replace and may be stationed in new locations (see Summary Table 1). In sum, CBO estimates that the costs for the Modularity Initiative could be nearly \$100 billion from 2009 through 2013 and \$155 billion from 2014 through 2030, yielding a total cost from 2009 through 2030 of \$254 billion.

## The Army's Modernization Programs Related to Modularity

The Army has several modernization programs that are a major part of its transformation efforts. The most costly and technically ambitious of those is the FCS program and its related Spin-Out program. The Army also has several programs designed to maintain and upgrade the armored combat vehicles that equip its modular units.

### Description of the FCS Program Included in the Previous Administration's 2009 Plan

The FCS program was first conceived by then Army Chief of Staff General Eric Shinseki to develop a new generation of combat vehicles that would be as lethal and

survivable as the heavy weapons the Army now fields but that would weigh much less, be easier to transport, and require far less logistical support.

The FCS program would have developed and purchased new vehicles to replace most of the combat vehicles that equip the service's heavy units and several types of unmanned aerial and ground vehicles (to provide remote surveillance and protection). Specifically, under the previous Administration's 2009 plan, the Army would have developed eight new types of manned armored vehicles, two classes of unmanned aerial vehicles (UAVs), two types of unmanned ground vehicles, unattended ground sensors, and a missile launcher and associated munitions (see Summary Table 2). The final component of the FCS program is the network, which comprises the common operating software and the communications and computer systems that would allow all of the FCS elements to communicate with one another and with the Army's other systems.

**Schedule for Fielding Full Brigade Sets of FCS Components.** The Army planned to field all 14 FCS components and the associated network in full brigade sets—replacing all of the combat vehicles in a brigade at once—for a total

**Summary Table 1.**

**Costs of the Army's Transformation Programs Under the Previous Administration's 2009 Plan, 2009 to 2030**

(Billions of 2009 dollars)

Program and Account	2009-2013	2014-2030	Total, 2009-2030
<b>Modularity</b>			
Military Personnel	25	93	118
Operation and Maintenance	17	62	79
Procurement	44	<sup>a</sup>	44
Construction	13	<sup>a</sup>	13
<b>Total, Modularity</b>	<b>99</b>	<b>155</b>	<b>254</b>
<b>Modernization</b>			
Future Combat Systems			
RDT&E	12	2	14
Procurement	8	94	103
<b>Subtotal</b>	<b>20</b>	<b>96</b>	<b>117</b>
FCS Spin-Out Program			
RDT&E	*	*	*
Procurement	3	15	18
<b>Subtotal</b>	<b>3</b>	<b>15</b>	<b>18</b>
Combat Vehicle Modernization <sup>b</sup>			
RDT&E	1	1	2
Procurement	6	47	53
<b>Subtotal</b>	<b>7</b>	<b>48</b>	<b>55</b>
<b>Total, Modernization</b>	<b>30</b>	<b>159</b>	<b>189</b>
<b>Memorandum:</b>			
Average Annual Cost			
Modularity	20	9	12
Modernization	6	9	9

Source: Congressional Budget Office based on Government Accountability Office, *Force Structure: Better Management Controls Are Needed to Oversee the Army's Modular Force and Expansion Initiatives and Improve Accountability for Results*, GAO-08-145 (December 2007), p. 18; Congressional Budget Office, "Estimated Cost of the Administration's Proposal to Increase the Army's and Marine Corps's Personnel Levels," letter to the Honorable Carl Levin (April 16, 2007); and data from the Department of the Army.

Note: RDT&E = research, development, test, and evaluation; FCS = Future Combat Systems; \* = less than \$500 million.

a. Unknown and assumed to be zero.

b. Includes upgrades to Abrams tanks, Bradley fighting vehicles, and M109 howitzers and purchases of Stryker vehicles to replace M113-based vehicles.

**Summary Table 2.****FCS Systems and Current Counterparts in the Army's Combat Brigades**

Future Combat System <sup>a</sup>	Mission	Current System Being Replaced
<b>Manned Vehicles</b>		
Mounted Combat System	Destroy enemy	Abrams tank
Infantry Carrier Vehicle	Transport and protect soldiers	Bradley fighting vehicle and M113 armored personnel carrier
Reconnaissance and Surveillance Vehicle	Scout	Bradley fighting vehicle
Non-Line-of-Sight Cannon	Provide fire support	M109 howitzer
FCS Recovery and Maintenance Vehicle	Recover stranded vehicles	M88 recovery vehicle
Command and Control Vehicle	Transport and protect commanders	M113-based vehicle
Non-Line-of-Sight Mortar	Provide fire support	M113-based vehicle
Medical Vehicle	Treat and evacuate wounded personnel	None
<b>Unmanned Ground Vehicles</b>		
Armed Robotic Vehicle-Assault-Light	Perform sentry duty, provide cover	None
Multifunctional Utility/Logistics and Equipment	Carry cargo, detect and counter mines	None
Small Unmanned Ground Vehicle	Investigate small confined spaces	None
<b>Unmanned Aerial Vehicles</b>		
Class I UAV	Provide surveillance out to a distance of 8 km	None
Class IV UAV	Provide surveillance and communications relay out to a distance of 75 km	None
<b>Other Systems</b>		
Non-Line-of-Sight Launch System	Attack with precision out to a distance of 70 km	None
Unattended Ground Sensors	Detect and identify intruders	REMBASS

Source: Congressional Budget Office based on data from the Department of the Army, FCS Program Manager, Brigade Combat Team, *Future Combat Systems Brigade Combat Team: 14 + 1 + 1 Systems Overview* (March 2007); and Army Training and Doctrine Command (TRADOC), Unit of Action Maneuver Battle Lab and TRADOC System Manager FCS, *Family of Systems Battle Book* (January 31, 2005).

Note: FCS = Future Combat Systems; UAV = unmanned aerial vehicle; km = kilometer; REMBASS = remotely monitored battlefield sensor system.

a. Systems included in the FCS program prior to changes announced by Secretary of Defense Robert M. Gates in April 2009.

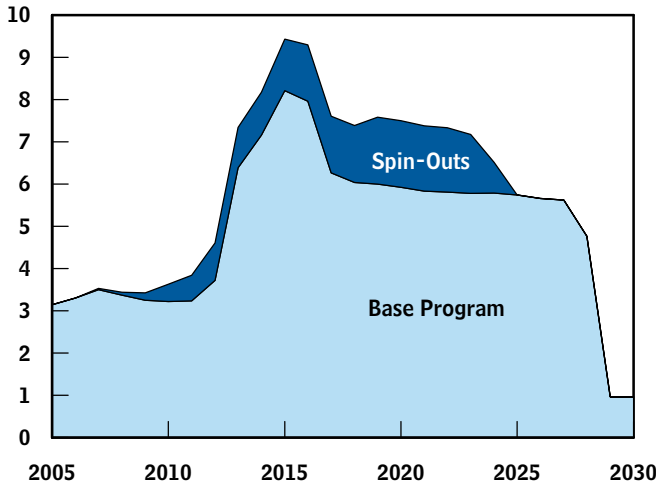
of 15 BCTs. Because of the technological sophistication and complexity of some of the systems, the Army did not expect to field the first BCT to be equipped with all 14 components until 2016. After that, the service planned to equip one additional BCT a year with the full suite of FCS components. Under the schedule in effect at the end of 2008, equipment for the last brigade would have been purchased in 2028 and fielded in 2030.

**The FCS Spin-Out Program**

The Army has created the FCS Spin-Out program to introduce some FCS components as soon as they have been developed into Army combat units that are not scheduled to receive the full complement of equipment. The Army's program included in the 2009 plan will equip those modular BCTs that have no armored combat vehicles, known as infantry BCTs, with six of the FCS components—everything except the manned vehicles and

**Summary Figure 2.****Annual Costs of Programs Related to the Future Combat Systems Under the Previous Administration's 2009 Plan**

(Billions of 2009 dollars)



Source: Congressional Budget Office based on Office of the Secretary of Defense, *Future Combat Systems: Selected Acquisition Report* (December 31, 2007); and budget data from the Department of the Army.

one variant of the larger unmanned ground vehicle.<sup>4</sup> In addition, some of the high mobility multipurpose wheeled vehicles (HMMWVs) in each infantry BCT will receive equipment enabling them to be connected to the FCS network so that the information collected by the sensors can be shared throughout the brigade.

Fielding of the various FCS components to the Army's infantry BCTs is scheduled to begin in 2011 with four FCS components, and fielding of the remaining two components included in the Spin-Out program will begin in 2014.<sup>5</sup> All of the Army's infantry BCTs would have received some FCS components by 2025 under the 2009 plan, although in lower quantities than would have been fielded to Future Combat Systems brigade combat teams.

4. Secretary Gates announced in April 2009 that the Obama Administration's 2010 plan will accelerate the fielding of Spin-Out technology to all of the Army's BCTs.

5. Initial fielding will include unattended ground sensors, one of the unmanned ground vehicles, one of the UAVs, the non-line-of-sight launch system, and a rudimentary version of the FCS network.

**Programs to Upgrade, Maintain, and Replace the Army's Current Armored Combat Vehicles**

The final modernization effort that CBO examined involves the Army's programs to modernize and upgrade the existing armored combat vehicles in its heavy brigade combat teams. CBO examined those programs because the Army would have retained large numbers of some of its current armored vehicles in its inventories even after FCS fielding was completed in 2030. In particular, the Army planned to retain indefinitely 11 heavy BCTs equipped with existing tanks and other tracked combat vehicles.

**Costs of the Army's Modernization Programs**

The total cost of the Army's modernization programs included in the previous Administration's 2009 plan could have reached \$189 billion from 2009 to 2030, according to CBO's estimates. The FCS program, which represented by far the biggest single investment that the Army was planning to make during the next 20 years, would have commanded the largest portion of that total, requiring \$14 billion for research and development (R&D) and slightly more than \$100 billion for purchasing 15 brigades' worth of systems.<sup>6</sup> The Army planned to buy one brigade's worth of FCS equipment each year starting in 2015, and the program would have required annual funding of \$5 billion to \$8 billion from 2013 through 2028 (see Summary Figure 2).

According to the Army, an additional \$18 billion will be needed to carry out the FCS Spin-Out program to equip all of the infantry BCTs with the FCS network and some FCS components (see Summary Table 1 on page 6). At the end of 2008, the Army planned to buy enough components each year to equip up to four infantry BCTs, and the resultant annual costs from 2014 to 2023 would have averaged \$1.4 billion.

To upgrade its armored combat vehicles, the Army has several programs to develop and procure improved electronics, engines, armor, and other components for installation in existing vehicles. CBO estimates that the Army could invest a total of \$7 billion in such programs from 2009 through 2013, considerably less than the \$11 billion it invested from 2005 through 2008. Although the

6. That estimate is based on data in the December 2007 Selected Acquisition Report. CBO was unable to develop an independent estimate of the cost of one brigade's worth of equipment because some of the individual FCS components are not yet fully defined.



Army has expressed a desire to upgrade many of the vehicles that will remain in its heavy BCTs until 2040, some of those programs were not well defined after 2013 in its 2009 plan. CBO estimates that total costs between 2014 and 2030 to modernize the Army's armored combat vehicle fleet could reach \$48 billion.

## Questions Regarding the Army's Transformation Programs

Although the Army has made progress over the past five years in implementing its Modularity Initiative and FCS program, questions remain about the ability of those two programs to deliver the intended results. Additional questions surround whether the Army will be able to complete the programs without investing more time, personnel, or funds than its 2009 plans included.

### Will the Army's Increase in Personnel Be Sufficient to Support Its Growth?

Despite the fact that the Army plans to add more than 76,000 personnel by 2013 (compared with its authorized strength at the end of 2003), those additional personnel are unlikely to be sufficient to support all of the combat and support units—or operating force—that the Army was planning to create under its Modularity Initiative. Even though 67,000 personnel would be added to the active Army, that increase is 28,000 soldiers short of the 95,000 additional personnel that the active Army would have needed by 2013 to support 48 BCTs and associated support units. The Army planned to find the additional 28,000 active-duty soldiers that it needed by reducing the number of soldiers that are allocated to other portions of the active Army. (Similar changes are planned for the Army National Guard and the Army Reserve.)

Under the previous Administration's plan, the two major areas of the active Army that were scheduled for personnel cuts are the institutional Army, or generating force—which trains, equips, and manages the operating force—and the Individuals Account, which includes soldiers who are part of the active Army but are not assigned to units. (The latter group includes soldiers in basic training and between assignments, for example.) The Army planned to reduce the number of active-duty soldiers in those two personnel pools by assigning some tasks currently performed by soldiers—such as designing and purchasing weapons—to civilians or contractors and by reducing the number of soldiers in the Individuals Account through improved management practices.

The Army planned to find the 28,000 additional active-duty soldiers it needed to fill its combat and support units through a reduction in its generating force. However, reducing the generating force in the active Army by moving tasks from the military sector to the civilian sector may be difficult or inadvisable. Military personnel are better suited for recruiting new soldiers, being drill sergeants, and establishing new unit structure and tactics—jobs all performed by the generating force—than are civilians. To make the proposed task even more difficult, the active Army reduced by 15,000 the number of military personnel assigned to its generating force between 2003 and 2007 and thus may already have transferred to the civilian sector those jobs that are easiest to convert.

The Army also planned to reverse the increase in the size of its Individuals Account in the active Army that took place between 2003 and 2007. Such a reduction was needed to provide the active-duty soldiers required to fill the operating force included in the previous Administration's 2009 plan. That task may be even more difficult than reducing the size of the generating force. In the active Army, new recruits who are in training and have not yet been assigned to units account for more than half of all soldiers in the Individuals Account. Because the active Army will grow in size between 2007 and 2013, it will need to recruit and add more soldiers each year, yielding a growing number of trainees, rather than a smaller number. Other major contributors to the account—cadets at West Point, as well as officers and soldiers in school—are also not likely to shrink as the Army itself grows. Previous analyses by the Army's personnel managers have found that the size of the Individuals Account grows, relative to the overall size of the Army, during periods when the Army itself is expanding. Given the constraints that are likely to limit the Army's ability to transfer the needed personnel from its generating force and Individuals Account to its operating force, CBO concluded that the Army might need to either request further increases in its end strength or, as Secretary Gates announced that the Obama Administration intends to do, cut back its plans for expanding its force structure.

### Are Modular Units Easier to Deploy than Similar Premodular Units?

Another purpose of the Modularity Initiative and the FCS program was to create combat units that would be easier to send overseas than premodular units. One way to make units easier to deploy is to reduce the weight of their associated equipment. But modular BCTs, in

**Summary Table 3.****Comparison of the Army's Premodular and Modular Brigade Combat Teams**

Type of Brigade Combat Team	Personnel	Equipment			Delivery Requirements <sup>b</sup>	
		Armored Vehicles <sup>a</sup>	Trucks <sup>a</sup>	Total Weight (Tons)	Cargo Aircraft Sorties <sup>c</sup>	Days <sup>d</sup>
Premodular <sup>e</sup>						
Infantry						
Light	2,700	0	420	2,900	70	4
Airborne	3,100	0	570	4,200	100	6
Heavy	3,800	450	840	25,000	480	26
Modular						
Infantry	3,400	*	1,000	7,400	170	10
Heavy	3,800	350	950	22,800	440	24
Stryker	3,900	320	700	14,900	350	19
FCS <sup>f</sup>	3,300	320	700 <sup>g</sup>	21,800	420	23

Source: Congressional Budget Office based on Military Traffic Management Command Transportation Engineering Agency, *Deployment Planning Guide: Transportation Assets Required for Deployment*, MTMCTEA Pamphlet 700-5 (May 2001); Department of the Air Force, *Air Mobility Planning Factors*, Pamphlet 10-1403 (December 18, 2003); and data from the Department of the Army.

Note: \* = fewer than 5 vehicles; FCS = Future Combat Systems.

- a. Rounded to the nearest 10 vehicles.
- b. Needed to deliver unit equipment to an overseas location in Eastern Africa.
- c. Rounded to the nearest 10 sorties and based on an average payload per sortie of 52 tons for heavy and FCS units and 43 tons for all other units.
- d. The number of daily sorties is constrained by the capacity of airfields in Eastern Africa.
- e. Premodular brigade combat teams are composed of several divisional units, including one maneuver brigade and several supporting units. Not all types of premodular brigade combat teams are included in the table.
- f. Based on the FCS program prior to changes announced by Secretary of Defense Robert M. Gates in April 2009.
- g. Includes 110 unmanned ground vehicles weighing roughly 3.5 tons each.

general, include roughly the same number of personnel and vehicles as their corresponding premodular teams. As a result, modular units equipped with current weapon systems are not significantly lighter than their predecessors and, in some cases, weigh more (see Summary Table 3). Because the modular units weigh almost as much as or more than their predecessors, they do not require significantly fewer cargo aircraft sorties or shiploads to transport them overseas. Consequently, it would take roughly the same amount of time to deliver modular units to a particular destination as it would take to deliver premodular formations of the same type.

Equipping units with FCS vehicles would not have made units easier to transport overseas. An FCS-equipped BCT, as conceived at the end of 2008, would have yielded less

than a 5 percent reduction in the time needed to deploy by air, as compared with a heavy BCT (see Summary Table 3). Furthermore, because FCS BCTs existed only on paper and were based on many assumptions about the weight and fuel efficiency of FCS vehicles—which also did not yet exist—the weight of an FCS-equipped BCT could have continued to grow as it had over the past few years.

#### **Are the FCS-Related Programs Affordable?**

Based on Army plans and estimates at the end of 2008, the FCS and Spin-Out programs would have required funding approaching \$10 billion annually starting in 2015, the first year in which the Army was scheduled to buy one BCT's worth of the full complement of FCS equipment. During the preceding five years, the program

would have consumed increasingly larger shares of the Army's planned procurement budget. If the Army's procurement funding grew after 2013 at a rate equal to inflation—that is, if it remained at the same level in constant 2009 dollars—the share of the Army's planned procurement budget consumed by the FCS and Spin-Out programs would have risen from almost 5 percent in 2011 to roughly 40 percent in 2015 and 2016 and remained above 30 percent through 2023.<sup>7</sup> (In comparison, the Army's purchase of ground combat vehicles during the 1980s accounted for 20 percent to 24 percent of the service's total procurement budget.) Dedicating such a large portion of the Army's procurement funding to the FCS-related programs might not have left sufficient money for purchasing other weapon systems (such as helicopters) or needed support equipment (such as trucks, generators, and ammunition).

### **Would the Limited Fielding of FCS Technologies in Army BCTs Have Been Worth the Investment?**

The FCS program was originally intended to inject new technologies into all of the Army's brigade combat teams early in the 21st century. As the fielding of fully equipped FCS BCTs slipped farther into the future and was limited to fewer brigades, however, the Army created the Spin-Out program to field to more of its combat units smaller quantities of some technologies as soon as they became available. The combined effect of those two programs, as included in the previous Administration's 2009 plan, was to put at least some FCS technology into almost 70 percent of the Army's BCTs by 2025. However, at that time, only 13 percent of the Army's BCTs would have had the full set of FCS equipment—all 14 components and hardware to connect the majority of a brigade combat team's vehicles, including all of its combat vehicles, to the network. Twenty three BCTs, representing roughly 30 percent of the total, would have had no FCS-related hardware.

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7. To put that assumption in historic context, the Army's procurement budget has experienced several peaks and valleys since 1960. Procurement funding in two-thirds of those years was less than that planned for 2013. The average procurement funding between 1960 and 2013 is \$19 billion, \$5 billion less than that planned for 2013 under the previous Administration's 2009 plan.

## **Alternative Approaches to Modernizing the Army's Combat Forces**

CBO analyzed three alternatives for modernizing the Army's combat units that would address concerns about the FCS program—specifically, its affordability as it was structured in 2008 and the slow rate of introduction of its systems into the Army's combat units. Under the first two alternatives, the Army would retain different components of the FCS program (to emphasize systems that would contribute to different objectives of modernization) while canceling the remainder (see Summary Table 4).

- Under Alternative 1, which closely resembles the FCS-related programs likely to be included in the Obama Administration's 2010 plan, the Army would develop and purchase the full suite of sensors called for in the FCS program (to provide enhanced information-collection capabilities), the non-line-of-sight launch system (to attack targets), and a version of the FCS network (to disseminate that information). None of the other large ground vehicles would be developed. With greater knowledge about the location and character of potential threats and the whereabouts of allies, the Army's forces would be better able to respond and act appropriately, either individually or in concert.
- Under Alternative 2, the Army's primary focus would be on introducing new vehicular technology into its heavy BCTs by developing several of the new manned ground vehicles in the FCS program (particularly those that would replace the older armored combat vehicles currently in the fleet). A secondary focus would be on developing and purchasing a modified version of the FCS network to enhance communication within the brigade.
- Under Alternative 3, the Army would develop a scaled-down version of the FCS network (as under the other two alternatives). All other elements of the FCS program would essentially be canceled.

Under all of the alternatives, the service would modernize its existing armored vehicle fleet by integrating into those vehicles the capabilities associated with the retained portions of the FCS network, when they become available.

**Summary Table 4.**

**Emphasis of and Components Included in Modernization Alternatives for the Army**

Alternative	Emphasis	FCS Components <sup>a</sup>	
		Retained	Canceled
Alternative 1	Information collection and sharing	Scaled-down network UAVs, Classes I and IV Unattended ground sensors Small unmanned ground vehicle Non-line-of-sight launch system	Manned vehicles (All) Large unmanned ground vehicles (All)
Alternative 2	New vehicular technology	Scaled-down network Manned vehicles Medical Infantry carrier <sup>b</sup> Non-line-of-sight mortar Non-line-of-sight cannon Command and control	Unmanned ground vehicles (All) Manned vehicles Mounted combat system FCS recovery and maintenance Reconnaissance and surveillance UAVs, Classes I and IV Non-line-of-sight launch system Unattended ground sensors
Alternative 3 <sup>c</sup>	Current systems	Scaled-down network	Manned vehicles (All) Unmanned ground vehicles (All) UAVs, Classes I and IV Unattended ground sensors Non-line-of-sight launch system

Source: Congressional Budget Office.

Note: FCS = Future Combat Systems; UAV = unmanned aerial vehicle.

- a. Based on systems included in the FCS program prior to changes announced by Secretary of Defense Robert M. Gates in April 2009.
- b. Under Alternative 2, the Army would buy roughly 25 percent of the infantry carrier vehicles included in the previous Administration's 2009 plan.
- c. Alternative 3 includes two variants that connect different quantities of vehicles in a brigade combat team to the network.

**Alternative 1. Accelerate the Fielding of FCS Technologies Through the Spin-Out Program**

CBO estimates that the Army would spend a total of \$96 billion from 2009 through 2030 under this alternative, a substantially smaller amount than the \$189 billion projected for the Bush Administration's 2009 modernization programs over the same period. The costs of developing and purchasing the FCS components under this alternative would be \$31 billion, in CBO's estimation, and the costs of upgrading and modernizing the existing armored combat vehicle fleet would be \$65 billion (see Summary Table 5). Annual costs to implement this alternative, which would range from \$4 billion to slightly more than \$8 billion from 2012 to 2020, would be less than the corresponding annual costs under the Bush

Administration's 2009 plan (\$6 billion to \$12 billion) over the same period (see Summary Figure 3).

This alternative would introduce FCS-based technologies into the Army's brigade combat teams at a faster pace than the Bush Administration's 2009 plan would have (see Summary Figure 4), fulfilling the Chief of the Army's desire to get new technologies into the hands of soldiers. By 2020, the Army would purchase enough FCS components under this alternative to equip all of its combat brigades. But because quantities per brigade would be much lower than those planned for the fully equipped FCS BCTs, the total number of FCS sensors and combat vehicles attached to the network would also be lower than under the Bush Administration's 2009 plan.

**Summary Table 5.****Costs of the Army's Modernization Programs Under the Previous Administration's 2009 Plan and CBO's Alternatives, 2009 to 2030**

(Billions of 2009 dollars)

	Research and Development	Procurement	Total Acquisition
		<b>Administration's Plan<sup>a</sup></b>	
FCS Program <sup>b</sup>	14	103	117
FCS Spin-Out Program	*	18	18
Upgrades to Current Systems			
Explicitly included in the Administration's plan	1	8	9
CBO's estimate of additional upgrades included in the Administration's plan <sup>c</sup>	1	45	46
<b>Total</b>	<b>16</b>	<b>173</b>	<b>189</b>
		<b>Alternative 1. Emphasize Information Collection and Sharing</b>	
FCS Components <sup>d</sup>	10	21	31
Upgrades to Current Systems <sup>c</sup>	2	63	65
<b>Total</b>	<b>12</b>	<b>84</b>	<b>96</b>
		<b>Alternative 2. Emphasize New Vehicular Technology</b>	
FCS Components <sup>e</sup>	12	64	76
Upgrades to Current Systems <sup>c</sup>	2	55	57
<b>Total</b>	<b>14</b>	<b>119</b>	<b>133</b>
		<b>Alternative 3. Cancel the FCS Program (Except the network)</b>	
Alternative 3A: Link All Combat Vehicles			
FCS network	9	32	41
Upgrades to current systems <sup>c</sup>	2	63	65
<b>Total</b>	<b>11</b>	<b>95</b>	<b>106</b>
Alternative 3B: Link a Fraction of Combat Vehicles			
FCS network	9	9	18
Upgrades to current systems <sup>c</sup>	2	63	65
<b>Total</b>	<b>11</b>	<b>72</b>	<b>83</b>

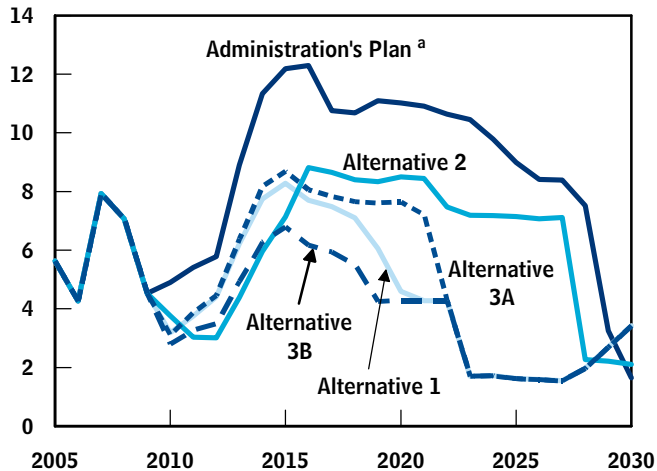
Source: Congressional Budget Office based on data from the Department of the Army.

Note: FCS = Future Combat Systems; \* = less than \$500 million.

- a. Based on the FCS program prior to changes announced by Secretary of Defense Robert M. Gates in April 2009.
- b. Includes costs to develop and purchase 15 brigades' worth of FCS components—enough to equip almost 60 percent of the Army's planned 26 heavy brigades (19 brigades in the active Army and 7 brigades in the Army National Guard).
- c. Includes upgrades to Abrams tanks, Bradley fighting vehicles, and M109 howitzers to maintain a relatively constant average age for each fleet after 2013, and purchases of Stryker vehicles to replace M113-based vehicles.
- d. Includes unattended ground sensors, unmanned aerial vehicles (Classes I and IV), non-line-of-sight launch systems, small unmanned ground vehicles, and the network.
- e. Includes manned vehicles (command and control, medical, non-line-of-sight mortar, non-line-of-sight cannon, and infantry carrier) and the network.

**Summary Figure 3.****Annual Costs of the Army's Modernization Programs Under the Previous Administration's 2009 Plan and CBO's Alternatives**

(Billions of 2009 dollars)



Source: Congressional Budget Office.

- a. Includes CBO's estimates of costs of additional upgrades to and purchases of armored combat vehicles to maintain a relatively constant average age of the fleets after 2013.

The fleet's average age would also remain relatively constant under this alternative—between 8 years and 12 years—because the Army would invest \$65 billion in upgrades from 2009 through 2030. By contrast, under the Bush Administration's 2009 plan, the average age of the "active" armored combat vehicle fleet (those vehicles that the Army needs to equip and support its forces) would have risen to more than 14 years in 2015 and then eventually declined, as FCS vehicles began to replace significant numbers of the older combat vehicles (see Summary Figure 4).

One disadvantage of this alternative (when compared with the Bush Administration's 2009 plan) is that the Army would retain its full inventory of tanks, fighting vehicles, and self-propelled howitzers indefinitely. By 2030, therefore, some of those vehicles would have been in the Army's inventory for almost 50 years. A second disadvantage of this and all of the alternatives that CBO considered is that none of the BCTs would include the

full complement of FCS technologies that the Army once argued was necessary to realize the system's full benefit.

**Alternative 2. Emphasize Investment in New Manned Combat Vehicles**

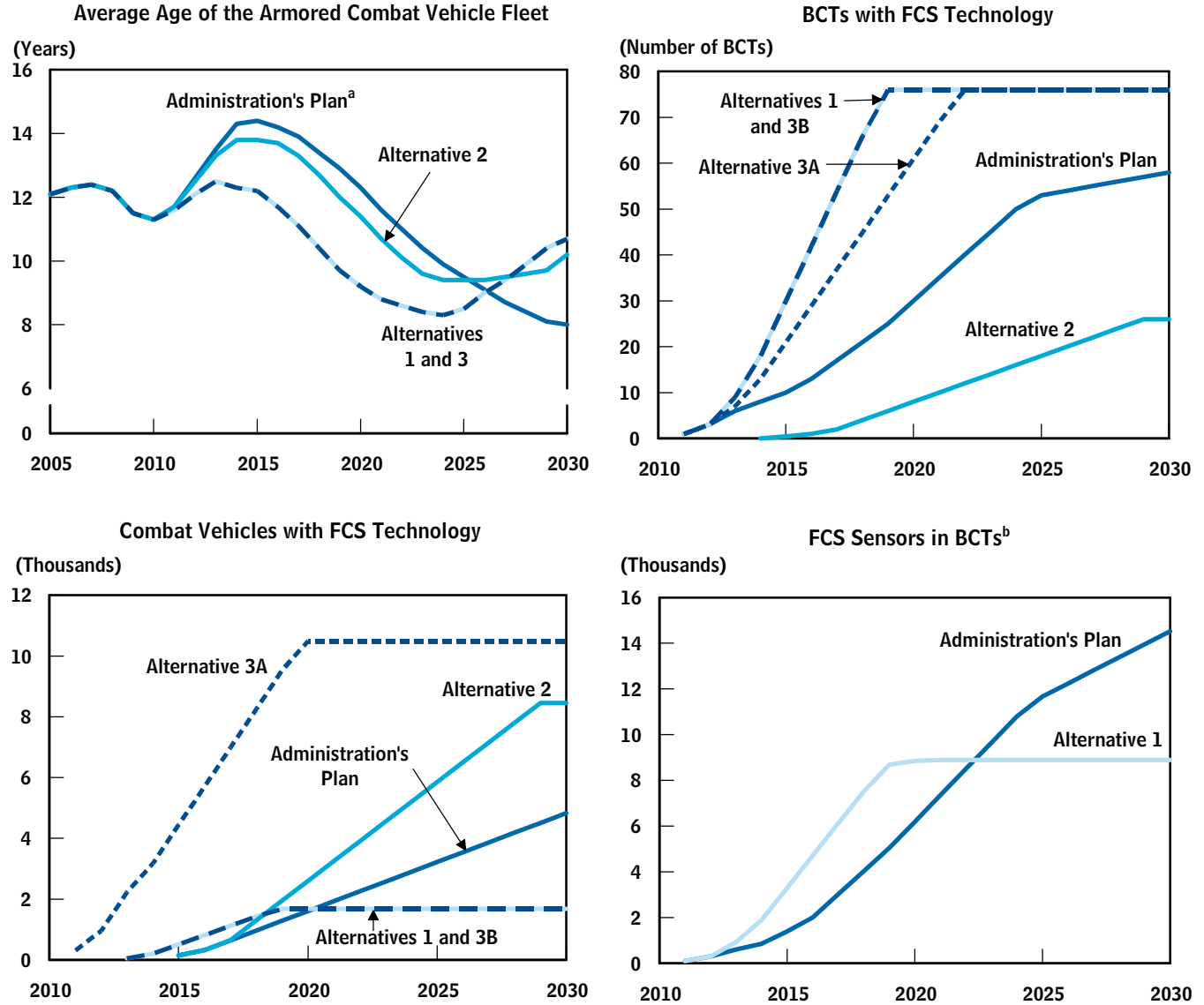
CBO estimates that costs under this alternative would exceed those under Alternative 1, totaling \$133 billion from 2009 through 2030. Of that amount, \$76 billion would be needed to develop the five variants of FCS manned vehicles and to purchase 26 BCTs' worth of equipment. Upgrading the armored vehicles retained under this alternative would cost \$57 billion from 2009 through 2030 (see Summary Table 5 on page 13). Because purchases of large numbers of FCS manned vehicles would not begin until 2015 under this alternative, the annual funding required through 2015 would be less than that required under the previous alternative or under the Bush Administration's 2009 plan (see Summary Figure 3). After 2015, annual costs for this alternative, at \$7 billion to \$9 billion, would be greater than those under the previous alternative through 2028 but still less than costs under the Bush Administration's 2009 plan.

Among the approaches that CBO considered, Alternative 2 is unique in its introduction of new vehicular technology into the Army's forces. More new armored combat vehicles would be introduced annually and some of the Army's oldest armored vehicles would be retired earlier under this alternative than under any other—including the Bush Administration's 2009 plan. In addition, this alternative would modernize all of the Army's heavy BCTs with some FCS vehicles, and it would link more manned vehicles to the FCS-based network than would the Bush Administration's 2009 plan. However, this alternative would not upgrade the current vehicles remaining in the fleet as quickly as would the other alternatives. As a consequence, the average age of all armored vehicles in the active fleet under this alternative would be similar to that under the Bush Administration's 2009 plan (see Summary Figure 4).

Perhaps the most serious disadvantage of Alternative 2 is that it would do nothing to introduce FCS technologies into those brigade combat teams that contain no tracked combat vehicles, which make up the bulk of the Army's combat forces. Furthermore, it would forgo development and fielding of FCS sensors to any of the Army's BCTs. As with the other two alternatives that CBO examined, the Army under this alternative would indefinitely retain

**Summary Figure 4.**

**Comparison of the Army's Modernization Programs Under the Previous Administration's 2009 Plan and CBO's Alternatives**



Source: Congressional Budget Office based on data from the Department of the Army.

Note: BCT = brigade combat team; FCS = Future Combat Systems.

- a. Includes CBO's estimates of additional purchases of armored combat vehicles to maintain a relatively constant average age of the fleets after 2013.
- b. Includes unmanned aerial vehicles, unattended ground sensors, small unmanned ground vehicles, and armored robotic vehicles-assault-light. Under Alternatives 2 and 3, the Army would not purchase any FCS sensors.

large numbers of Abrams tanks and Bradley fighting vehicles in its inventory.

### **Alternative 3. Cancel All Portions of the FCS Program Except the Network**

CBO developed two versions of Alternative 3. One version, Alternative 3A, would equip roughly 300 vehicles in each brigade combat team with links to the FCS network. Alternative 3B would purchase far fewer links to the FCS network—84 per BCT—an amount equal to that envisioned in the Army's Spin-Out program.

The Army would purchase the least amount of hardware in variant 3B of this alternative, when compared with that purchased under the other alternatives, and would incur the lowest costs—\$83 billion from 2009 through 2030. CBO estimates that \$18 billion of that total would be needed to develop and purchase the hardware for the FCS network; the other \$65 billion would be used to modernize the Army's existing armored combat vehicles (see Summary Table 5 on page 13). The annual funding needed to implement Alternative 3B would be roughly \$4 billion to \$6 billion from 2013 to 2022 and \$2 billion to \$3 billion thereafter (see Summary Figure 3 on page 14).

Alternative 3A, because it would purchase more network hardware per BCT than Alternative 3B, would also be more expensive. Its costs for FCS-related hardware would amount to \$41 billion from 2009 through 2030, or \$106 billion with the costs associated with combat vehicle upgrades and purchases included. Annual costs would be roughly \$8 billion from 2014 through 2021.

Both variants of Alternative 3 would introduce FCS technologies into the Army's brigade combat teams more quickly than the Bush Administration's 2009 plan would have (see Summary Figure 4 on page 15). Under both variants, each of the Army's BCTs would have some vehicles integrated into the FCS-based network by 2022, although the total number of vehicles under Alternative 3A would be nearly four times as large as that under Alternative 3B. But those vehicles would be able to receive information only from sensors that exist currently or from each other, because this alternative would cancel the development of all FCS sensors. And, even though the Army's fleets of tanks, fighting vehicles, and self-propelled howitzers would be connected by a new network and upgraded to keep them in working condition under this alternative, they would essentially be the same vehicles that the service has already had for more than 20 years.