



The Army's Future Combat System (FCS): Background and Issues for Congress

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Summary

The Future Combat System (FCS) was a multiyear, multibillion dollar program at the heart of the Army's transformation efforts. It is was to be the Army's major research, development, and acquisition program consisting of 14 manned and unmanned systems tied together by an extensive communications and information network. FCS was intended to replace current systems such as the M-1 Abrams tank and the M-2 Bradley infantry fighting vehicle. The FCS program has been characterized by the Army and others as a high-risk venture due to the advanced technologies involved and the challenge of networking all of the FCS subsystems together so that FCS-equipped units could function as intended.

The FCS program exists in a dynamic national security environment which ultimately played a role in determining the program's fate. Some questioned if FCS, envisioned and designed prior to September 11, 2001 to combat conventional land forces, was relevant in current and anticipated future conflicts where counterinsurgency and stabilization operations are expected to be the norm. The Army contended, however, that FCS was relevant throughout the "entire spectrum of conflict" and that a number of FCS technologies and systems were effectively used in counterinsurgency and stabilization campaigns in Iraq and Afghanistan.

On April 6, 2009, Secretary of Defense Gates announced that he intended to significantly restructure the FCS program. The Department of Defense (DOD) plans to accelerate the spin out of selected FCS technologies to all brigade combat teams (BCTs) but will recommend cancelling the manned ground vehicle (MGV) component of the program, which was intended to field eight separate tracked combat vehicle variants built on a common chassis that would eventually replace combat vehicles such as the M-1 Abrams tank, the M-2 Bradley infantry fighting vehicle, and the M-109 Paladin self-propelled artillery system. Secretary Gates was concerned that there were significant unanswered questions in the FCS vehicle design strategy and that despite some adjustments to the MGVs, they did not adequately reflect the lessons of counterinsurgency and close quarters combat in Iraq and Afghanistan. Secretary Gates was also critical that the FCS program did not include a role for Mine-Resistant, Ambush-Protected (MRAP) vehicles that have been used successfully in current conflicts. After re-evaluating requirements, technology, and approach, DOD will re-launch the Army's vehicle modernization program, including a competitive bidding process.

Plans for transition from the FCS program to a new program where the Army intends to modernize all BCTs with remaining FCS technologies will likely be of critical congressional interest. The development of a new Ground Combat Vehicle (GCV) to replaced the cancelled MGVs could also be subject to congressional debate and oversight. This report will be superseded by a report on the Army's BCT Modernization Strategy when sufficient details are available.

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Issues for Congress

The Future Combat System (FCS) was a multiyear, multibillion-dollar program at the heart of the Army's transformation efforts. It was to be the Army's major research, development, and acquisition program and was to consist of 14 manned and unmanned systems tied together by an extensive communications and information network. FCS was intended to replace current systems such as the M-1 Abrams tank and the M-2 Bradley infantry fighting vehicle. The Army's success criteria for FCS was that it should be "as good as or better than" the Army's current force in terms of "lethality, survivability, responsiveness, and sustainability."¹

The primary issues presented to 111th Congress are how the Army plans to transition from the FCS program to a BCT Modernization Program, incorporating selected remaining FCS technologies in a series of spin outs. Key oversight questions for consideration include the following:

- What are some of the issues resulting from the cancellation of the MGCV?
- What is the Army's BCT modernization strategy and spin out plan?
- Is the Army rushing the GCV program?
- Will the Army replace the Non-Line-of-Sight Cannon (NLOS-C)?
- What is the impact on the Army's operational concept, force structure, and doctrine?

The 111th Congress's decisions on these and other related issues could have significant implications for U.S. national security, Army funding requirements, and future congressional oversight activities.

Background

FCS Program Origins

In October 1999, then Chief of Staff of the Army (CSA) General Eric Shinseki introduced the Army's transformation strategy which was intended to convert all of the Army's divisions (called Legacy Forces) into new organizations called the Objective Force. General Shinseki's intent was to make the Army lighter, more modular, and—most importantly—more deployable. General Shinseki's deployment goals were to deploy a brigade² in four days, a division in five days, and

¹ Government Accountability Office (GAO) Report "Defense Acquisitions: Improved Business Case is Needed for Future Combat System's Successful Outcome," GAO-06-367, March 2006, p. 2.

² According to Department of the Army Pamphlet 10-1, "Organization of the United States Army," dated June 14, 1994, a brigade consists of approximately 3,000 to 5,000 soldiers and a division consists of approximately 10,000 to 18,000 soldiers.

five divisions in 30 days.³ As part of this transformation, the Army adopted the Future Combat System (FCS) as a major acquisition program to equip the Objective Force.⁴

This transformation, due to its complexity and uncertainty, was scheduled to take place over the course of three decades, with the first FCS-equipped objective force unit reportedly becoming operational in 2011 and the entire force transformed by 2032.⁵ In order to mitigate the risk associated with the Objective Force and to address the near-term need for more deployable and capable units, the Army's transformation plan called for the development of brigade-sized units called the Interim Force in both the active Army and the Army National Guard. These Interim Brigade Combat Teams (IBCTs) were the predecessors to the Army's current Stryker Brigade Combat Teams (SBCTs).⁶

General Shinseki's vision for the FCS was that it would consist of smaller and lighter ground and air vehicles—manned, unmanned, and robotic—and would employ advanced offensive, defensive, and communications/information systems to “outsmart and outmaneuver heavier enemy forces on the battlefield.”⁷ In order to initiate the FCS program, General Shinseki turned to the Defense Advanced Research Projects Agency (DARPA), not only because of its proven ability to manage highly conceptual and scientifically-challenging projects, but also because he reportedly felt that he would receive a great deal of opposition from senior Army leaders who advocated heavier and more powerful vehicles such as the M-1 Abrams tank and the M-2 Bradley infantry fighting vehicle. In May 2000, DARPA awarded four contracts to four industry teams to develop FCS designs and in March 2002, the Army chose Boeing and Science Applications International Corporation (SAIC) to serve as the lead systems integrators to oversee certain aspects of the development of the FCS's 18 original systems. On May 14, 2003, the Defense Acquisition Board⁸ (DAB) approved the FCS's next acquisition phase and in August 2004 Boeing and SAIC awarded contracts to 21 companies to design and build its various platforms and hardware and software.

³ Frank Tiboni, “Army's Future Combat Systems at the Heart of Transformation,” *Federal Computer Week*, February 9, 2004.

⁴ James Jay Carafano, “The Army Goes Rolling Along: New Service Transformation Agenda Suggests Promise and Problems,” *Heritage Foundation*, February 23, 2004, p. 5.

⁵ Bruce R. Nardulli and Thomas L. McNaugher, “The Army: Toward the Objective Force,” in Hans Binnendijk, ed. *Transforming America's Military* (National Defense University Press, 2002), p. 106.

⁶ The Stryker is the Army's name for the family of wheeled armored vehicles that will constitute most of the brigade's combat and combat support vehicles. Annex A (Modular Conversion) to Army Campaign Plan, Change 2, September 30, 2005, p. A-1.

⁷ The following description of the early stages of the FCS program is taken from Frank Tiboni's *Army's Future Combat Systems at the Heart of Transformation*.

⁸ The Defense Acquisition Board (DAB) is the Defense Department's senior-level forum for advising the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) on critical decisions concerning DAB-managed programs and special interest programs.

The FCS Program

Program Overview⁹

The Army described FCS as a joint (involving the other services) networked “system of systems.” FCS systems were to be connected by means of an advanced network architecture that would permit connectivity with other services, situational awareness and understanding, and synchronized operations that are currently unachievable by Army combat forces. FCS was intended to network with existing forces, systems currently in development, and systems that would be developed in the future. The Army intended to field 15 FCS BCTs equipped with new FCS manned ground vehicles (MGVs) and to provide selected FCS communications, sensor, and unmanned vehicle technologies to its Infantry Brigade Combat Teams (IBCTs) by FY2025.

DOD's April 2009 FCS Restructuring Decision

On April 6, 2009, Secretary of Defense Gates announced that he intended to significantly restructure the FCS program.¹⁰ The Department of Defense (DOD) plans to accelerate the spin out of selected FCS technologies to all brigade combat teams (BCTs) but will recommend cancelling the manned ground vehicle (MGV) component of the program. The MGV program was intended to field eight separate tracked combat vehicle variants built on a common chassis that would eventually replace combat vehicles such as the M-1 Abrams tank, the M-2 Bradley infantry fighting vehicle, and the M-109 Paladin self-propelled artillery system. Secretary Gates was concerned that there were significant unanswered questions in the FCS vehicle design strategy and, despite some adjustments to the MGVs, that they did not adequately reflect the lessons of counterinsurgency and close quarters combat in Iraq and Afghanistan. Secretary Gates was also critical that the FCS program did not include a role for Mine-Resistant, Ambush-Protected (MRAP) vehicles¹¹ that have been used successfully in current conflicts. After re-evaluating requirements, technology, and approach, DOD will re-launch the Army's vehicle modernization program, including a competitive bidding process.

Current FCS Program Status

The Army plans to halt the current FCS program shortly after the completion of a previously scheduled May 2009 Systems of Systems Preliminary Designed Review. The successor to the FCS program is expected to be called the Army Brigade Combat Team Modernization (ABCTM) program, which will be responsible for developing and fielding a new ground combat vehicle (GCV) and spinning out remaining FCS technologies to the Army's 73 BCTs.¹² The FCS program's lead systems integrators—Boeing and Science Applications International Corporation (SAIC)—will not be retained for the GCV program but may serve as lead systems integrators for

⁹ Information in this section is taken from the FCS Program Manager System Overview Briefing, December 10, 2008.

¹⁰ Information in this section is taken from a transcript of Secretary of Defense Robert M. Gates Budget Press Briefing, Arlington, VA April 6, 2009.

¹¹ For additional information on MRAPs see CRS Report RS22707, *Mine-Resistant, Ambush-Protected (MRAP) Vehicles: Background and Issues for Congress*, by Andrew Feickert.

¹² Kris Osborn, “FCS is Dead: Program Lives On,” *Defense News*, May 18, 2009.

the spin out of FCS technologies to BCTs.¹³ Boeing and SAIC are expected to receive about \$350 million in cancellation penalties due to the decision to discontinue their services as lead systems integrators for the MGV program.¹⁴ One report suggests that the FCS contract will be restructured into three parts: the ground combat vehicle, the spin out technologies, and the network.¹⁵

Remaining FCS Technologies for Spin Outs

The following FCS technologies are expected to be retained and incorporated into future BCT spin outs:

- The FCS Network;
- Unmanned Ground Vehicles (UGVs);
- Unmanned Aerial Vehicles (UAVs);
- Unattended Ground Sensors (UGSs); and
- Non-Line-of-Sight Launch System (NLOS-LS).¹⁶

The Army's BCT Modernization Strategy¹⁷

Pursuant to Secretary Gate's recommendation to cancel FCS MGVs, the Army devised a tentative BCT modernization strategy. Some of the key tenets of this strategy are as follows:

- Incorporating MRAPs and Uparmored High Mobility, Multi-Wheeled Vehicles (HMMWVs) into the overall ground vehicle plan and develop a motorized concept by integrating them into the Infantry Brigade Combat Team (IBCT).
- Preserving FCS Spin Outs and field them to all 73 BCTs along with the FCS Network by 2025.
- The Training and Doctrine Command (TRADOC) will develop a Ground Combat Vehicle (GCV) "from a blank sheet of paper" focused on building a versatile vehicle that incorporates the lessons of the last seven years of war.
- TRADOC will develop the requirement for the GCV, the Network, and a threshold IBCT with the intention of fielding the GCV in five to seven years from now.
- The Army will preserve key capabilities once provided by FCS that will no longer be delivered.

Army leaders are currently planning on delivering a comprehensive review to the Office of the Secretary of Defense that provides more details on its BCT modernization

¹³ Ibid.

¹⁴ Ibid.

¹⁵ Kate Brannen, "FCS Contract Will be Restructured; Program to be Split Into Three Parts," *InsideDefense.com*, May 21, 2009.

¹⁶ Kris Osborn, "FCS is Dead: Program Lives On," *Defense News*, May 18, 2009.

¹⁷ Information in this section is from a briefing given to CRS by the Army on April 29, 2009.

strategy—as well as a preliminary design concept for the new GCV—by September 7, 2009.¹⁸

Current Ground Combat Vehicle (GCV) Details

While the Army is in the preliminary phases of developing a new concept design for the GCV, a number of details have emerged during recent congressional testimony and DOD and Army news conferences that provide some useful insights. Because the Army's goal is to have the GCV in production five to seven years, they have indicated that they would rely on existing technologies and capabilities,¹⁹ suggesting that the GCV may be more of a modified “off the shelf” vehicle as opposed to one “developed from a blank sheet of paper.” It is also possible that the Army might consider a foreign-produced GCV.²⁰ Army leadership has also indicated that the GCV could be either a tracked or wheeled vehicle. The Army has also suggested that it sees “a lot of value in common chassis in terms of logistics support,” and the Army might pursue a common chassis for GCV variants.²¹ Other possible GCV features could include a V-shaped hull and side armor to protect against improvised explosive devices (IEDs).²² Another possible feature for the new GCV could be fuel efficiency.²³ The air transportability of the GCV will also be a key design consideration and the Army has said that the GCV must be able to fit on C-17 transports.²⁴

FCS Program Budget Issues

FY2010 Budget Request and Savings from the Termination of the Manned Ground Vehicle (MGV)²⁵

According to the Office of Management and Budget (OMB), the Administration is requesting \$2.981 billion for FCS in FY2010—\$633 million less than the FY2009 enacted amount of \$3.614 billion. Including the \$2.981 billion for FY2010, OMB estimates that the remaining elements of FCS should cost approximately \$24.5 billion through FY2015. OMB has said that the cancellation of the MGV program will save approximately \$22.9 billion.

¹⁸ Marjorie Censer and Kate Brannen, “Army Assessing Brigade Combat Modernization in Plan Due to OSD,” *InsideDefense.com*, May 18, 2009.

¹⁹ Emelie Rutherford, “Army Casting Wide Net for Post-FCS Vehicles Coming in Five to Seven Years,” *Defense Daily*, May 13, 2009.

²⁰ Marjorie Censer and Kate Brannen.

²¹ Emelie Rutherford, “Army Casting Wide Net for Post-FCS Vehicles Coming in Five to Seven Years,” *Defense Daily*, May 13, 2009.

²² *Ibid.*

²³ John T. Bennett, “Carter: FCS Successor Effort Could Have Many Primes,” *Defense News*, May 18, 2009.

²⁴ Marjorie Censer and Kate Brannen.

²⁵ Information in this section is from the United States Government Fiscal Year 2010 Budget: Terminations, Reductions, and Savings, Office of Management and Budget, May 2009, pp. 30-31.

FY2010 FCS Budget Request Amounts for FCS Programs²⁶

A breakdown of FCS program budget requests for FY2010 is as follows:

- Non-Line-of-Sight Launch System (NLOS-LS): \$88.660 million;
- Non-Line-of-Sight Cannon (NLOS-C): \$58.216 million;
- FCS Manned Ground Vehicles: \$368.557 million;²⁷
- FCS Systems of Systems Engineering & Program Management: \$1.067 billion;
- FCS Reconnaissance (UAV) Platforms: \$68.701 million;
- FCS Unmanned Ground Vehicles: \$125.616 million;
- FCS Unattended Ground Sensors: \$26.919 million; and
- FCS Sustainment & Training Research and Development: \$749.182 million.

For a detailed description of the cancelled MGV variants as well as remaining FCS systems that will be spun out to BCTs, see the **Appendix**.

Potential Issues for Congress

MGV Cancellation

If DOD's proposed cancellation of the MGVs is approved, there are a variety of issues that Congress might consider. Will the Army be required to extend the useful lives through recapitalization of combat vehicles that the MGV was intended to replace? What technologies developed in the MGV program can be incorporated into other programs and what technologies will be "lost" when the MGV program is terminated? Will the cancellation of the MGV program also result in the termination or scaling back of the Active Protection System (APS) program? Will any of the armaments that were under development for various MGV variants, such as the Lightweight XM360 120 mm cannon, be incorporated into other combat vehicle designs? How will DOD's cancellation of the MGV program influence the defense industry in future endeavors—will developmental costs increase because industry has little confidence that DOD will remain committed to future ground combat systems programs?

Army BCT Modernization Strategy and Spin Outs

While FCS MGVs are likely to be terminated, elements of the FCS program such as sensors, unmanned aerial and ground vehicles, the Non-Line-of-Sight Launch System, and a modified FCS network will continue on and be incorporated into the Army BCT Modernization Strategy and spin outs. DOD and the Army has committed to "spinning out" remaining FCS systems and

²⁶ Information in this section is taken from the Army's Supporting Data FY 2010 Budget Estimate – May 2009, Research, Development, Test, and Evaluation.

²⁷ This amount (\$ 368.557 million) is reportedly to cover program cancellation penalties. See Kris Osborn, "FCS is Dead: Program Lives On," *Defense News*, May 18, 2009.

the FCS Network to all 73 BCTs by 2025. When can Congress expect to see a detailed proposed BCT modernization strategy and how much does the Army estimate it will cost to modernize all 73 BCTs? Will the Army retain the services of FCS lead systems integrators Boeing and SAIC for the spin outs and what role, if any, does the Army envision for these firms as part of BCT modernization? Is it realistic to expect that the BCT modernization program will survive the 15 years that it will take to outfit all 73 BCTs, given poor track record of previous long-term programs such as Crusader, Comanche, and now the MGCV program?

Proposed Ground Combat Vehicles

As part of the Secretary of Defense's April 2009 decision to restructure the FCS program, the MGCV component was recommended for cancellation. In response, the Army plans to develop a new Ground Combat Vehicle (GCV) "from a blank sheet of paper" and deliver an initial concept for this full spectrum vehicle in September 2009. It can be argued that the Army might be rushing the process to develop the GCV and possibly inviting undue risk and setting the stage for yet another unfulfilled major vehicle or aircraft acquisition program.

The Army has also pledged that the GCV will be fielded in "5 to 7 years from now." What changes will DOD and the Army make in the traditional acquisition process to achieve this goal? What will be different in the GCV development and procurement process compared to the FCS MGCV development and procurement process? Other possible GCV questions include how many variations of this new GCV does the Army envision, or is it too early in the conceptual process to speculate? What current combat vehicles will the GCVs eventually replace? Will the Army cost-constrain the GCVs (i.e., each version will cost no more than \$ X million per vehicle) and other than C-17 deployable, are there any other deployability constraints that will influence the development of GCVs?

Non-Line-of-Sight Cannon (NLOS-C) Replacement?

DOD and the Army have also indicated that the congressionally mandated Non-Line-of-Sight Cannon (NLOS-C) program will also be cancelled, subject to congressional approval. Will the development of a new self-propelled artillery system to replace the venerable M-109 Paladin fall under the new GCV program—perhaps as a variant—or does the Army plan to initiate a separate developmental and procurement effort?

Impact on Operational Concepts and Doctrine

The Army has expended a great deal of intellectual capital and budgetary authority over the past 10 years developing force structure, operational concepts, doctrine, and soldier education and training predicated on the success of the FCS program in developing and fielding 15 FCS BCTs and associated support units. In light of the FCS program restructuring, will the Army have to "go back to the drawing board" in the aforementioned areas as well? If there is a corresponding requirement to revise force structure, operational concepts, doctrine, and education and training, is there a plan or "road map" and what are the associated budgetary requirements?

Additional Reading

CRS Report RL32476, *U.S. Army's Modular Redesign: Issues for Congress*, by Andrew Feickert.

CRS Report RS22707, *Mine-Resistant, Ambush-Protected (MRAP) Vehicles: Background and Issues for Congress*, by Andrew Feickert.

CRS Report RL33161, *The Joint Tactical Radio System (JTRS) and the Army's Future Combat System (FCS): Issues for Congress*, by Andrew Feickert.

CRS Report RL34333, *Does the Army Need a Full-Spectrum Force or Specialized Units? Background and Issues for Congress*, by Andrew Feickert.

CRS Report RS21195, *Evolutionary Acquisition and Spiral Development in DOD Programs: Policy Issues for Congress*, by Gary J. Pagliano and Ronald O'Rourke.

Appendix. Original FCS Subsystems

Manned Ground Vehicles

FCS manned ground vehicles (MGVs) were a family of eight different combat vehicles—with some having more than one variation—that were based on a common platform and were being designed to be air transportable by the U.S. Air Force. They were to be equipped with a variety of passive and active protection systems and sensors that the Army hoped would offer them the same survivability as the current heavy armor force. In addition the Army intended for its MGVs to be highly reliable, require low maintenance, and have fuel-efficient engines. The following are brief descriptions of MGV types and variants that were cancelled in May 2009.²⁸

Mounted Combat System (MCS) (XM1202)

As envisioned, the MCS was to provide direct and beyond-line-of-sight (BLOS) fires, was to be capable of providing direct fire support to dismounted infantry, and to attack targets with BLOS fires out to a range of 8 kilometers. The MCS was intended to replace the current M-1 Abrams tank. The MCS was to have had a crew of two and to be armed with a 120 mm main gun, a .50 caliber machine gun, and a 40 mm automatic grenade launcher.

Infantry Carrier Vehicle (ICV) (XM1206)

As planned, the ICV was to have consisted of four versions: the Company Commander version, the Platoon Leader version, the Rifle Squad version, and the Weapons Squad version. All four versions were to have appeared to be identical from the exterior to prevent the targeting of a specific carrier version. The Rifle Squad version was to have had a two-man crew and able to transport a nine-man infantry squad and dismount them so that they could conduct combat operations on foot. The ICV was to have mounted a 30 or 40 mm cannon.

Non-Line-of-Sight Cannon (NLOS-C) (XM1203)

The NLOS-C was to have provided networked, extended-range targeting and precision attack of both point and area targets with a wide variety of munitions. Its primary purpose was to have been to provide responsive fires to FCS Combined Arms Battalions and their subordinate units. The NLOS was to have had a two-man crew and a fully automated handling, loading, and firing capability.

Non-Line-of-Sight Mortar (NLOS-M) (XM1204)

The NLOS-M was intended to provide indirect fires in support of FCS companies and platoons. The NLOS-M was to have had a four-man crew, mount a 120mm mortar, and also carry an 81 mm mortar for dismounted operations away from the carrier.

²⁸ Information for these descriptions are taken from two Army sources: The Army's *FCS 18+1+1 White Paper*, dated October 15, 2004, and the *FCS Brigade Combat Team*, August 22, 2007.

Reconnaissance and Surveillance Vehicle (RSV) (XM1201)

As planned, the RSV was to feature advanced sensors to detect, locate, track, and identify targets from long ranges under all climatic conditions, both day and night. The RSV was to have had a mast-mounted long-range, electro-optical infra-red sensor, sensors for radio frequency (RF) intercept and direction finding as well as a remote chemical warfare agent detector. RSVs were also to have carried four dismounted scouts, unattended ground sensors (UGS), a Small Unmanned Ground Vehicle (SUGV) with various payloads, and two Unmanned Aerial Vehicles (UAVs). In addition to the four scouts, the RSV was to have had a two-man crew and a defensive weapons system.

Command and Control Vehicle (C2V) (XM1209)

The C2V was intended to serve as the “hub” for battlefield command and control. It was to have provided information management for the integrated network of communications and sensors for the FCS brigade combat teams. The C2V was to have had a crew of two and carry four staff officers and also be capable of employing UAVs.

Medical Vehicle - Evacuation (MV-E) (XM1207) and Medical Vehicle - Treatment (MV-T) (XM1208)

There were to be two versions of the MV: the MV-E and MV-T. The MV-E would permit combat trauma specialists to be closer to the casualty's point of injury as it is to move with combat forces and evacuate casualties to other treatment facilities. The MV-T was to enhance the ability to provide Advanced Trauma Management/Advanced Trauma Life Support forward in the battle area and both MV-E and MV-T would have been capable of conducting medical procedures and treatments using telemedicine systems. Both would have four-man crews and the capability to carry four patients.

Field Recovery and Maintenance Vehicle (FRMV) (XM1205)

The FRMV would have been the FCS BCT's recovery and maintenance system. The FRMV was to have a crew of three, plus additional space for up to three recovered crew members.

Unmanned Aerial Vehicles (UAVs)²⁹

Each BCT will have a number of UAVs.³⁰ While these UAVs are to provide a variety of capabilities to forces on the ground, some experts note that they could also present an air space management challenge to not only manned Army aviation assets, but also to Navy, Marine Corps, Air Force, and other nation's aircraft that might be providing support to Army ground operations. The following are brief descriptions of the Army's two classes of UAVs:

²⁹ Unless otherwise noted, UAV information for these descriptions are taken from two Army sources: The Army's *FCS 18+1+1 White Paper*, dated October 15, 2004 and the *FCS Brigade Combat Team*, August 22, 2007.

³⁰ Sandra I. Erwin, “Army to Field Four Classes of UAVs,” *National Defense*, April 2003.

Class I UAVs (XM156)

Class I UAVs are intended to provide Reconnaissance, Surveillance, and Target Acquisition (RSTA) at the platoon level. Weighing less than 15 pounds each, these Class I UAVs are intended to operate in urban and jungle terrain and have a vertical takeoff and landing capability. They are to be used to observe routes and targets and can provide limited communications transmissions relay. The Class I UAV are to be controlled by dismounted soldiers and can also be controlled by selected ground vehicles, and have an endurance of 50 minutes over an 8 kilometer area, and a 10,500 foot maximum ceiling.

Class IV UAVs (XM157)

Class IV UAVs are intended to provide BCT commanders with a long endurance capability. It is intended to stay aloft for 72 continuous hours and operate over a 75 kilometer radius with a maximum ceiling of 16,500 feet. It is also planned to interface with other manned and unmanned aerial vehicles and be able to take off and land without a dedicated airfield.

Unmanned Ground Vehicles (UGVs)³¹

Armed Robotic Vehicle - Assault Light (ARV- AL) (XM1219)

The ARV was originally intended to come in two variants—the Assault variant and the Reconnaissance, Surveillance, and Target Acquisition (RSTA) variant. The RSTA variant has been deferred as part of the Army's 2007 FCS program restructuring. The two variants were to share a common chassis. The Assault Light variant is to provide remote reconnaissance capability, deploy sensors, and employ its direct fire weapons and special munitions at targets such as buildings, bunkers, and tunnels. It is also intended to be able to conduct battle damage assessments, act as a communications relay, and support both mounted and dismounted forces with direct and anti-tank fire as well as occupy key terrain.

Small Unmanned Ground Vehicle (SUGV) (XM1216)

The SUGV is a small, lightweight, manportable UGV capable of operating in urban terrain, tunnels, and caves. The SUGV will weigh 30 pounds, operate for 6 hours without a battery recharge, and have a one kilometer ground range and a 200 meter tunnel range. Its modular design will permit a variety of payloads which will enable it to perform high-risk intelligence, surveillance, and reconnaissance (ISR) missions, and chemical weapons or toxic industrial chemical reconnaissance.

Multifunctional Utility/Logistics and Equipment Vehicle (MULE)

The MULE is a UGV that will support dismounted infantry. It is to come in two variants sharing a common chassis—a transport variant (XM1217) and a countermine variant (XM1218). The transport variant is to be able to carry 1,900 to 2,400 pounds of equipment and rucksacks for

³¹ Unless otherwise noted, information for these descriptions are taken from two Army sources: The Army's *FCS 18+1+1 White Paper*, dated October 15, 2004 and the *FCS Brigade Combat Team*, August 22, 2007.

dismounted infantry and follow them in complex and rough terrain. The countermine variant is to have the capability to detect, mark, and neutralize anti-tank mines.

Unattended Ground Sensors (UGS)³²

UGS are divided into two groups—Tactical UGS and Urban UGS—and are described as follows:

Tactical UGS (AN/GSR-10)

Tactical UGS include intelligence, surveillance, and reconnaissance (ISR) sensors and Chemical, Biological, Radiological, and Nuclear (CBRN) sensors. These sensors are to employ a variety of sensing technologies and integrated into the overall network. They are intended to be deployed by hand, by vehicle, or by robot and have a 48 hour endurance. They are intended to be expendable, low-cost sensors used for such tasks as perimeter defense, surveillance, target acquisition, and CBRN early warning.

Urban UGS (AN/GSR-9)

Urban UGS can also be employed by soldiers, vehicles, or robots and are intended to provide situation awareness inside and outside of buildings for force protection and also for previously cleared buildings and areas.

Non-Line-of-Sight Launch System (NLOS-LS) (XM501)

NLOS-LS is to consist of missiles in a deployable, platform-independent, container launch unit (CLU), which can be fired in an unmanned and remote mode. Each CLU is to have a fire control system and 15 missiles consisting of Precision Attack Missiles (PAM).

The PAM is to have two employment modes—a direct-fire and a fast attack mode or a boost-glide mode. The missile is intended to receive target information prior to launch and receive and respond to target location updates while in flight. The PAM can be fired in the laser-designated mode and transmit near real-time target imagery prior to impact.

The Network³³

The FCS network program will continue but will likely be significantly modified because of the cancellation of the MGVs. The original FCS network was to have consisted of four interactive components—the System-of-Systems Common Operating Environment (SOSCOE); Battle Command (BC) software; communications and computers (CC); and intelligence, reconnaissance and surveillance (ISR) systems.

³² Ibid.

³³ Ibid.

System-of-Systems Common Operating Environment (SOSCOE)

The SOSCOE is to enable the integration of a variety of software packages into the network. It is intended to use commercial, off-the-shelf hardware and allow for the integration of critical interoperability packages that translate Army, Navy, Air Force, Marine Corps, and allied message formats into internal message formats.

Battle Command (BC) Software

Battle Command mission applications are to include mission planning and preparation, situational understanding, battle command and mission execution, and warfighter-machine interface.

Mission Planning and Preparation

Consists of 16 different functions that provide units with the following automated capabilities:

- The development of deliberate, anticipatory, and rapid-response plans;
- The ability to perform plan assessments and evaluations;
- The ability to perform terrain analysis;
- The conduct of mission rehearsals; and
- The conduct of after action reviews.

Situational Understanding

This consists of 10 different packages that allow the user to better comprehend his surroundings. These packages employ map information and a variety of databases that help to determine enemy locations and capabilities, infer enemy intentions, and assess the threat to U.S. forces.

Battle Command and Execution

This package contains a variety of planning and decision aids to help commanders make rapid, informed, and accurate decisions during battle. These packages can also be used in the training and rehearsal modes.

Warfighter-Machine Interface Package

This package receives soldier-generated information and displays information across all FCS platforms for soldier use.

Communications and Computer (CC) Systems

The Communications and Computer network is intended to provide secure, reliable access to information over extended distances and complex terrain. This network is not intended to rely on a large and separate infrastructure because it is to be embedded in combat vehicles and move with the combat units. The communications network is to consist of a variety of systems such as the Joint Tactical Radio System (JTRS); Wideband Network Waveform and Soldier Radio Waveform

systems; Network Data Link; and the Warfighter Information Network Tactical (WIN-T).

Intelligence, Reconnaissance and Surveillance (ISR) Systems

The Intelligence, Reconnaissance and Surveillance System is to be a distributed and networked array of multispectral ISR sensors intended to provide timely and accurate situational awareness to the force. In addition, the ISR system is intended to help formations avoid enemy fires while providing precision, networked fires to the unit.

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