Congressional Research Service
Informing the legislative debate since 1914

The Army's M-1 Abrams, M-2/M-3 Bradley, and M-1126 Stryker: Background and Issues for Congress

Andrew Feickert
Specialist in Military Ground Forces

October 15, 2015

Congressional Research Service
7-5700
www.crs.gov
R44229

CRS REPORT
Prepared for Members and Committees of Congress

Summary

The M-1 Abrams Tank, the M-2/M-3 Bradley Fighting Vehicle (BFV), and the M-1126 Stryker Combat Vehicle are the centerpieces of the Army's Armored Brigade Combat Teams (ABCTs) and Stryker Brigade Combat Teams (SBCTs).

In addition to the military effectiveness of these vehicles, Congress is also concerned with the economic aspect of Abrams, Bradley, and Stryker recapitalization and modernization. Due to force structure cuts and lack of Foreign Military Sales (FMS) opportunities, Congress has expressed a great deal of concern with the health of the domestic armored combat vehicle industrial base.

ABCTs and SBCTs constitute the Army's "heavy" ground forces; they provide varying degrees of armored protection and mobility that the Army's light, airborne (parachute), and air assault (helicopter transported) infantry units that constitute Infantry Brigade Combat Teams (IBCTs) do not possess.

These three combat vehicles have a long history of service in the Army. The first M-1 Abrams Tank entered service with the Army in 1980; the M-2/M-3 Bradley Fighting Vehicle in 1981; and the Stryker Combat Vehicle in 2001. Under current Army modernization plans, the Army envisions all three vehicles in service with Active and National Guard forces beyond FY2028.

There are several different versions of these vehicles in service. The Marines, for example, have an older version of the M-1 Abrams tank and the Active Component of the Army has the most modern version of the Abrams while many Army National Guard units have an older version of the M-1. There are also different M-2/M-3 Bradley versions in the Active and Reserve Components and some have called for "pure fleeting" (i.e., all components using the same variant) in both the Active and Reserves so they have the same models.

There are plans to upgrade and modernize these weapon systems but currently only the M-2/M-3 Bradley is scheduled to be replaced by the Future fighting Vehicle (FFV) sometime after FY2029. The Army has not said much publicly about eventual successors for the M-1 and M-1126.

Both the House and Senate have identified—in FY2016 Authorizations, Appropriations, and Conference report language—particular areas of congressional concern, including:

- "Pure fleeting" M-1 Abrams and M-2/M-3 Bradleys between the Army's Active and Reserve components so both components have the same vehicle variants;
- Managing and monitoring the "health" of the Army's ground combat vehicle industrial base given decreasing Army force structure, limited foreign military sales opportunities, budgetary constraints, and an uncertain geostrategic future; and
- Developing improved lethality and survivability for the Army's Stryker fleet given recent and potential future conflicts.

Other possible areas for congressional examination include the Army's plans for replacing the M-1 Abrams, the M-2/M-3 Bradley, and the M-1126 Stryker as well as the relevance of the Army's ground combat vehicles in what is popularly referred to as "Hybrid Warfare."

Contents

Why This Issue Is Important to Congress 1
A Brief History of the Abrams, Bradley, and Stryker 1
The M-1 Abrams Tank 2
Basic Characteristics—M-1A2 Abrams Tank 3
The M-2/M-3 Bradley Fighting Vehicle 4
Basic Characteristics—M2/3-A2 Bradley Fighting Vehicle 5
M-1126 Stryker Combat Vehicle 6
Basic Characteristics—M-1126 Stryker Combat Vehicle 7
Wheeled or Tracked Fighting Vehicles? 8
Vehicle Variants Currently in Service 8
M-1 Abrams 8
M-1 Abrams in the U.S. Marine Corps 9
Why the Active Component and National Guard Have Different Versions of the M-1 Abrams 9
The Army Staff's Explanation 9
An Argument for Full Fielding of M-1A2 SEPv2s to the ARNG 10
M-2/M-3 Bradley 11
FY2015 M-2/M-3 Allocation by Component 11
M-1126 Stryker 11
Abrams, Bradley, and Stryker Allocation by BCT Type 13
Vehicle Modernization, Recapitalization, and Reset 13
A Fully Modernized Force? 14
A Summary of M-1 Abrams and M-2/M-3 Bradley Modernization 15
Issues Concerning the Army's M-1 Abrams Modernization Plans 18
M-1126 Stryker Modernization Plans 19
Automotive 19
Electrical/Digital 19
Request to "Up-Gun" European-Based Strykers 19
Successors to the Abrams, Bradley, and Stryker 20
Foreign Military Sales (FMS) 20
M-1 Abrams Foreign Military Sales 21
M-2 Bradley and M-1126 Stryker Foreign Military Sales 21
Industrial Base Issues 21
Current Legislation 23
FY2016 Budget Requests 23
H.R. 1735, National Defense Authorization Act for Fiscal Year 2016 23
Funding 23
Report Language 24
S.1376, National Defense Authorization Act for Fiscal Year 2016 27
Funding 27
Report Language 27
H.R. 2685, Department of Defense Appropriations Bill, 2016 27
Funding 27
Report Language 28
S. 1558, Department of Defense Appropriations Bill, 2016 28

Funding 28
Report Language 28
Conference Report to Accompany H.R. 1735, National Defense Authorization Act for FY2016 29
Funding 29
Report Language 29
Potential Issues for Congress 30
Army's Plans for Replacing the M-1 Abrams, M-2/M-3 Bradley, and the M-1126 Stryker 30
Relevance of the Army's Ground Combat Vehicles in "Hybrid Warfare" 31

Figures

Figure 1. M-1 Abrams Battle Tank 1
Figure 2. M-2/M-3 Bradley Fighting Vehicle 4
Figure 3. M-1126 Stryker Combat Vehicle 6

Tables

Table 1. Selected Basic Characteristics—M-1A2 3
Table 2. Selected Basic Characteristics—M2/3-A2 5
Table 3. Selected Basic Characteristics—M-1126 7
Table 4. FY2015 M-2/M-3 Allocation by Component 11
Table 5. ABCT Allocations 13
Table 6. SBCT Allocations 13
Table 7. FY2016 Presidential Budget Request: Abrams, Bradley, and Stryker 23

Contacts

Author Contact Information 34

Why This Issue Is Important to Congress

The M-1 Abrams Tank, the M-2/M-3 Bradley Fighting Vehicle (BFV), and the M-1126 Stryker Combat Vehicle are the centerpieces of the Army's Armored Brigade Combat Teams (ABCTs) and Stryker Brigade Combat Teams (SBCTs). ABCTs and SBCTs constitute the Army's "heavy" ground forces; they provide varying degrees of armored protection and mobility that the Army's light, airborne (parachute), and air assault (helicopter transported) infantry units that constitute Infantry Brigade Combat Teams (IBCTs) do not possess.

These three combat vehicles have a long history of service in the Army. The first M-1 Abrams Tank entered service with the Army in 1980; the M-2/M-3 Bradley Fighting Vehicle in 1981; and the Stryker Combat Vehicle in 2001. Under current Army modernization plans, the Army envisions all three vehicles in service with Active and National Guard forces beyond FY2028.

Congress, however, is concerned with the long-term military effectiveness of these vehicles. It is also sensitive to the economic aspect of Abrams, Bradley, and Stryker recapitalization and modernization which are necessary to keep these vehicles operationally effective and in service. Recapitalization and modernization also have an economic impact on the defense industrial base in terms of keeping depots and maintenance facilities operational as Abrams and Bradleys are no longer being manufactured.

A Brief History of the Abrams, Bradley, and Stryker

Figure 1. M-1 Abrams Battle Tank

Source: Taken from http://www.armyrecognition.com/images/stories/news/2014/december/New_$120_million_upgrade_program_for_the_US_M1_Abrams_main_battle_tank_640_001.jpg, accessed April 13, 2015.

The M-1 Abrams Tank[1]

The M-1 Abrams Tank is designed to close with and destroy enemy armored forces on the battlefield by means of mobility, survivability, and firepower. The M-1 is named for General Creighton Abrams, a noted World War II armored battalion commander who later served as Army Chief of Staff from 1972 to 1974. As Chief of Staff, he led the Army in the final stages of the Vietnam War, supervised Army force reductions, and oversaw the restructuring of the Army. M-1 Abrams Tanks are found in Armored Brigade Combat Teams (ABCTs). There are currently 9 Active and 7 Army National Guard (ARNG) ABCTs.

The M-1 program was initiated in December 1971. In June 1973, two contracts were awarded for prototype development to the Defense Division of Chrysler Corporation (which in 1982 became General Dynamics Land Systems) and the Detroit Diesel Allison Division of General Motors. In February 1976, the Army accepted prototype vehicles from both vendors and operational and engineering testing was conducted through April 1976. In November 1976, the Secretary of the Army announced that the Chrysler Corporation prototype had been selected for Full Scale Engineering Development. The first M-1 tanks—mounting a 105 millimeter main gun—were delivered to the Army in 1980. A total of 2,374 tanks were produced for the Army until February 1985, when production was shifted to the Improved M-1[2], which was completed in May 1986. The Army then began acquiring the M-1A1 version, which included a 120 millimeter smoothbore main gun, an integrated Nuclear, Biological, and Chemical (NBC) protection system, and a number of improvements to the tank's armor protection, transmission, and drive train. A total of 4,796 M-1A1 tanks were built for the Army and 221 for the U.S. Marine Corps. In 1988, General Dynamics Land Systems was awarded a contract for the M-1A2 version, which included improvements such as an Improved Commander's Weapons Station (ICWS); a Commander's Independent Thermal Viewer (CITV); a Position/Navigation System (POS/NAV) and several survivability features. The first M-1A2s began to enter service in late 1992. The Army also upgraded more than 600 M-1s to the M-1A2 configuration between 1996 and 2001.[3] The M1-A2 is the baseline export version of this tank; depending on which country purchases the vehicle, a variety of armor and communications packages are available.

The M-1 saw its first combat service during Operation Desert Storm in 1991. The majority of the M-1s were the M-1A1 model. A January 1992 Government Accounting Office (GAO) report on the "Early Performance Assessment of Bradley and Abrams," noted:

> During the war, the Abrams tank exhibited good reliability, lethality, survivability, and mobility, but limited range, according to the observations of commanders, crews, maintenance personnel, and Army after action reports. Reported Army readiness rates for the Abrams were 90 percent or higher during the ground war-indicating a high availability to move, shoot, and communicate during combat. The Abrams was lethal, as crews said its 120-mm gun was accurate and its ammunition deadly against all forms of Iraqi armor. Army observers attribute the gun's high degree of accuracy to superior sights, high levels of tank readiness, and soldier training. The Abrams also survived well on the battlefield. For example, according to officials from the Center for Army Lessons Learned, several M-lAl crews reported receiving direct frontal hits from Iraqi T-72s

[1] Information from this section, unless otherwise noted, is taken from Jane's Armour and Artillery, 2011-2012, pp.177-185, and the author's personal knowledge.

[2] The Improved M-1 is essentially the same vehicle as the M-1 but with improved armor. A total of 894 Improved M-1s were built.

[3] M1A1/2 Abrams Main Battle Tank – Army Technology, http://www.army-technology.com/projects/abrams, accessed April 13, 2015.

[tanks] with minimal damage. In fact, the enemy destroyed no Abrams tanks during the Persian Gulf War, according to the Army. Crews said Abrams tanks were fast and maneuvered well in the sand. Abrams crews were impressed with the power and performance of the Abrams' turbine engine, but they were concerned about its high fuel consumption and the need to frequently clean air filters in the sandy desert environment. Refueling was a constant concern, and faulty fuel pumps further compounded the problem. The harsh desert environment demanded frequent air filter cleaning because sand-clogged filters reduced engine power and speed.[4]

Basic Characteristics—M-1A2 Abrams Tank

Table 1. Selected Basic Characteristics—M-1A2

Armament	1 x turret mounted 120 mm M-256 smoothbore gun 1 x coaxial mounted 7.62 mm M-240 machine gun 1 x roof mounted 12.7 mm M-2 HB machine gun 1 x roof mounted 7.62 mm M-240 machine gun 12 x turret mounted smoke grenade launchers
Crew	4
Maximum Speed	42 mph
Maximum Cross Country Speed	30 mph
Range (unrefueled)	264 miles
Weight	69.54 tons

Source: Jane's Armour and Artillery, 2011-2012, p. 185

[4] United States General Accounting Office (now Government Accountability Office), Report to the Chairman, Subcommittee on Regulation, Business Opportunities, and Energy, Committee on Small Business, House of Representatives, *Operation Desert Storm: Early Performance Assessment of Bradley and Abrams*, GAO/NSIAD-92-94, January 1992, pp. 3-4.

Figure 2. M-2/M-3 Bradley Fighting Vehicle

Source: Taken from http://olive-drab.com/images/id_m2bradley_pettit_4id_20051202_348_700.jpg, accessed April 15, 2015

The M-2/M-3 Bradley Fighting Vehicle[5]

The M-2 Bradley is an Infantry Fighting Vehicle (IFV) used to transport infantry on the battlefield and provide fire support to dismounted troops and suppress enemy fighting vehicles. The M-2 has a crew of three—commander, gunner, and driver—and carries six fully equipped infantrymen. The M-3 Bradley Cavalry Fighting Vehicle (CFV) performs scouting missions. The M-3 has a three-person crew and carries two scouts. M-2/M-3 Bradley Fighting Vehicles are primarily found in Armored Brigade Combat Teams. There are currently nine Active and seven Army National Guard ABCTs.

In April 1972, the Army issued a Request for Proposal (RFP) for a new IFV. In November 1972, an Engineering Development and Advanced Production Engineering contract was awarded to the Ordnance Division of the FMC Corporation (now BAE Systems, U.S. Combat Systems). The program was later renamed the Fighting Vehicle System (FVS) program and under this program, the M-2 IFV and M-3 CFV were to be developed and produced. The first M-2 prototypes were turned over to the Army in December 1978 and the first delivery of M-2s for Army units started in May 1981. In October 1981, the M-2/M-3 Fighting Vehicles were named the Bradley Fighting Vehicle after the late General of the Army, General Omar N. Bradley.

In May 1986, the Army began to receive the M-2A1 and M-3A1 Bradley versions, which included an improved NBC protection system and a number of ergonomic improvements. In 1986, the Army began the M-2A2 and M-3A2 upgrade program, which included upgraded survivability features as well as transmission modifications and a new engine. In 1995, as a result of Operation Desert Storm, a number of improvements began to be incorporated into the M-

[5] Information from this section, unless otherwise noted, is taken from Jane's Armour and Artillery, 2011-2012, pp.458-464 and the author's personal knowledge.

2A2/M-3A2 Operation Desert Storm (ODS) version. While existing Bradleys were being modified to the ODS version, the last production version of the Bradley was handed over to the Army in February 1995 with a total of 6,385 M-2/M-3 Bradleys being produced for the Army. Since February 1995, all "new" Bradley fighting vehicles have been refurbished vehicles.

The M-2/M-3 Bradley saw its first combat service during Operation Desert Storm in 1991. The majority of the M-2/M-3s were the A2 model and many units that deployed with the A1 version were provided the A2 versions when they became available. A January 1992 Government Accounting Office (GAO) report on the "Early Performance Assessment of Bradley and Abrams," noted:

> The Bradley Fighting Vehicle performed well during the war, according to the observations of commanders, crews, maintenance personnel, and Army after action reports. It exhibited good reliability, lethality, mobility, and range, and crews perceived the A2 model to have good survivability. The Army reported readiness rates for the Bradley that were generally 90 percent or higher during the ground war-indicating its high availability to move, shoot, and communicate during combat. The Bradley proved to be lethal, as crews reported that its 25-mm automatic gun was effective against a variety of targets and that its Tube-Launched, Optically-Tracked, Wire-Guided (TOW) missile system was able to destroy tanks. Crews also said the Bradley was fast, maneuvered well in the desert terrain, and exhibited good range. The A2 high survivability model Bradley was praised for its added engine power and maneuverability, and crews felt safer with its increased armor protection.
>
> Although crews were very satisfied with the Bradley's performance, they identified various hardware deficiencies that they believe should be fixed, though these problems usually did not stop the system in combat. Army officials were aware of most of them-leaking radiators, unreliable heaters, and misdirected exhaust-and are planning or are implementing corrective actions. Army crews also identified other needed vehicle improvements, such as the addition of a laser range finder and an identification of friend or foe system, better sight magnification and resolution, and a faster reverse speed.[6]

Basic Characteristics—M2/3-A2 Bradley Fighting Vehicle

Table 2. Selected Basic Characteristics—M2/3-A2

Armament	1 x turret mounted M-242 25mm "Bushmaster" chain gun 2 x turret mounted TOW anti-tank missiles 1 x coaxial mounted 7.62 mm M-240C machine gun 8 x turret mounted smoke grenade launchers
Crew	M-2: 3 crew, 6 infantrymen M-3: 3 crew, 2 scouts
Maximum Speed	36 mph
Maximum Cross Country Speed	—
Range (unrefueled)	248 miles
Weight	36-40 tons

[6] *United States General Accounting Office (now Government Accountability Office), Report to the Chairman, Subcommittee on Regulation, Business Opportunities, and Energy, Committee on Small Business, House of Representatives, Operation Desert Storm: Early Performance Assessment of Bradley and Abrams, GAO/NSIAD-92-94, January 1992*, p. 3.

Source: Jane's Armour and Artillery, 2011-2012, p. 463.

Figure 3. M-1126 Stryker Combat Vehicle

Source: http://www.army-technology.com/projects/stryker/images/stryker_10.jpg, accessed April 16, 2015

M-1126 Stryker Combat Vehicle[7]

The Stryker is a family of eight-wheeled combat vehicles based on the Canadian LAV III 8x8 light armored vehicle. The U.S. Army, perceiving a gap between light and heavy forces, developed a medium-weight brigade combat team in 2003. The Army's original goal was to structure these brigades light enough to deploy anywhere in the world within four days. These medium-weight brigades would supplement light and heavy forces and were not intended to fight heavy armored and mechanized forces but instead move infantry forces rapidly around the battlefield. The Army, wanting to get these medium-weight units in service as soon as possible, and looking for a vehicle that could be transported by a U.S. Air Force C-130 transport aircraft, opted to take a nondevelopmental approach and select and modify a combat vehicle already in production and service.

In November 2000, following an international competition, the Army selected the now General Dynamics Land Systems (GDLS)—Canada LAV III 8x8 Light Armored Vehicle for its new medium-weight brigade combat teams. There are eight versions of the Stryker Combat Vehicle, which will be discussed in greater detail later in this report. In 2002, the Army decided to name the LAV III 8x8 Light Armored Vehicle the Stryker Combat Vehicle in honor of two enlisted Medal of Honor recipients—PFC. Stuart Stryker from World War II and SPC. Robert F. Stryker, who served in Vietnam. In September 2002, the Army received its first ICV variant Strykers and the Army's first Stryker Brigade Combat Team —the 3rd Brigade of the 2nd Infantry Division—

[7] Information from this section, unless otherwise noted, is taken from Jane's Armour and Artillery, 2011-2012, pp.733-737; Stryker Armoured Combat Vehicle Family, Army Technology, http://www.army-technology.com/projects/stryker/, accessed April 16, 2015, and the author's personal knowledge.

was ready for operations in May 2003. There are currently eight Active and one Army National Guard (ARNG) SBCTs.

The M-1126 Stryker saw its first combat service in October 2003 during Operation Iraqi Freedom. Although Army officials and many soldiers praised the Stryker's performance, the *Washington Post* reported a number of problems, including:

> .... for example, that an armor[ed] shield installed on Stryker vehicles to protect against unanticipated attacks by Iraqi insurgents using low-tech weapons works against half the grenades used to assault it. The shield, installed at a base in Kuwait, is so heavy that tire pressure must be checked three times daily. Nine tires a day are changed after failing, the report says; the Army told The Post the current figure is 11 tire and wheel assemblies daily.
>
> "The additional weight significantly impacts the handling and performance during the rainy season says the report," which was prepared for the Center for Army Lessons Learned in Fort Leavenworth, Kansas. "Mud appeared to cause strain on the engine, the drive shaft and the differentials," none of which was designed to carry the added armor.
>
> Commanders' displays aboard the vehicles are poorly designed and do not work; none of the 100 display units in Iraq are being used because of "design and functionality shortfalls," the report states. The vehicle's computers are too slow and overheat in desert temperatures or freeze up at critical moments, such as "when large units are moving at high speeds simultaneously" and overwhelm its sensors.
>
> The main weapon system, a $157,000 grenade launcher, fails to hit targets when the vehicle is moving, contrary to its design, the report states. Its laser designator, zoom, sensors, stabilizer and rotating speed all need redesign; it does not work at night; and its console display is in black and white although "a typical warning is to watch for a certain color automobile," the report says. Some crews removed part of the launchers because they can swivel dangerously toward the squad leader's position.
>
> The vehicle's seat belts cannot be readily latched when troops are in their armored gear, a circumstance that contributed to the deaths of three soldiers in rollover accidents, according to the report. On the vehicle's outside, some crews have put sand-filled tin cans around a gunner's hatch that the report says is ill-protected.[8]

Basic Characteristics—M-1126 Stryker Combat Vehicle

Table 3. Selected Basic Characteristics—M-1126

Armament	1 x 12.7 millimeter M-2 HB machine gun 16 x smoke grenade launchers
Crew	2 crew, 9 infantrymen M-3: 3 crew, 2 scouts
Maximum Speed	60 mph
Maximum Cross Country Speed	—
Range (unrefueled)	329 miles
Weight	20-23.5 tons

Source: Jane's Armour and Artillery, 2011-2012, p. 735.

[8] R. Jeffrey Smith "Study Faults Army Vehicle: Use of Transport in Iraq Puts Troops at Risk, Internal Report Says," *Washington Post*, March 31, 2005.

Wheeled or Tracked Fighting Vehicles?

When comparing fighting vehicles, the question often arises: Which is better—a tracked combat vehicle or a wheeled combat vehicle? While no single criterion can answer this question, tests and studies suggest tracked vehicles offer the following advantages:

- Cross country mobility.
- Traction on slopes.
- Survivability.
- Gap and obstacle crossing.
- Ability to modify (add more components).

For wheeled vehicles, the following advantages are cited:

- Road speed.
- Fewer logistics requirements.
- Cheaper operational and support costs.

Information is taken from Paul Hornback, "The Wheel Versus Track Dilemma," *Armor Magazine*, March-April 1998, pp. 33-34.

Vehicle Variants Currently in Service

M-1 Abrams

The Army's Active Component (AC) ABCTs are currently receiving M-1A2 Systems Enhancement Package (SEP) Version 2 (v2) tanks.[9] The M-1A2 SEPv2 tank is described as follows:

> The M1A2 SEP v2 is an all-digital tank, with a new electronic backbone and powerful new computers that provides split-second command and control over the entire spectrum of combat. The M1A2 SEP's open architecture is designed to accept spin-off technologies without the need for significant re-design. The Built-In Test system ensures that diagnosis and repair are fast and efficient, improving combat availability and saving operational costs. Improved digital displays provide tank commanders and crews with a better understanding of their tank's operational status and their situation on the battlefield.[10]

With the exception of two ARNG ABCTs (155th ABCT [MS ARNG] and the 116th ABCT [ID ARNG]) and one battalion (2-137th Combined Arms Battalion [KS ARNG]) that are equipped with the M-1A2 SEPv2 tank, the remaining five ARNG ABCTs are equipped with the M-1A1 Situational Awareness (SA) tank. The M-1A1 SA is an upgraded version of the basic M-1A1 variant. These tanks are configured with additional technologies to improve crew situational awareness (SA). The situational awareness package increases the tank's fighting capability by providing soldiers with Blue Force Tracker, a Global Positioning System (GPS)-based system which provides commanders and units with location information about friendly and hostile military forces. Additional enhancements to the M-1A1 include a second generation Forward-

[9] U.S. Army Program Executive Office Ground Combat Systems Fact Sheet, Abrams Family of Vehicles: M-1A1SA & M-1A2 SEPv2, http://www.peogcs.army.mil/documents/ABCT-Abrams.pdf, accessed April 17, 2015.

[10] National Guard Association of the United States (NGAUS) Fact Sheet, M-1A2 SEP v2 Abrams, 2014, http://www.ngaus.org/sites/default/files/AbramsFactSheetFY14.pdf, accessed April 17, 2015.

Looking Infrared Radar (FLIR) thermal site, Tank Urban Survivability (TUSK)[11] enhancements, and a driver's thermal viewer.

M-1 Abrams in the U.S. Marine Corps

In 2008, the Marines reportedly had 403 M-1A1 tanks.[12] The Marine version of the M-1A1 includes a Deep Water Fording Kit (DWFK), hardware to accommodate the Position Location Reporting System (PLRS), and additional tie-down points for storage on U.S. naval vessels.[13]

Why the Active Component and National Guard Have Different Versions of the M-1 Abrams[14]

Many, including some in Congress, have expressed concern that there are different versions of the M-1 Abrams in service with the Active Component and the Army National Guard. The following arguments are presented by the Army Staff and the National Guard Association of the United States.

The Army Staff's Explanation

During the Army's modular reconfiguration[15] in 2005, the Army decided to narrow down the number of variants of Abrams and Bradleys as, at that time, there were about five variants of each vehicle in service. The goal was to get to two variants of each vehicle. Over time, the heavy brigade (now referred to as ABCT) force structure changed (the Army had fewer ABCTs and the remaining ones became smaller), and the Army increased the recapitalization of combat vehicles through Global War on Terror/Overseas Contingency Operation funding. The Army's initial plans called for M-1A1 SA tanks in both the AC and ARNG. As the Army's number of heavy brigades continued to decrease and Abrams recapitalization[16] continued, the Army was able to provide M-1A2 SEPv2's to all AC ABCTs, Army Prepositioned Stocks and the 116th ABCT (ID ARNG). Also during this time the Army reset 791 M-1A1's to a common configuration with second generation FLIR (M-1A1 SA). Further force structure changes such as withdrawal of ABCTs from Europe and congressional "adds"[17] permitted the Army to field M-1A2 SEPv2 to the 155th ABCT and the 2-137th Combined Arms Battalion.

---

[11] From U.S. Army Program Executive Office Ground Combat Systems Fact Sheet, Abrams Family of Vehicles :M-1A1SA & M-1A2 SEPv2, http://www.peogcs.army.mil/documents/ABCT-Abrams.pdf, accessed April 17, 2015, "The Tank Urban Survivability Kit, or TUSK, improves force protection, lethality, survivability and situational awareness on the Abrams main battle tank. The inclusion of reactive armor tiles, gun shields, a mine-resistant driver seat, a stabilized commander's weapon station, counter sniper / anti-materiel mount and loader's thermal weapon sight, and underbelly armor provide enhanced capabilities for the urban fight."

[12] Jane's Armour and Artillery, 2011-2012, 2012, pp.181-182.

[13] Ibid.

[14] CRS discussions with U.S. Army G-8 Staff, April 24, 2015.

[15] For additional information on Army modularity see CRS Report RL32476, *U.S. Army's Modular Redesign: Issues for Congress*, by Andrew Feickert.

[16] According to the Defense Acquisition University, there is no official Federal or DOD definition of recapitalization. Recapitalization is generally considered as the major reconstruction needed to keep existing weapon systems modern and relevant in an environment of changing standards and missions. Recapitalization extends the service life of weapon systems or restores lost service life. It includes restoration and modernization of existing weapon systems as well as their replacement.

[17] Additional funding over and above the President's Budget request authorized and appropriated by Congress.

With the large investment in Abrams over the last 10 years and the young age of the fleet (based on reset /recapitalization of the vehicles), the Army decided not to fund continued M-1A2SEPv2 production and instead decided to focused its resources on research, development, testing, and evaluation (RDT&E) and upgrade all tanks to the M-1A2SEPv2 starting in FY2017.

An Argument for Full Fielding of M-1A2 SEPv2s to the ARNG

From the National Guard Association of the United States (NGAUS)[18] 2104 Fact Sheet: *M-1A2 SEP v2 Abrams*:

> The M-1A2 SEP v2 Abrams main battle tank is the Army's premier ground combat system and has demonstrated its value on the battlefields of Iraq. With its advanced thermal sights and Commander's Independent Thermal Viewer (CITV), this tank is 110% better than an M-1A1 in the defense, and 50% better in the offense. The CITV provides the crew with a hunter-killer capability, which means that the M-1A2 SEP v2 can acquire targets 45% faster and hand off targets 50-75% faster, thus giving it a percent of hit on evasive targets that is 80% better than an M-1A1.
>
> The M-1A2 SEP v2 is an all-digital tank, with a new electronic backbone and powerful new computers that provides split-second Command and Control over the entire spectrum of combat. The M-1A2 SEP's open architecture is designed to accept spin-off technologies without the need for significant re-design. The Built-In Test system ensures that diagnosis and repair are fast and efficient, improving combat availability and saving operational costs. Improved digital displays provide Tank Commanders and crews with a better understanding of their tank's operational status and their situation on the battlefield.
>
> All-digital M-1A2 SEP v2s will be easier for the National Guard to maintain and to train on than M-1A1s. Digital tanks have embedded diagnostics and Vehicle Health Management Systems that provide critical maintenance data on the current status of key systems in the tank through its computers. Digital tanks will also be easier for the National Guard tankers to train on. Digital tanks allow for embedded training on the tank's computers, and laptop and desktop trainers that simulate the tank's operating systems. Army schools currently provide training solely on M-1A2 SEP v2s, meaning that any National Guard tankers attending an Army school will only be trained on M1A2s, not the vehicle they will be assigned.
>
> The National Guard, as the Army's Operational Reserve, must be equipped with tanks that are superior to the M-1A1s that the Army is providing to countries like Egypt and Iraq. This potential upgrade of National Guard tanks also comes at a critical time for the tank industrial base. Tank upgrades for the National Guard will help maintain the industrial base, bridging a gap between current tank upgrades and future tank developments. Congress recognized this and passed funding to the Army to upgrade about 50 more M-1A1 tanks to the M-1A2 SEP Configuration, both in FY2012 and FY2013. This adds more than 100 M-1A2 SEP tanks to the Army's inventory.[19]

[18] From the NGAUS Website: "The National Guard Association of the United States is the nation's oldest military association lobbying solely for the benefit of the National Guard of the United States and educating the public about the Guard's role and history in the Armed Forces of the United States. It was formed by militia officers in 1878 to obtain better equipment and training by petitioning Congress for more resources." http://www.ngaus.org/united-voice-national-guard, accessed April 24, 2015.

[19] National Guard Association of the United States (NGAUS) Fact Sheet, M-1A2 SEP v2 Abrams, 2014, http://www.ngaus.org/sites/default/files/AbramsFactSheetFY14.pdf, accessed April 17, 2015.

M-2/M-3 Bradley[20]

There are currently four types of Bradleys serving in ABCTs:

- M-2A3 Bradley IFV;
- M-3A3 Bradley Cavalry Vehicle;
- M-2A3 Fire Support Vehicle (BFIST); and
- M-2A3 Engineer Squad Vehicle.

According to the Army's Program Executive Office Ground Combat Systems:

> The Bradley Fighting Vehicle Family continues to field upgraded, digitized vehicles to the Active Army and National Guard in the form of the Bradley A3 and Bradley Operation Desert Storm-Situational Awareness (ODS-SA) vehicles .... The Bradley has received increased force protection in the form of upgraded add-on-armor, improved reactive armor tiles, and the Bradley Urban Survivability Kit (BUSK). The Bradley Fire Support Team (BFIST) Vehicle recently equipped its first unit with the Fire Support Sensor System (FS3), enabling the FIST team to conduct precision targeting and designation missions from under armor with significantly increased observation range. PM Bradley is in the process of integrating the FS3 on the M7 BFIST SA platform for the National Guard. PM [Program Manager] Bradley is pursuing additional vehicle upgrades via an Engineering Change Proposal (ECP) program to restore space, reduce weight, increase electrical power and recover mobility to be able to support integration of future network and other programmed capabilities.[21]

FY2015 M-2/M-3 Allocation by Component

Table 4. FY2015 M-2/M-3 Allocation by Component

	M-2A3	M-3A3	M-2A2 ODS SA	M-3A2 ODS SA
AC ABCTs	1,199	453	—	—
ARNG ABCTs	162	62	477	197

Source: Information provided to CRS by Army G-8, April 24, 2015.

Notes: These figures do not include M-2/M-3 versions maintained by the Army for Army Prepositioned Stocks (APS), training, and testing and evaluation.

M-1126 Stryker[22]

There are currently eight Stryker variants in service with SBCTs as discussed below.

- **M-1126 Infantry Carrier Vehicle (ICV).** The ICV is a nine-man infantry squad carrier that provides protected battlefield transport and direct fire support for dismounted operations. Each ICV has a crew of two (vehicle commander and

[20] Unless otherwise noted, information in this section is taken from U.S. Army Program Executive Office Ground Combat Systems Fact Sheet: Bradley Fighting Vehicle, http://www.peogcs.army.mil/documents/ABCT-Bradley.pdf, accessed April 24, 2015.

[21] Ibid.

[22] Information in this section, unless otherwise noted, is taken directly from U.S. Army Program Executive Office Ground Combat Systems Fact Sheet: Stryker Family of Vehicles, http://www.peogcs.army.mil/documents/SBCT.pdf, accessed April 29, 2015.

driver) who operate and maintain the ICV to help insure protected delivery of infantry squads to dismount locations.

- **M-1127 Reconnaissance Vehicle (RV).** The RV is used by reconnaissance, surveillance, and target acquisition squadrons and battalion scouts to perform reconnaissance and surveillance operations. The RV carries a crew and a scout squad for dismounted reconnaissance. The main reconnaissance asset is the Long Range Advanced Scout Surveillance System (LRAS3), which has a capability to detect targets at long range. Armament includes a commander's cupola that can mount a .50 caliber M2HB machine gun or MK19 40 mm grenade launcher.
- **M-1128 Mobile Gun System (MGS).** The MGS provides direct supporting fires to assault infantry in order to destroy or suppress hardened enemy bunkers, machine gun positions, and sniper positions in urban, restricted, and open rolling terrain. The M-1128 mounts a 105 mm main gun.
- **M-1129 Stryker Mortar Carrier (MC).** The MC provides accurate, lethal, high angle fire to support operations in complex terrain and urban environments. The MC accommodates a 120 mm mortar system that fires a full family of mortar ammunition while mounted, including high explosive (HE), illumination, infra-red (IR) illumination, smoke, precision guided, and Dual Purpose Improved Conventional Munitions (DPICM).
- **M-1130 Commander's Vehicle (CV).** The CV provides commanders with communication, data, and control functions to analyze and prepare information for combat operations. The CV integrates command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) equipment for the unit commanders and can also link to aircraft antenna/power for planning missions while en route aboard aircraft. Commanders have the capability to see and direct the operations continuously, by means of the Common Relevant Operating Picture (CROP) system, which tracks all friendly forces within their respective areas of operation.
- **M-1131 Fire Support Vehicle (FSV).** The FSV provides enhanced surveillance, target acquisition, target identification, target designation, and communications supporting the SBCT with "first round" fire-for-effect capability. The FSV provides the Fire Support Teams (FIST) with the capability to automate command and control functions, to perform fire support planning, directing, controlling and cross-functional area coordination, and execution of fire support missions.
- **M-1133 Medical Evacuation Vehicle (MEV).** The MEV is an ambulance variant of the Stryker capable of transporting four patients on standard litters, or six ambulatory patients, in addition to an ambulance team of three. The MEV provides protection for the patient and medical team and can additionally provide medical evacuation to casualty collection points to higher-level treatment centers.
- **Nuclear, Biological, Chemical, Reconnaissance Vehicle (NBCRV).** The NBCRV detects and identifies chemical, biological, and radiological hazards. It warns units of contamination, reports the location of hazards, marks areas of contamination, locates and marks clean bypass routes, and collects and transports samples of radiological, biological, and chemical material for later analysis.[23]

[23] Ibid.

Abrams, Bradley, and Stryker Allocation by BCT Type[24]

Table 5. ABCT Allocations

ABCT = 4,694 soldiers

M-1 Abrams	87
M-2 Bradley Fighting Vehicle	102
M-3 Bradley Cavalry Vehicle	50
TOTALS	**239**

Source: U.S. Army Briefing: Maneuver Warfighter Conference: Concept Implications on BCT Design Workgroup BCT 2020 Design Read Ahead, September 11, 2014.

Notes: Table does not differentiate by variants.

Table 6. SBCT Allocations

SBCT = 4,454 soldiers

M-1126 ICV	128
M-1127 RV	51
M-1128 MGS	27
M-1129 MC	36
M-1130 CV	26
M-1131 FSV	13
M-1133 MEV	16
NBCRV	3
M-1126 Engineer	12
M-1126 Anti-Tank Guided Missile (ATGM)	9
TOTALS	**321**

Source: U.S. Army Briefing: Maneuver Warfighter Conference: Concept Implications on BCT Design Workgroup BCT 2020 Design Read Ahead, September 11, 2014.

Vehicle Modernization, Recapitalization, and Reset

In order to keep the Abrams, Bradley, and Stryker operational and effective over a prolonged period, a variety of activities have been undertaken over the lives of these vehicles. The most common terms used to describe these activities are modernization, recapitalization, and reset. Although there is a lack of formal DOD and Army definition for these terms, the following descriptions can be considered representative of how the Army uses these terms:

[24] Information in this section is taken from U.S. Army Briefing: Maneuver Warfighter Conference: Concept Implications on BCT Design Workgroup BCT 2020 Design Read Ahead, September 11, 2014.

Modernization, Recapitalization, and Reset

Modernization: "Efforts undertaken related to current weapon systems to meet current and future capability needs through upgrade, replacement, recapitalization, refurbishment, and technology insertions."[25]

Recapitalization: "Recapitalizing systems, involves either completely overhauling and rebuilding an item (such as a tank or truck) so that it is returned to an 'as-new,' zero-mile condition; or upgrading a system—a more extensive makeover that also includes substantial improvements in the system's capabilities."[26]

Reset: The Army's"reset program is designed to reverse the effects of combat stress on equipment. The program encompasses several activities:"

- "Replacing equipment lost in the theater or deemed irreparable on its return. (The latter is known as a washout.)"
- "Repairing and reconditioning systems to bring them back to a satisfactory operating condition either at the field level, by soldiers in the units once they have returned to their home stations, or, in the case of more-extensive repairs, by Army personnel at depots or by contractors at their own sites. (Repairs may have been made to a piece of equipment while it was in the theater, but that activity is not part of the reset program, which comprises only repairs made after equipment has been brought home.)"[27]

Upon comparison, it might appear these terms describe somewhat similar activities. It has been a common criticism by some that the Army frequently uses these terms interchangeably when describing its efforts and activities related to these and other weapon systems. This indiscriminate use of terminology and lack of specific definitions can cause confusion, particularly when conducting oversight of funding. Traditionally, modernization and recapitalization efforts are funded by Operations and Maintenance (O&M) funds, while reset has been funded as part of Overseas Contingency Operations account.

A Fully Modernized Force?

It has been suggested that as a result of the wars in Iraq and Afghanistan, the Army has been able to significantly modernize its Abrams and Bradleys in a manner that would not likely have been possible in a peacetime environment. One study, summarized in the following section, suggests that the Active Component is comparatively speaking almost "fully modernized."

> At the start of the past decade, the Army intended to upgrade about 1,806 Bradleys, 1,100 of them to the most advanced A3 variant. The Army had upgraded 266 by the end of FY00. By the end of FY09, however, the Army far exceeded its goal and had upgraded 4,372 Bradleys, 2,446 of them to the A3 variant — leaving the less capable ones mostly in the National Guard. The upgrade gives the Bradley a modern optics package, with a sight for the commander independent of the gunner, a communication suite including the Army's networked situational awareness package, and a fully integrated GPS navigation system. In other words, the upgrade gives the Bradley state-of-the-art digital technology. As the Army's own justification says, "the Bradley A3 will maintain combat overmatch over current and future threat forces and complements the M1A2 Abrams SEP (System Enhancement Program) tank." The Army completed its Bradley upgrade program in FY11, having modernized the bulk of the fleet.
>
> The Abrams record is similar. In the FY00 budget justification, the Army stated its intention of modernizing about 1,700 tanks divided between the M1A2 upgrade and the

[25] Army Equipment Program in Support of the President's Budget: Formerly Army Equipment Modernization Plan, May 2014, p. 2.

[26] Congressional Budget Office Paper, Replacing and repairing Equipment Used in Iraq and Afghanistan: the Army's Reset Program, September 2007, pp. xiii – xiv.

[27] Ibid.

> M1A2 System Enhancement Program (SEP) that was entering production. By the end of FY00, they'd converted 360, all to the lower upgrade. In its FY12 budget justification, the Army reports to have upgraded 1,158 tanks — all to the more advanced SEP configuration — and plans to upgrade only 42 more in FY11 and FY12 to complete the program. As with the Bradley, the M1A2 SEP has modernized digital technology, including new optics and communications suites.
>
> In the past decade, the Army has modernized nearly its entire fleet of ground combat vehicles despite its original intent to pursue a much more limited modernization plan. It did so because of the unexpected bonuses from the supplemental war funding. The Abrams and Bradley programs each received more than $1B in both the FY07 and FY08 supplementals. Coupling that extra funding with a decade of procurement growth, the Army has now equipped its entire active force structure with the most modern variants of its basic vehicles.[28]

The Army generally agrees that its vehicle fleet is in relatively good shape as a result of war. However, the Army cautions about the necessity to modernize and upgrade its fleet on a regular basis which could be challenging in a fiscally constrained environment.

A Summary of M-1 Abrams and M-2/M-3 Bradley Modernization

The following excerpts from an article in *National Defense* magazine provide a useful summary of current and planned M-1 Abrams and M-2/M-3 Bradley Modernization efforts:

> More than 1,600 Abrams tanks and 2,500 Bradley infantry combat vehicles would be overhauled over the next decade.
>
> The work will be done in stages. Each phase, called an "engineering change proposal," or ECP, will tackle different parts of the vehicle that need to be modernized, including engines, transmissions, electrical power systems, communications networks, sensors and weapons.
>
> This month [May 2015], the Army expects to unveil the first Bradleys with updated suspensions and tracks. "It will bring the vehicle back to where it was before the war," said Col. James W. Schirmer, Army program manager for armored fighting vehicles. The next ECP will deal with engines and transmissions, and will increase electrical power. Then comes the more challenging upgrade, called "lethality ECP," when the Army will seek to install a new targeting sensor, known as third-generation forward-looking infrared, or 3rd generation FLIR.
>
> The Army expects to release this month a solicitation for industry bids for the new sensor. FLIR technology detects heat and creates images from it, allowing operators to see through darkness, smoke, rain, snow and fog.
>
> Current ground platforms use a single-band FLIR that was designed in the 1990s, Sullivan said in an interview. "But with advances in technology we were able to incorporate an additional waveband — another band of the non-visible IR spectrum — to get more clarity. This allows the soldier not only to see through the dirty battlefield but also see more clearly."
>
> The new FLIR will be "horizontal technology integration," meaning that Sullivan's office will develop a set of common components that will fit in different sights. There are two sights on the Abrams and two on the Bradley. The 3rd generation FLIR components will be common across the four sights.

[28] Russell Rumbaugh, The Stimson Center, Washington, D.C., "What We Bought: Defense Procurement from FY01 to FY10," October 2011, pp. 8-9.

The Army soon will request industry bids and expects to award a 3rd generation FLIR development contract during fiscal year 2016. Production would begin in 2023.

The FLIR program is a significant opportunity for defense contractors. Industry sources estimate it could be worth more than $2 billion if all Abrams and Bradleys in the current plan are upgraded.

Vendors said 3rd generation FLIR technology is relatively mature and should not pose difficulties for the Army. "It is ready for engineering and manufacturing development," said Clay Towery, business development manager at Raytheon. The company teamed with DRS Technologies for the new FLIR program. Both firms have spent their own funds on prototypes in preparation for the upcoming competition.

Upgrading electronics onboard vehicles is a hard job. "Technology evolves much faster than automotive components. We face obsolescence problems with electronic components in vehicles we just finished designing."

In addition to the Abrams and the Bradley, the Army is looking to upgrade its Stryker light armored vehicles and Paladin howitzers. It remains to be seen if there will be enough money to refurbish every vehicle.[29]

[29] Taken directly from Sandra I. Erwin, "Army Begins Massive Makeover of Combat Vehicle Fleet, *National Defense Magazine*, May 6, 2015.

Abrams and Bradley Upgrade Plans

Abrams Upgrade Plan

Engineering Change Proposal 1a

ECP-1a will address the system architecture (power and data management systems) to support inbound technology, specifically the Army's network requirements. It is scheduled to begin production in FY2017.

Improvements include network compatibility, mass memory upgrade, power generation and distribution. Upgrades to the tank's electronic architecture and power distribution system enable integration of the Army's future battle command and communication systems. Protection improvements include armor upgrade and integration of counter radio-controlled IED electronic jammers. A new auxiliary power unit and advanced on-board diagnostics will improve sustainability by reducing the fuel usage and the cost of spare parts.

Engineering Change Proposal 1b

ECP 1b is scheduled to begin development in FY2016 and enter production in 2024. This upgrade will improve the tank's lethality through enhancements in sights and sensors that are centered on the integration of the next generation of forward looking infrared (FLIR) technology, a color camera and a laser range finder.

Bradley Upgrade Plan

Engineering Change Proposal 1

ECP 1 focuses on mobility and survivability, increases movement and restores lost ground clearance. A production contract award was made in 2014 and fielding will begin in the third quarter of FY2015.

Engineering Change Proposal 2

ECP 2 addresses embedded digital systems. A later effort will focus on integration of technologies currently in development: Mounted Family of Computing Systems, Net-Ready, Integrate Counter Remote-Controlled Improvised Explosive Device Electronic Warfare (CREW) Duke v3 and Vehicle Health Management System. ECP 2 consists of a power pack upgrade to enable enough power to run the current approved counter IED and mission command components. ECP 2 production award is scheduled for FY2017 with fielding beginning in 2018.

Engineering Change Proposal 2b

ECP 2B is about lethality, and parallels the Abrams ECP1b program. They are being developed together to take advantage of as much commonality as possible. The Bradley ECP2b program includes the Improved Bradley Acquisition System and the Commander Independent Viewer with 3Gen FLIR, a color camera and a laser pointer that works at standoff distance.

Source: Sandra I. Erwin, "Army Begins Massive Makeover of Combat Vehicle Fleet, *National Defense Magazine,* May 6, 2015

Issues Concerning the Army's M-1 Abrams Modernization Plans[30]

The Army began upgrading M-1A2s to the M-1A2SEPv2 version in 2007. In 2011, the Army proposed suspending the upgrade of M-1A2s to the M-1A2SEPv2 variant between FY2013 and FY2017 to save funds that could instead be used to develop the new M-1A3 variant. The Army argued that $1.3 billion could be saved in the FY2012 defense budget if the upgrade work, which would be conducted at the Joint Systems Manufacturing Center[31] in Lima, OH, was suspended until 2017, when work would begin on the M-1A3 variant. The Army estimated that shutting down the Lima Army Tank Plant in 2013 and reopening it in 2017 would cost $800,000 whereas keeping the plant open during this period would cost $2.1 billion.

Some Members, concerned about the potentially adverse impact of the Army's proposal on the U.S. industrial base, sent a letter to Secretary of the Army John McHugh, urging instead the limited production of 70 M-1A2SEPv2 tanks per year from FY2013 to FY2017.[32] Congress subsequently decided to include an additional $225 million in the FY2012 defense budget to upgrade 49 M-1A2s.

In 2012, the Army again proposed postponing M-1A2 upgrade work until FY2017. Some Members, concerned about the impact on the industrial base, sent Secretary of Defense Leon Panetta a letter on April 20, 2012 urging him to support the upgrade of additional tanks. Congress decided to include $136 million in the FY2013 defense budget to upgrade an additional 33 M-1 A2s.

In 2013, Army leadership reaffirmed their position that they did not require any additional M-1 A2 tanks. In May 2013, a number of House Members sent a letter to Secretary of the Army McHugh expressing concern over the Army's failure to fund production of the M-1A2. Congress included $346 million in the FY2014 defense budget to fund M-1 upgrades.

In FY2014 Congress included $90 million for M-1A2 upgrades and $120 million in FY2015.[33] As the Army had repeatedly emphasized they did not require additional M-1A2 tanks, some have criticized Congress for "making the Army buy tanks that it did not need."[34]

During a January 20, 2015, conference at the American Enterprise Institute (AEI), House Armed Services Committee Chairman Mac Thornberry provided a congressional perspective on this issue:

> Some of you have heard that the House and the Senate are forcing the Army to buy tanks that it doesn't want to satisfy some donor, or some lobbyist or some parochial interest. Now here's the reality. We made a judgment call.

[30] Information in this section is taken from Alexander Pearson, "Fact Sheet: M-1 Abrams Tank," Center for Arms Control and Non-Proliferation, December 4, 2013.

[31] The Joint Systems Manufacturing Center—also known as the Lima Army Tank Plant (LATP)—is a government-owned, contractor-operated (GOCO) facility operated by General Dynamics Land Systems (GDLS).

[32] Letter to Secretary of the Army John McHugh by Rep. Sander Levin and Rep. Mike Rogers, May 6, 2011.

[33] See CRS Reports: CRS Report R43323, *Defense: FY2014 Authorization and Appropriations*, by Pat Towell and Amy Belasco, and CRS Report R43788, *Defense: FY2015 Authorization and Appropriations*, by Pat Towell.

[34] See, for example, NBC News, "The M1 Abrams: The Army Tank that Could Not be Stopped," July 28, 2012, http://investigations.nbcnews.com/_news/2012/07/28/12991946-the-m1-abrams-the-army-tank-that-could-not-be-stopped and Matthew Cox, "Pentagon Tells Congress to Stop Buying Equipment it Doesn't Need," *Miltary.com*, January 28, 2015, http://www.military.com/daily-news/2015/01/28/pentagon-tells-congress-to-stop-buying-equipment-it-doesnt-need.html.

> There's one plant left in America that builds tanks. The Army said foreign sales would keep it open until 2019 when they needed it to start upgrading our own tanks. The House and Senate Armed Services Committees and the House and Senate Appropriations Committees looked into it and all decided their math didn't work. So we started upgrading our tanks earlier than planned to make sure the plant stayed open, the trained workforce stayed engaged and improved tanks could get into the field even faster.[35]

M-1126 Stryker Modernization Plans[36]

From the Army's Program Executive Office Ground Systems:

> In response to a need to better protect Stryker soldiers from the threat of mines and improvised explosive devices, the Stryker Double V-Hull (DVH) effort emerged. DVH includes: a new hull configuration, increased protection, upgraded suspension and braking system, wider tires, blast-attenuating seats and a Height Management System (HMS) designed to increase ground clearance and improve both survivability and mobility.[37]

The DVH Engineering Change Proposal project also will provide a variety of other upgrades described below:[38]

Automotive

DVH Strykers will receive a new engine and suspension. A 450 horsepower engine will increase vehicle mobility and power generation and a new driveline will be installed to match the new engine. New tires will also be added. These chassis upgrades will increase the vehicle's gross weight.

Electrical/Digital

The DVH Stryker's electrical system will be upgraded to a 910 amp alternator to meet current power requirements and will leave room for future power growth. On the digital side, the Stryker's driver and commander's stations will receive smart displays and an upgraded Ethernet and the vehicle's digital infrastructure will be set up for future upgrade.

Request to "Up-Gun" European-Based Strykers[39]

The Army has reportedly requested the European-based 2nd Cavalry Regiment—a SBCT—be equipped with a 30 mm weapon systems in order to provide enhanced "direct fire support for

---

[35] "A Congressional Roadmap for Rebuilding our Nation's Military: A Conversation with House Armed Services Committee Chairman Mac Thornberry," AEI, January 20, 2015.

[36] Information in this section is taken from Army Program Executive Office Ground Combat Systems Fact Sheet: Stryker Family of Vehicles, http://www.peogcs.army.mil/documents/SBCT.pdf,accessed, April 29, 2015, and Ann Roosevelt, "Army Upgrading Stryker, Abrams for Improved Performance, Future Growth," *Defense Daily*, October 22, 2014.

[37] Army Program Executive Office Ground Combat Systems Fact Sheet: Stryker Family of Vehicles, http://www.peogcs.army.mil/documents/SBCT.pdf,accessed April 29, 2015.

[38] Ann Roosevelt, "Army Upgrading Stryker, Abrams for Improved Performance, Future Growth," *Defense Daily*, October 22, 2014.

[39] Sydney J. Freedberg Jr., The 30 Millimeter Solution: Army Upgunning Strykers vs.Russia, *Breaking Defense*, April 23, 2015, and John Vandiver, "Germany-Based Stryker Brigade Gets Provisional OK for More Firepower, *Stars and Stripes*, May 4, 2015.

dismounted infantrymen when engaging like units."[40] This request was characterized as an "operational need to fill an urgent requirement" and would outfit 81 of the 2nd Cavalry Regiment's M-1126 ICV variants with 30 millimeter cannons. The Army has requested Congress authorize and appropriate a total of $411.8 million in FY2016 funding. The Army contends it would cost $3.8 million per Stryker including both the 30 millimeter cannon as well as other selected improvements such as a new suspension. Work on the upgraded Strykers would be conducted at both Anniston Army Depot in Alabama and the Joint Systems Manufacturing Center in Lima, OH. Once funding is approved, the Army states the first production vehicle could be delivered in 18 months and the final vehicles delivered in 24 months.

Successors to the Abrams, Bradley, and Stryker

The *Army's Equipment Program in Support of the President's Budget 2015* describes the Abrams, Bradley, and Stryker as part of the operational force until at least FY2029 and perhaps beyond.[41] Regarding the Abrams and Stryker, Army plans call for an upgraded M-1A3 Abrams and an upgraded Stryker vehicle. The Army, however, is planning for a successor to the Bradley—the Future Fighting Vehicle (FFV). The FFV succeeds the Army's previous attempt at a Bradley successor—the Ground Combat Vehicle (GCV)—which was deemed too heavy and impractical by many defense analysts and cancelled by the Defense Department in early 2013. The FFV could be either a completely new vehicle design or could come in the form of an upgraded Bradley. The Army reportedly will make this decision—a new design or upgraded Bradley—by the spring of 2016.[42]

The Army reportedly plans to relax its previous GCV requirement that the proposed vehicle carry an entire nine-man infantry squad—a requirement many believe made the GCV too large, too heavy, and potentially unaffordable. In May 2015, BAE Systems and General Dynamics Land Systems received contracts—$28.9 million and $28.3 million, respectively—to develop design concepts for the FFV.

Foreign Military Sales (FMS)[43]

According to the Army, "Foreign Military Sales is a form of security assistance authorized by the Arms Export Control Act (AECA) [Public Law 94-329]. Under Section 3 of the AECA, the U.S. may sell defense articles and services to foreign countries and international organizations when the President of the United States formally finds that to do so will strengthen the security of the U.S. to promote world peace."[44] According to the Army, FMS is important because:

- Foreign Military Sales are vital and beneficial in supporting U.S. national security and foreign policy objectives by allowing allies to promote peace and stability in their region;

[40] John Vandiver, May 4, 2015.

[41] Army Equipment Program in Support of the President's Budget 2015, February 2015, p. 32.

[42] Sebastian Sprenger, "Vendors Hone their Designs: BAE Systems Get New Fighting-Vehicle Contracts," *InsideDefense.com*, June 5, 2015.

[43] Information from this section is taken from Army Program Executive Office Ground Combat Systems Fact Sheet: Foreign Military Sales (FMS), http://www.peogcs.army.mil/documents/ABCT-FMS.pdf, accessed July 2, 2015.

[44] Ibid.

- FMS allows for weapon system interoperability between allies which can be valuable during joint operations; and
- Industry benefits from FMS by keeping production lines warm when there is a decrease or gap in production from U.S. Government sales.[45]

M-1 Abrams Foreign Military Sales[46]

The United States has sold M-1A1 Abrams to Australia, Egypt, and Iraq under the provisions of FMS. Also under FMS, the United States has provided M-1A2s to Kuwait and Saudi Arabia. Since 2002 when the U.S. Army Tank, Automotive, and Armaments Command awarded a contract to General Dynamics Land Systems to support the co-production of M-1A1s at the Egyptian Tank Plant near Cairo, Egypt has been producing M-1A1s. As of July 2011, Egypt had a fleet of 1,005 M-1A1s with their stated long-term objective of 1,500 M-1A1 tanks. As part of an Excess Defense Article grant, Morocco was provided 200 M1-A1 SA Abrams tanks in 2011.[47]

M-2 Bradley and M-1126 Stryker Foreign Military Sales[48]

Under FMS, Saudi Arabia acquired 400 M-2 Bradleys. Although there are no known FMS actions for the Stryker, Israel once expressed interest in the Stryker possibly to equip two brigades. The Israelis decided instead in 2005 to develop their own vehicle based on existing Israeli combat vehicles.

Industrial Base Issues

The viability of the Army's combat vehicle industrial base is a crucial consideration for DOD, the Army, and Congress. DOD's 2013 Annual Industrial Capabilities Report to Congress captures the current state of play:

> The Department has not acquired new combat tracked vehicles for many years, instead choosing to remanufacture and update legacy platforms. The Army upgrades and maintains its existing fleet of tracked vehicles using a combination of organic capabilities and the private sector. As a result, the average age of refurbished Abrams Tanks and Bradley Fighting Vehicles is only a couple of years. With the drawdown of the military, there are few requirements to continue remanufacturing these platforms, with the possible exception of Foreign Military Sales. Unlike combat tracked vehicles, the Stryker combat wheeled vehicle is still in production, but its quantities have also dropped off—from 292 in 2011, to 100 in 2012, to 58 in 2013.
>
> Despite a lack of operational requirements, the Army is considering the need to bear the cost of continuing Abrams, Bradley, and Stryker production lines at a minimum sustainment rate (MSR) to maintain manufacturing capabilities and to avoid shutdown and startup costs resulting from a three-year production gap. Abrams ECP [Engineering

[45] Ibid.

[46] Information from this section, unless otherwise noted, is taken from Jane's Armour and Artillery, 2011-2012, 2012, pp.177-185.

[47] Defense Security Cooperation News Release, *Kingdom of Morocco – M1A1 SA Abrams Tank Enhancement, Support and Equipment*, June 18, 2012.

[48] Information from this section, unless otherwise noted, is taken from Jane's Armour and Artillery, 2011-2012, 2012, pp.458-459.

> Change Proposal] 1 (FY17-FY18) and BFV ECPII (FY17) will help to revitalize the Combat Vehicle Industrial Base.[49]

Congress has an enduring interest in the oversight of the Army's combat vehicle industrial base, particularly in light of decreased production of combat vehicles. A June 2015 Government Accountability Office (GAO) report details their response to decreased production:

> In response to questions raised over the effect of this planned decrease in production, the Senate Armed Services Committee and conferees for the National Defense Authorization Act for Fiscal Year 2013 directed the Army to report on the status of the combat vehicle industrial base In October 2012, the Army issued a contract with A.T. Kearney, a private independent management consulting firm, to complete an assessment of the combined commercial and government combat vehicle industrial base that supports the United States Army and delivered the final report to the congressional defense committees in April 2014.[50]

GAO's report summarizes the Kearney report's findings as:

- There is excess capacity in facilities with the ability to machine large, complex metal structures for the ground combat vehicle industrial base;
- Unique capabilities exist at each production and sustainment facility within the combat vehicle industrial base, but there is a significant overlap of similar capabilities across the facilities;
- A small number of skills such as armor steel welding are critical to the production and sustainment of combat vehicles;
- There are a small number of high-risk critical and fragile suppliers, such as those that provide certain engines and transmissions, and the risk to these suppliers can be mitigated by individual company action or limited Army intervention;
- Production and sustainment demand is the factor that has the most impact on the industrial base; and
- There is a lower financial impact to the Army for potential production breaks—specifically, stopping all Bradley Fighting Vehicle production work at a particular facility—than previously identified by the original equipment manufacturer in a 2012 report.[51]

These findings suggest a relatively healthy Army combat vehicle industrial base provided the existence of adequate production and sustainment demand. The question then becomes what is considered adequate if the only production of M-1s, M-2s, and M-3s is for military sales or newer vehicle versions? This is further complicated by the possibility the Army could eliminate additional ABCTs and SBCTs due to fiscal constraints attributed to the Budget Control Act of 2011 (P.L. 112-25). Without a degree of certainty in these areas, it might prove difficult for all parties to monitor the "health" of the Army's combat vehicle industrial base without a persistent level of oversight.

[49] Under Secretary of Defense for Acquisition, Technology and Logistics Office of the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy, "Annual Industrial Capabilities Report to Congress," October 2013, p. 22.

[50] United States Government Accountability Office, Report to Congressional Committees, *Army Combat Vehicles: Industrial Base Study's Approach Met Research Standards*, June 2015, p. 1.

[51] Ibid., p. 6.

Current Legislation

FY2016 Budget Requests[52]

Table 7. FY2016 Presidential Budget Request: Abrams, Bradley, and Stryker

($ in thousands)

Budget Activity	Amount
M-1 Abrams Tank (Modification)	$367,939
Abrams Upgrade Program	$0
Abrams Total	$367,939
Bradley Program (Modification)	$225,042
Bradley Total	$225,042
Stryker Procurement	$181,245
Stryker Modification	$74,085
Stryker Upgrade	$305,743
Stryker Total	$561,073

Source: Army Justification Book, Procurement of Wheeled and Tracked Combat Vehicles (W&TCV), Department of Defense Fiscal Year (FY) 2016 President's Budget Submission, February 2015, p. A-3A.

Notes:

1) All requested amounts are from the Base Budget request. There were no Overseas Contingency Operations requests for these systems.

2) In terms of differentiating between **upgrades** and **modifications** in the budget request: **Upgrades** generally involve adding additional capabilities to a weapons system such as a larger main gun or additional armor, for example. **Modifications** address vehicle issues such as obsolescence, reliability, capability, performance degradation, safety, and operationally related issues.

H.R. 1735, National Defense Authorization Act for Fiscal Year 2016

Funding[53]

The House authorized the FY2016 Presidential Budget Request for the Abrams, Bradley, and Stryker with the following exceptions:

- For Stryker Modifications (MOD) the House added $44.5 million for Lethality Upgrades for a total authorization of $118.585 million.
- For Abrams (Modification) the House added $40 million for a total authorization of $407.939 million.

[52] Army Justification Book, Procurement of Wheeled and Tracked Combat Vehicles (W&TCV), Department of Defense Fiscal Year (FY) 2016 President's Budget Submission, February 2015, p. A-3A.

[53] H.Rept. 114-102, Report of the Committee on Armed Services House of Representatives on H.R. 1735, National Defense Authorization Act for Fiscal Year 2016, May 5, 2015, p. 406.

Report Language[54]

"Bradley Fighting Vehicles. The committee is aware that the US Army is working to standardize its fleet of Bradley Fighting Vehicles to two digital configurations; the M2A3 and the M2A2 ODS–SA. The committee understands that the majority of Active Duty and National Guard units are equipped with the most advanced versions of these vehicles that include digitized fire control and communications systems. The committee is aware that two units in particular, the 11th Armored Cavalry Regiment and the Nevada National Guard, as well as several other active duty Brigade Engineer Battalions are equipped with the least modernized M2A2–ODS variant. The committee acknowledges that the Bradley Family of Vehicles, to include the M2A2 ODS, M2A2 ODS–SA, and M2A3, share the same materiel engineering and construction with no differences in protection or survivability and that all three variants are deployable for combat. The committee is concerned that soldiers in the units M2A2 ODS versions lack the technical proficiency necessary to operate the advanced Bradley vehicles used in combat operations.

The committee is concerned that this could degrade combat effectiveness and pose additional risk to units who deploy with the older Bradley variant. The committee understands that the Army provides new equipment training for units scheduled to fall-in on equipment with unfamiliar capabilities upon deployment to combat theaters of operation. The committee also understands that the Army maintains a program of record for remanufacturing M2A2–ODS Bradley's that ceased production in 2014 and notes that the budget request did not include funding to modernize these remaining vehicles. As such, the committee directs the Secretary of the Army to brief the House Committee on Armed Services by February 15, 2016, on what resources would be required to maintain the readiness and technical proficiency of these units as well as current and long terms plans for modernizing the remaining vehicles."

"Combat Vehicle Industrial Base Management. The committee notes that as a result of the Budget Control Act of 2011 (P.L. 112-25), the Army is in the process of reducing its Active Duty end strength to 420,000, unless sequestration is resolved. Additionally, the Army will have reduced Active Component Brigade Combat Teams (BCTs) from 45 to 32 by the end of fiscal year 2015. In 2012 the active Army had 17 Armored BCTs (ABCT), 20 Infantry BCTs (IBCT), and 8 Stryker BCTs. Notably, by the end of fiscal year 2015, the Army will have reduced active Army ABCTs to 9, nearly half the number it had in 2012. The committee notes that the ABCT, which is comprised of Abrams tanks and Bradley fighting vehicles, is the only full-spectrum force in the Army's force structure. With regard to the future utility of armored forces, the committee notes that a RAND Corporation report from 2010 concluded that, ''Heavy forces—based on tanks and infantry fighting vehicles—are key elements of any force that will fight hybrid enemies that have a modicum of training, organization, and advanced weapons. Light and medium forces can complement heavy forces, particularly in urban and other complex terrain; they do not provide the survivability, lethality, or mobility inherent in heavy forces. Quite simply, heavy forces reduce operational risks and minimize friendly casualties.

The committee is encouraged by the restoration of a third maneuver battalion in Armored and Infantry BCTs, and notes that in the committee report (H.Rept. 109-452) accompanying the National Defense Authorization Act for Fiscal Year 2007, the committee opposed the Army's original decision to have only two maneuver battalions per BCT. The committee remains concerned about the reduction of active ABCTs and the Army's ability to have sufficient numbers of fully ready active ABCTs to meet combatant commander steady state and contingency plan requirements. Additionally, the committee has concerns about the mobility, protection, and

[54] Ibid. p. 11.

lethality of IBCT, and encourages the Army to pursue rapid incremental solutions to address these shortfalls. In addition to the mix of BCTs, the committee continues to need a better understanding of the ramifications to the future combat vehicle industrial base capabilities with regard to the Abrams tank, Bradley fighting vehicle, Paladin howitzer, Hercules recovery vehicle, Armored Multi-Purpose Vehicle, and the Stryker combat vehicle.

The committee commends the Army for making positive progress in information collection and analysis of long-term sustainment of the combat vehicle industrial base, and also its use of the analytical information collected to mitigate risk at both the prime and vendor level using congressionally appropriated funds. Moreover, the committee acknowledges that this information has helped inform the Army's position that Foreign Military Sales alone is not sufficient to sustain the viability of the combat vehicle industrial base. Such a position poses an unacceptable level of risk at both the prime contractor and vendor level and Congress has been consistently vocal on these risks in previous years.

The committee supports the Army's decision to accelerate the 4th Stryker Double-Vee-Hull conversion and Stryker Engineering Change Proposal (ECP) program for Stryker combat vehicle, as well as continuing its efforts in ECP production of the Bradley fighting vehicle, and M1 Abrams tank, to include development of six pilot M1A2 SEP V3. In addition, the committee understands that the Army awarded an Engineering Manufacturing Development contract for the Armored Multi-Purpose Vehicle in December 2015, a program the committee has encouraged the Army to accelerate for several years. The out-year funding reflected in the budget request for fiscal year 2016 indicates a commitment by the Army to move forward with the next major technology upgrades for the existing fleet of weapon systems that would ensure fielding of the highest quality combat vehicles to a smaller force and also sustain the fragile industrial base. However, the committee remains concerned about the stability of Army modernization funding in FY2017 and beyond given the implications of sequestration. In particular, and verified by the Army's industrial base analysis, the committee is concerned about the viability of select vendor base suppliers, such as the Forward Looking Infra-red and transmissions sectors. The committee encourages the Army to continue to monitor these two sectors closely and to take necessary actions to maintain their viability."[55]

"M1 Abrams Tank Fleet Configuration. The committee notes that the M1A2 System Enhancement Program (SEP) v2 Abrams tank is the Army's premier ground combat system and has demonstrated its value on the battlefields of Iraq. Its built-in test system ensures that diagnosis and repair are fast and efficient, improving combat availability and saving operational costs. Improved digital displays provide tank commanders and crews with a better understanding of their tank's operational status and their situation on the battlefield. However, despite the capabilities of the M1A2 SEP v2, the committee is aware that the Army maintains two configurations of Abrams tanks, and believes that this dual configuration is inefficient and increasingly expensive. The committee further notes that all Armor Brigade Combat Teams (ABCT) in the active component are equipped with M1A2 SEP v2 tanks, but that only two out of seven ABCTs in the National Guard are equipped with new M1A2 SEP v2 tanks. The other five ABCTs in the National Guard, and the three separate Combined Arms Battalions, are equipped with less-capable M1A1 Situational Awareness (SA) tanks. The committee is also aware that Army schools currently provide training solely on M1A2 SEP v2s, meaning that Army National Guard soldiers attending an Army armor school are trained on M1A2 SEP v2 tanks, which is not the vehicle they will operate in their units.

[55] Ibid., pp 11-14.

Finally, the committee also notes that the Army intends to begin fielding a new version of the M1 Abrams tank, the M1A2 SEP v3, in 2018. The committee understands that this tank will be an incremental improvement from the M1A2 SEP v2 and retain significant commonality.

The committee believes that the Army should take advantage of upcoming changes to its ABCT force structure to achieve a pure fleet of M1A2 SEP v2 tanks across both the active duty Army and Army National Guard. The committee believes that maintaining only one type of tank in the Army will reduce support and training costs, allow better integration the Army National Guard, and provide a more capable overall tank fleet for the Army. The committee directs the Secretary of the Army to provide a briefing to the House Committee on Armed Services by January 30, 2016, on the potential force structure changes and production programs necessary to achieve a pure fleet of M1 Abrams tanks across the Army."[56]

"Stryker Lethality Upgrades. The budget request contained $74.0 million in Weapons and Tracked Combat Vehicles, Army for Stryker modifications and $257.1 million in PE 23735A for the Combat Vehicle Improvement Program. The committee notes that U.S. Army deployments in Operation Iraqi Freedom and Operation Enduring Freedom placed a strain on the Army's combat vehicle fleet and prompted a significant investment in the force protection and survivability of M1 Abrams tanks, Bradley Fighting Vehicles and the Stryker family of wheeled combat vehicles to defeat mines, improvised explosive devices and other threats. One notable example is the success of the Double V Hull on the Stryker vehicle. The committee understands that this necessary investment in vehicle survivability did degrade vehicle mobility and may have caused the Army to defer investments in vehicle lethality.

The committee notes that the Army is addressing the mobility issues with Abrams, Bradley and Stryker with Engineering Change Proposal (ECP) modernization programs that are funded in the fiscal year 2016 request. The committee understands that the Army is also resourcing lethality improvements in later phases of the Abrams and Bradley ECP programs. The committee also notes that the Army is interested in pursuing lethality upgrades within Stryker Brigades, but has not yet resourced these upgrades. The committee understands that the Army has an emerging urgent operational requirement for Stryker Infantry Carrier Vehicles that have a direct fire weapon system. The committee also understands the Army initially wants Stryker vehicles with improved lethality to be fielded to the 2nd Cavalry Regiment, a Stryker Brigade Combat Team forward deployed to Europe, to increase formation lethality against threat vehicles and dismounted infantry. The committee supports this urgent need and believes the Army should continue to pursue lethality upgrades of its Stryker Brigade Combat Teams in order to meet combatant commander requirements. Further, the committee notes that the Stryker lethality upgrade program will use existing Stryker chassis that are leftover from the Stryker exchange process that creates Double V Hull Strykers, which will reduce the cost of the lethality upgrades. Finally, the committee encourages the Army to conduct appropriate live fire testing as soon as possible on any potential Stryker survivability enhancements that have the potential to improve crew protection and overall vehicle survivability. The committee recommends $118.5 million, an increase of $44.5 million, for Stryker modifications procurement and $292.1 million, an increase of $35.0 million, in PE 23735A for Stryker lethality upgrades."[57]

[56] Ibid. pp. 14-15.

[57] Ibid., pp 16-17.

S. 1376, National Defense Authorization Act for Fiscal Year 2016[58]

Funding[59]

The Senate authorized the FY2016 Presidential Budget Request for the Abrams, Bradley, and Stryker with the following exceptions:

- For the Stryker, the Senate added $40 million in Research, Development, Test, and Evaluation (RDT&E) funding in the Combat Vehicle Improvement Program (PE 0203735A) for developing and testing Stryker lethality upgrades.

Report Language

Stryker Modification and Improvement

"The budget request included $257.6 million in PE 23735A for the combat vehicle improvement program of which $105.8 million would be for Stryker improvement. The committee notes that Army deployments in Iraq and Afghanistan placed a strain on its combat vehicle fleets prompting a significant investment in the force protection and survivability of the Stryker family of wheeled combat vehicles in order to protect soldiers against rocket propelled grenades, anti-armor grenades, and improvised explosive devices (IED). In this regard, the committee commends the Army for the success of the double-V hull modification to the Stryker providing improved protection from under belly IED blasts.

The committee understands that these high priority often operationally urgent vehicle modifications for force protection and survivability resulted in the deferral of lower priority investments for improved vehicle lethality. The committee has also learned that the Army has recently approved an operational needs statement requesting a significant lethality upgrade for some, but not all Stryker infantry carrier and reconnaissance vehicles. The committee is aware that the Army is considering the delivery of such a Stryker lethality upgrade, when identified and proven feasible and suitable, to its forward stationed Stryker brigade. The committee supports the Army's efforts to improve Stryker lethality and recommends an increase of $40 million in PE 23735A only for development and testing of Stryker lethality upgrades."[60]

H.R. 2685, Department of Defense Appropriations Bill, 2016[61]

Funding[62]

The House approved the FY2016 Presidential Budget Request for the Abrams, Bradley, and Stryker with the following exceptions:

[58] S.Rept. 114-49, Report to Accompany S. 1376, National Defense Authorization Act for Fiscal Year 2016, May 19, 2015.

[59] Ibid., p 347 and p. 402.

[60] Ibid, p. 57.

H.[61] Rept. 114-139, Report of the Committee on Appropriations, Department of Defense Appropriations Bill, 2016, June 5, 2015.

[62] Ibid., p 126 and p. 329.

- For the Bradley (MOD) transferred $89 million of the requested amount to Title IX (Other Contingency Operations).
- For the Abrams (MOD) added $23 million to requested amount.
- For the Stryker (Upgrade) added $106.6 million to upgrade 36 Strykers to the Double V hull configuration.
- For the Stryker (MOD) added $314.3 million for Stryker lethality upgrades.

Report Language

Stryker

"The Stryker series of vehicles has provided improved force protection, agility, and mobility for the Army's medium weight vehicle class. The Committee is aware of efforts to improve Stryker survivability, power, and lethality while limiting growth in size and weight. The Committee recommendation provides an increase of $106,300,000 to upgrade 36 Strykers to Double V Hull vehicles. Additionally, the Committee provides an increase of $314,300,000 to purchase Stryker lethality upgrades."[63]

S. 1558, Department of Defense Appropriations Bill, 2016[64]

Funding[65]

The Senate approved the FY2016 Presidential Budget Request for the Abrams, Bradley, and Stryker with the following exceptions:

- For Stryker Procurement, a decrease of $3.9 million to maintain program affordability (unjustified growth in program management funding).
- For the Bradley (MOD), a decrease of $25 million as a result of improved program management and prior year carryover of funds.

Report Language

Stryker Lethality Upgrades

"The Committee understands that the Army is evaluating various courses of action to address the operational needs statement for increased Stryker lethality of the 2nd Cavalry Regiment, U.S. Army Europe. As the courses of action materialize and the tradeoffs between the schedule of fielding the first upgraded units and the risk in the acquisition schedule are properly balanced, the Committee is open to considering reprogramming requests that address the required funding."[66]

[63] Ibid., p. 329.

H.[64] Rept. 114-63, Report of the Committee on Appropriations, Department of Defense Appropriations Bill, 2016, June 11, 2015.

[65] Ibid., p. 73.

[66] Ibid.

Conference Report to Accompany H.R. 1735, National Defense Authorization Act for FY2016[67]

Funding[68]

The conference authorized the FY2016 Presidential Budget Request for the Abrams, Bradley, and Stryker with the following exceptions:

- For Abrams Modification added $40 million to requested amount.
- For Stryker Modification added $314 million to requested amount for Stryker lethality upgrades.

Report Language

Stryker Vehicle Lethality Upgrades

"The House bill contained an increase in funding for Stryker vehicle lethality upgrades of $35.0 million in Research, Development, Test & Evaluation, Army and $44.5 million in Procurement of Weapons and Tracked Combat Vehicles, Army respectively.

The Senate amendment contained an increase in these same funding areas of $97.0 million and $314.0 million, respectively.

The conference report, in Sections 4101 and 4102, includes increased funding in line with the Senate amendment.

The conferees support the Army's plan to upgrade 81 Stryker vehicles with increased lethality as requested by the U.S. Army Europe in a recent Operational Need Statement. The conferees understand the urgency for this requirement given heightened security concerns of our NATO partners due to Russian aggression in Ukraine. As such, the conferees expect the rapid production of fully serviceable, upgraded Strykers. In order to meet the compressed timeline for fielding upgraded Strykers to the 2nd Cavalry Regiment, the conferees expect the Army to manage this program with dispatch and efficiency. Identified risks associated with cost, schedule, and performance are to be managed with focused controls and leadership. The conferees view this initiative, which is intended to increase the combat power of a forward deployed unit, as an opportunity to succeed in accordance with significant acquisition reforms illustrated in many provisions within this bill.

With regard to cost, the conferees note the Army currently plans on starting with existing chassis of Stryker vehicles discarded during the upgrade to Double V Hull (DVH) Strykers. This approach appears to add significantly to the unit cost for the lethality upgrades which the Army has informed the defense committees may be approximately $4.5 million per vehicle. The conferees note that the Army already has extensive upgrade programs for the Stryker vehicle to include additional DVH Strykers and the Engineering Change Proposal modernization program. It is unclear if the Army ultimately plans on adding the lethality initiative to DVH Strykers, including those equipped with the Engineering Change Proposal upgrade. The conferees are concerned that simply adding a broad Stryker lethality package for the Army's Stryker Brigade

[67] Conference Report to Accompany H.R. 1735, National Defense Authorization Act for FY2016, Sept 29, 2015.

[68] Ibid., p. 4.

Combat Teams could add billions of dollars to the already stressed resources of the combat vehicle portfolio. Therefore, the committee encourages the Army to reduce the unit cost of the Stryker lethality upgrade program and evaluate ways to more efficiently pursue upgrades to the Stryker vehicle fleet and Stryker Brigade Combat Teams."[69]

Potential Issues for Congress

Both the House and Senate have identified—in FY2016 Authorizations, Appropriations, and Conference report language—particular areas of congressional concern including:

- "Pure fleeting" M-1 Abrams and M-2/M-3 Bradleys between the Army's Active and Reserve components so both components have the same vehicle variants;
- Managing and monitoring the "health" of the Army's ground combat vehicle industrial base given decreasing Army force structure, limited foreign military sales opportunities, budgetary constraints, and an uncertain geostrategic future; and
- Developing improved lethality and survivability for the Army's Stryker fleet in a cost-effective and rapid manner given recent, current, and potential future conflicts.

In addition to these stated congressional priorities, Congress might also choose to examine other related issues in its oversight role. Two potential issues include the eventual replacement of these combat vehicles and their relevance in what is being referred to as "Hybrid Warfare."

Army's Plans for Replacing the M-1 Abrams, M-2/M-3 Bradley, and the M-1126 Stryker

As previously noted, the Army plans to keep the Abrams, Bradley, and Stryker as part of the operational force until at least FY2029 and perhaps beyond. The Army does plan to replace the Bradley with the Future Fighting Vehicle (FFV) but in the Army's Executive Summary, U.S. Army Program Objective Memorandum Fiscal Years 2017-2021, the Army stated it now plans to delay the FFV Milestone A (Technology Development Phase Approval) from FY2021 to FY2029 (eight years) due to budgetary constraints.[70]

The Army's last program to replace the Abrams and Bradley—the Future Combat System (FCS) program—was cancelled in 2009 due to cost and developmental issues. After the FCS cancellation, a Bradley replacement program—the Ground Combat Vehicle (GCV)—was initiated but it also was cancelled in 2014 due to size, weight, and affordability concerns. Many believe the Army's track record on developing and fielding major combat systems has not been encouraging, and there are some doubts that the Army can successfully develop combat systems.

Other than the FFV program to replace the Bradley, the Army has said little publicly about its plans to eventually replace the M-1 Abrams and, possibly, the M-1126 Stryker. There might be a number of reasons for this, including a reluctance to commit to future replacements for these systems given the failure of the FCS program. Perhaps the Army, occupied with worldwide

[69] Ibid. pp. 2-3.

[70] Executive Summary: U.S. Army Program Objective Memorandum Fiscal Years 2017-2021, July 13, 2015, p. 17. This document was obtained from *InsideDefense.com*.

conflicts and operations, has not had an opportunity to fully explore future options for replacing the Abrams and Stryker.

Given the absence of information on replacements for the Abrams and Stryker, Congress might choose to examine the Army's potential options for eventually replacing these systems. In the case of the Abrams, given the geostrategic impact of armed unmanned aerial vehicles (UAVs), there might be possible benefits in developing an unmanned version of the Abrams. Without the requirement to protect a crew, a new unmanned version could be lighter, smaller, and therefore more deployable, as well as possibly more affordable than current manned Abrams tanks. Critics of such a course of action might note it is inherently more difficult to navigate an unmanned ground vehicle than a UAV, making it less effective in ground combat scenarios. In terms of replacing the Stryker vehicle, it is not clear if the Army envisions keeping the Stryker in service beyond FY2029. Originally, the SBCT was intended as a "middle-weight force" that offered better speed and enhanced situational awareness capabilities than traditional heavy mechanized forces. Given the need to improve Stryker survivability, the addition of double V hulls, more armor, and upgraded power trains has made the Stryker less deployable. Also, lethality upgrades might have detrimental impacts on deployability. It is possible at some point, that the Army might decide the Stryker does not offer that much more of an advantage over tracked IFVs and opt to go exclusively with tracked IFVs.

The defense industrial base might also benefit from a greater degree of clarity on the Army's intentions to replace the Abrams and Stryker. If defense industry has a sense of the Army's requirements to replace the Abrams and Stryker, it might be able to convey the "art of the possible" to Army leadership and policymakers and possibly avoid the "technological overreach" that characterized and contributed to the demise of the FCS program. Also, knowing the Army's future requirements, defense industry might orient its research and development toward these eventual replacements, thereby potentially facilitating more effective and rapid development of replacement vehicles.

Relevance of the Army's Ground Combat Vehicles in "Hybrid Warfare"

In June 2015, the Chairman of the Joint Chiefs of Staff issued the revised National Military Strategy[71] noting:

> Today, the probability of U.S. involvement in interstate war with a major power is assessed to be low but growing. Should one occur, however, the consequences would be immense. VEOs [violent extremist organizations], in contrast, pose an immediate threat to trans-regional security by coupling readily available technologies with extremist ideologies. Overlapping state and non-state violence, there exists an area of conflict where actors blend techniques, capabilities, and resources to achieve their objectives. Such "hybrid" conflicts may consist of military forces assuming a non-state identity, as Russia did in the Crimea, or involve a VEO fielding rudimentary combined arms capabilities, as ISIL has demonstrated in Iraq and Syria. Hybrid conflicts also may be comprised of state and non-state actors working together toward shared objectives, employing a wide range of weapons such as we have witnessed in eastern Ukraine. Hybrid conflicts serve to increase ambiguity, complicate decision-making, and slow the

[71] Information in this section is taken from "The National Military Strategy of the United States of America 2015," Department of Defense, June 2015, p. 4 and CRS Insight IN10333, *The 2015 National Military Strategy: Background and Questions for Congress*, by Kathleen J. McInnis.

> coordination of effective responses. Due to these advantages to the aggressor, it is likely that this form of conflict will persist well into the future.[72]

This strategic assessment plays a major role in how the Army organizes, equips, and trains. While it suggests while interstate war is unlikely, there is a growing possibility the Army might be called upon to operate in such an environment that is considered the primary domain of the Abrams, Bradley, and Stryker combat vehicles. It is suggested the more likely form of future conflict will be hybrid in which a wide range of weapons, technologies, and techniques and tactics could be employed against the United States. This emphasis on hybrid warfare brings with it a need to examine the relevance of the Army's organizations, equipment, and tactics, techniques, and procedures.

One such examination is the RAND Arroyo Center's[73] *The Challenges of the "Now" and What They Mean for America's Land Forces*,[74] which characterizes state-sponsored hybrid forces as:

- Moderately trained, disciplined forces, organized up to battalion level that employ multiple means of decentralized command and control.
- Equipped to a degree with conventional ground combat fighting systems and also possessing stand-off systems such as anti-tank guided missiles (ATGMs), man-portable air defense systems (MANPADs), and longer-range rockets.

The Hezbollah in Lebanon (2006); Hamas in Gaza (2008); ISIS (present); and Ukrainian Separatists (present) fit RAND's definition of state-sponsored hybrid threats. The challenges posed by these hybrid opponents are considered qualitative in nature and attributed to their training, discipline, command and control, as well as their use of standoff weapons and ability to operate effectively in complex terrain.[75] RAND further notes hybrid opponents "often go to ground in urban areas to hide amongst the people."[76] Because of these capabilities and tactical tendencies, RAND concludes "Armor (tanks/IFVs/APCs) matters against adversaries with stand-off fires."[77]

A 2010 RAND report on Recent Trends in Armored Forces captures Israel's 2006 experience in Lebanon:

---

[72] "The National Military Strategy of the United States of America 2015," Department of Defense, June 2015, p. 4.

[73] "Founded in 1982, the Arroyo Center is the United States Army's sole federally funded research and development center (FFRDC) for studies and analysis. At RAND, the center is housed within RAND's Army Research Division. As an FFRDC, Arroyo enables the Army to maintain a strategic relationship with an independent, nonprofit source of high-quality, objective analysis that can sustain deep expertise in domains of direct relevance to perennial Army concerns. RAND Arroyo Center's mission is to:

- Conduct objective analytic research on major policy concerns, with an emphasis on mid- to long-term policy issues.
- Help the Army improve effectiveness and efficiency.
- Provide short-term assistance on urgent problems.
- Be a catalyst for needed change."

http://www.rand.org/ard/about.html, accessed September 15, 2015.

[74] Dr. David Johnson, "The Challenges of the "Now" and What They Mean of America's Land Forces," RAND Arroyo Center, 2015.

[75] Ibid.

[76] Ibid.

[77] Ibid.

> In the 2006 Second Lebanon War, Israel faced in Hezbollah an opponent with a modicum of training, discipline, organization, command and control, and advanced weapons (e.g., ATGMs, MANPADS, RPGs [rocket propelled grenades], mines, and IEDs [improvised explosive devices]).
>
> For several years before the 2006 Second Lebanon War, the Israeli Army was focused on what it calls low-intensity conflict (LIC), particularly in dealing with the intifadas, whose suicide bombers caused numerous civilian Israeli casualties. Heavy units (tank and mechanized infantry) played little, if any, role in these operations. Armored unit training was neglected because heavy forces were deemed largely irrelevant in LIC. The 2006 Lebanon War against Hezbollah changed this perception.
>
> After the 2006 Second Lebanon War, the Israel Defense Forces (IDF), particularly the Army, reoriented their training. They went, in their words, "back to basics" after years of focusing almost exclusively on LIC and trained extensively on high-intensity combat (HIC) skills, particularly joint combined arms fire and maneuver.
>
> The IDF also rethought the role of heavy forces and concluded that armored vehicles would play a critical role in hybrid conflicts. Consequently, the IDF began replacing their more vulnerable older tanks and armored personnel carriers with newer models, e.g., Merkava IV MBT and heavy IFVs, based on a Merkava tank chassis (the Namer). Additionally, the Israelis have armor kits specifically designed to make these armored vehicles more resistant to IEDs, e.g., v-shaped belly armor.[78]

RAND's research seemingly reinforces the notion that the Abrams, Bradley, and Stryker have operational relevance in both conventional state-on-state conflicts as well as hybrid conflicts. Congress, in its oversight and authorization and appropriations roles, might act to review the modifications, upgrades, and possible eventual replacement of the Abrams, Bradley, and Stryker ground combat systems to insure that as these systems evolve, they continue to be relevant in both the conventional and hybrid warfare realms. For example active protective systems (APS) being developed to counter high-end ATGMs and rocket propelled grenades (RPGs) might be seen as more relevant in hybrid warfare scenarios than conventional conflicts. If the Army decides to mount APS systems on its ground combat vehicles there will likely be additional power, systems, and cost requirements.

In a similar manner, the incorporation of V-shaped and double hulls has also been pursued as a means of addressing the hybrid improvised explosive device (IED) threat. Another example of potentially competing vehicle requirements is the trade off in armor protection and lethality versus the need for lighter and smaller vehicles to facilitate rapid deployment in the event of an unforeseen conventional attack—a requirement that might not be seen by some as relevant in a hybrid warfare scenario.

In this regard, Congress could play a role in insuring the continued relevance of the Abrams, Bradley, and Stryker in all scenarios by reviewing the Army's potential competing requirements for these systems and maintaining a balance between requirements and capabilities for both conventional and hybrid conflicts.

[78] David E. Johnson and John Gordon IV, "Observations on Recent Trends in Armored Forces," RAND Arroyo Center, 2010, p. 5.

Author Contact Information

Andrew Feickert
Specialist in Military Ground Forces
afeickert@crs.loc.gov, 7-7673