

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

May 2009

BUDGET ACTIVITY		PE NUMBER AND TITLE			
<b>4 - Advanced Component Development and Prototypes</b>		<b>0603639A - Tank and Medium Caliber Ammunition</b>			
COST (In Thousands)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	46160	40731	33934	147300	268125
652 ADVANCED KINETIC ENERGY (AKE) 120MM CARTRIDGE			33934	147300	181234
656 FCS Mounted Combat System (MCS) Ammunition	43068	40731			83799
694 MEDIUM CALIBER AMMUNITION	3092				3092

**A. Mission Description and Budget Item Justification:** The Tank and Medium-caliber Ammunition (TMA) Program Element (PE) encompasses a comprehensive program to develop, rapidly transition to production, and field advanced tank, medium caliber, and other munitions. These programs will ensure continued battlefield overmatch and lethality of U.S. maneuver forces despite worldwide development and proliferation of enhanced armored vehicle protection technologies. To achieve this, TMA will identify and develop promising technologies through competitive development and streamlined acquisition procedures. All ammunition development funds within this PE are managed to facilitate transitions between phases, avoid administrative delays, and focus resources on the most promising areas.

FY 2010 funding supports EMD initiation of the Advanced Kinetic Energy (AKE) cartridge. The AKE round is an unguided, direct fire, platform-delivered Line of Sight (LOS) munition that will provide fast response lethality to rapidly destroy threat targets with Explosive Reactive Armor (ERA) and Active Protection Systems (APS) in the close fight from 0km to 2km. AKE will be compatible with both 120mm Current Force Abrams Main Battle Tank.

In FY 2010, the FCS Mounted Combat System (MCS) Ammunition is terminated due to restructuring of the MGCV portion of the FCS program and the refocusing to spin out FCS technologies faster to the IBCT. Funding in FY 2010 has been deleted.

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

May 2009

BUDGET ACTIVITY

PE NUMBER AND TITLE

**4 - Advanced Component Development and Prototypes**

**0603639A - Tank and Medium Caliber Ammunition**

**B. Program Change Summary**

	FY 2008	FY 2009	FY 2010
Previous President's Budget (FY 2009)	47474	45866	71451
Current BES/President's Budget (FY 2010)	46160	40731	33934
Total Adjustments	-1314	-5135	-37517
Congressional Program Reductions		-5135	
Congressional Rescissions			
Congressional Increases			
Reprogrammings	15		
SBIR/STTR Transfer	-1329		
Adjustments to Budget Years			-37517

Change Summary Explanation:

FY 2009: \$5.0M Congressional Reduction for MRM Follow-on Cartridge Integration Test forward funding.

FY 2010: Increase of \$33.9M for Advanced Kinetic Energy (AKE) Cartridge, Project 652.

FY 2010: FCS Mounted Combat System (MCS) Ammunition is terminated.

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**May 2009**

<b>BUDGET ACTIVITY</b> <b>4 - Advanced Component Development and Prototypes</b>	<b>PE NUMBER AND TITLE</b> <b>0603639A - Tank and Medium Caliber Ammunition</b>			<b>PROJECT</b> <b>652</b>	
COST (In Thousands)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	Cost to Complete	Total Cost
652      ADVANCED KINETIC ENERGY (AKE) 120MM CARTRIDGE			33934	147300	181234

**A. Mission Description and Budget Item Justification:** FY 2010 supports Phase I of the Advanced Kinetic Energy (AKE) cartridge Engineering and Manufacturing Development (EMD).

The AKE round is a platform-delivered Line of Sight (LOS) munition that will provide capability for the current force's Heavy Brigade Combat Teams (HBCT) and Future Combat System Brigade Combat Team's (FCS BCT) commander to conduct decisive operations and destroy current and future Main Battle Tanks (MBTs) with Explosive Reactive Armor (ERA) and Active Protection Systems (APS) at ranges from 0-2km (T) and 0-4km (O). The AKE will provide the capability to destroy and or neutralize the adversary and his capabilities, at any given time or place, while minimizing fratricide and noncombatant casualties in a joint environment.

The AKE is the next generation premier kinetic energy (KE) round and will replace the current Abrams KE round (M829A3). The AKE will provide lethal overmatch against designated threats throughout all combat operations, to include Military Operation in urbanized Terrain (MOUT), mountain, and non-traditional battlefields. The increased performance against standard armor, ERA, and APS will allow for the use of fewer rounds and will increase survivability of the platform with faster engagement of follow-on targets.

AKE will be compatible with both 120mm Current Force Abrams main battle tank and the FCS BCT Mounted Combat System (MCS) platforms.

<b><u>Accomplishments/Planned Program:</u></b>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>
Phase I Engineering and Manufacturing Development (EMD)			31234
Lethal Mechanism Test			1200
Mid-Point Gate Review System Test			1500
<b>Total</b>			<b>33934</b>

**B. Other Program Funding Summary** Not applicable for this item.

**C. Acquisition Strategy** The Advanced Kinetic Energy (AKE) cartridge is at Technology Readiness Level 6 (TRL6). A competitive Request for Proposal (RFP) for the initial Engineering and Manufacturing Development (EMD) phase will be issued with the plan to accept two separate contractors for Phase I. Following milestone B, scheduled for the fourth quarter FY 2009, EMD Phase I, will begin in FY 2010 and end in FY 2011 when there will be a down-select to one contractor. The down-select will be based on the cartridge design performance and program cost estimate of each contractor at the time of down-select testing. The selected contractor will be awarded the option to continue and

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

May 2009

BUDGET ACTIVITY

**4 - Advanced Component Development and Prototypes**

PE NUMBER AND TITLE

**0603639A - Tank and Medium Caliber Ammunition**

PROJECT

**652**

conclude EMD Phase II in FY 2013. Upon successful completion of Milestone C, a production option will be awarded to the EMD Phase II contractor.

# ARMY RDT&E COST ANALYSIS (R3)

May 2009

BUDGET ACTIVITY			PE NUMBER AND TITLE							PROJECT		
<b>4 - Advanced Component Development and Prototypes</b>			<b>0603639A - Tank and Medium Caliber Ammunition</b>							<b>652</b>		
I. Product Development	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	FY 2010 Cost	FY 2010 Award Date	Cost To Complete	Total Cost	Target Value of Contract
TBS (Phase I)	C/CPFF	TBS						10000	1Q		10000	
TBS (Phase I)	C/CPFF	TBS						10000	1Q		10000	
Aerojet	SS/FFP	Johnson City, TN						7000	1Q		7000	
PM-MAS	MIPR	Picatinny Arsenal, NJ						994	1-4Q		994	
Subtotal:								27994			27994	
II. Support Costs	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	FY 2010 Cost	FY 2010 Award Date	Cost To Complete	Total Cost	Target Value of Contract
ARDEC	MIPR	Picatinny Arsenal, NJ						2770	1-4Q		2770	
Army Research Lab	MIPR	APG, MD						500	1-4Q		500	
Miscellaneous	MIPR	TBS						400	1-4Q		400	
Subtotal:								3670			3670	
III. Test And Evaluation	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	FY 2010 Cost	FY 2010 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Yuma Proving Ground	MIPR	Yuma, AZ						1100	2-3Q		1100	
Aberdeen Proving Ground	MIPR	APG, MD						550	2-3Q		550	
Army Research Lab	MIPR	APG, MD						500	2-3Q		500	
ATEC	MIPR	APG, MD						120	2-3Q		120	
Subtotal:								2270			2270	

# ARMY RDT&E COST ANALYSIS (R3)

May 2009

BUDGET ACTIVITY

**4 - Advanced Component Development and Prototypes**

PE NUMBER AND TITLE

**0603639A - Tank and Medium Caliber Ammunition**

PROJECT

**652**

IV. Management Services	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	FY 2010 Cost	FY 2010 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Subtotal:												
<b>Project Total Cost:</b>								<b>33934</b>			<b>33934</b>	

# Schedule Profile (R4 Exhibit)

May 2009

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																																						
<b>4 - Advanced Component Development and Prototypes</b>	<b>0603639A - Tank and Medium Caliber Ammunition</b>	<b>652</b>																																						
Event Name	FY 08				FY 09				FY 10				FY 11				FY 12				FY 13				FY 14				FY 15											
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4								
(1) Phase I Contract Award																	▲ Phase I Contract Award																							
Engineering and Manufacturing Development (EMD) Phase I																	■ EMD Phase I																							
(2) Lethal Mechanism Test																					▲ Lethal Mech Test																			
(3) Mid-Point Gate Review System Test																					▲ MGRS Test																			
(4) Critical Design Review									▲ CDR																															

**Schedule Detail (R4a Exhibit)**

**May 2009**

BUDGET ACTIVITY <b>4 - Advanced Component Development and Prototypes</b>		PE NUMBER AND TITLE <b>0603639A - Tank and Medium Caliber Ammunition</b>					PROJECT <b>652</b>	
<u>Schedule Detail</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>
Phase I Contract Award			1Q					
Engineering and Manufacturing Development (EMD) Phase I			1Q - 4Q					
Lethal Mechanism Test			2Q					
Mid-Point Gate Review System Test			3Q					
Critical Design Review			4Q					

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**May 2009**

<b>BUDGET ACTIVITY</b> <b>4 - Advanced Component Development and Prototypes</b>		<b>PE NUMBER AND TITLE</b> <b>0603639A - Tank and Medium Caliber Ammunition</b>			<b>PROJECT</b> <b>656</b>
COST (In Thousands)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	Cost to Complete	Total Cost
656 FCS Mounted Combat System (MCS) Ammunition	43068	40731			83799

**A. Mission Description and Budget Item Justification:** This project supports the development of ammunition for the Future Combat System (FCS) Mounted Combat System (MCS). The Mid Range Munition (MRM) is critical to FCS force effectiveness, reinforcing the Beyond Line of Sight (BLOS) capability, and allows FCS to meet Key Performance Parameter #3, Networked Lethality. The MRM Capabilities Development Document (CDD) has a Key Performance Parameter (KPP) that requires the munition to be interoperable with the Abrams M256 cannon, breech, and ammunition wells / racks. MRM would provide a new capability for Abrams that drastically increases the lethal range of the platform well beyond that of any other large caliber munition. Required modifications to the platform include an ammunition data link, which is also required for the other large caliber future munitions including the Advanced Kinetic Energy and the Advanced Multi Purpose. Incorporation of MRM into Abrams will require additional qualification testing beyond what is currently planned for the FCS Mounted Combat System (MCS).

The MRM round is a precision-guided munition that provides the capability for the FCS BCT commander to both shape and set conditions in his battlespace to conduct decisive operations and destroy enemy forces by engaging moving and stationary targets throughout his area of operations. The MRM round will incorporate a seeker(s) that enables the munition to attack targets designated by the Mounted Combat System or another remote (manned/unmanned) sensor, or autonomously attack targets if designation is lost or not available.

MRM is a first generation fire and forget gun-launched munition that is being developed to provide the Mounted Combat System with a BLOS capability. MRM is a precision-guided munition that provides a moving or stationary Mounted Combat System the capability to engage and destroy moving and stationary enemy targets throughout his area of operations (2-12km (T) or 2-16km (O)) in a BLOS mode. MRM will have a seeker to enable it to engage designated targets or autonomously guide itself to and attack targets if designation is lost or not present.

There are three modes of operation when employing the MRM round: autonomous, designate, and designate only. The sensor/observer must decide which mode to use based on the factors of mission, enemy, troops, terrain, time, and civil considerations (METT-TC) and the commander's intent, in the Attack Guidance (AG) matrix. Autonomous shall be utilized when a sensor/observer does not want to give away his position, if a designator is not available or inoperative, or if inter-visibility terrain lines prevent illumination of the target.

Prior to firing, integration of battlefield command and control information (range to target, laser designation code, etc) will be transmitted to the munition through a data link connecting the MRM to the Mounted Combat System fire control system. Once fired, no further command and control from the MCS is required. The round will guide itself to the target using on board sensors or possibly a laser reflection with a properly encoded pulse rate. The munition will employ state-of-the-art kill mechanisms to achieve the highest probability of kill possible against a variety of armored targets. The technologies that provide both guidance and lethality shall be all weather and countermeasure resistant. Sensors for the Autonomous mode will also be enabled at a range that will reduce the probability of collateral damage.

The MRM successfully acquired, identified, guided and hit a stationary T-72 tank at 5.2 kilometers in December 2008.

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**May 2009**

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

**4 - Advanced Component Development and Prototypes**

**0603639A - Tank and Medium Caliber Ammunition**

**656**

In FY 2010, the FCS Mounted Combat System (MCS) Ammunition is terminated due to restructuring of the MGCV portion of the FCS program and the refocusing to spin out FCS technologies faster to the IBCT. The funding has been zeroed for FY2010.

**Accomplishments/Planned Program:**

	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>
MRM Engineering and Manufacturing Development (EMD) activities. Program Management activities consist of risk and Unit Production Price (UPP) management, finance/budgeting efforts, scheduling efforts, configuration management, and supply chain management. Systems Engineering activities consist of systems architecture efforts, functional analysis efforts, requirements allocation, interface definition, system design and performance efforts, system safety, and reliability/availability. Cartridge design activities include overall cartridge development/engineering activities. These are overall design architecture, airframe design, sensor suite design, guidance and electronics, lethality, and software. System Test and Evaluation activities include test architecture development, test facilities development and support, test equipment development/manufacture, engineering lab design, engineering field design, and test support. System Test and Evaluation will include Cartridge Integration Testing and Guided Flight Testing along with testing to include Live Fire Test and Evaluation (LFT&E) and armor/lethality testing. Manufacturing activities include manufacturing architecture development, material management and pilot production line development.	24143	18522	
EMD Initial Cartridge Integration Test units (Qty=3) Leveraged use of S&T hardware.		56	
EMD Initial Cartridge Integration Test		225	
EMD Software Seeker Integration	9347	10091	
EMD Producibility	2019	3099	
EMD Prototype Manufacture (various components, subsystems, systems and assemblies, inspections)	7559	7597	
Small Business Innovative Research/Small Business Technology Transfer Programs		1141	
<b>Total</b>	<b>43068</b>	<b>40731</b>	

**B. Other Program Funding Summary**

	FY 2008	FY 2009	FY 2010	To Compl	Total Cost
0604646A F72 Non Line of Sight - Launch System	246071	208009	88660		542740
0604647A F58 Non Line of Sight - Cannon	133139	89545	58216		280900
0604660A FC1 FCS Manned Grd Vehicles & Common Grd Vehicle Components	635846	782664	368557		1787067
0604661A FC2 FCS System of Systems Engr & Program Management	1292514	1414756	1067191	Continuing	Continuing
0604662A FC3 FCS Reconnaissance (UAV) Platforms	42772	57190	68701	Continuing	Continuing
0604663A FC4 FCS Unmanned Ground Vehicles	78826	102976	125616	Continuing	Continuing

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

May 2009

BUDGET ACTIVITY	PE NUMBER AND TITLE				PROJECT
<b>4 - Advanced Component Development and Prototypes</b>	<b>0603639A - Tank and Medium Caliber Ammunition</b>				<b>656</b>
0604664A FC5 FCS Unattended Ground Sensors	22007	17011	26919	Continuing	Continuing
0604665A FC6 FCS Network Hardware & Software	724397	556301	749182	Continuing	Continuing
0604666A FC7 FCS Spin Out Tech/Capability Integ	84111	111032		Continuing	Continuing
WTCV G86100 Future Combat System	78932	154127			233059
WTCV G86200 FCS Spin Out	1370	67268			68638

Comment:

**C. Acquisition Strategy** The Mid Range Munition (MRM) Program completed the Technology Development phase. MRM achieved Design Requirements in both autonomous and designated firing modes, and transitioned (Milestone B) to Engineering and Manufacturing Development (EMD) at the end of FY 2007. There were two competing technical concepts by Raytheon Inc. and Alliant Tech Systems. A single contractor, Raytheon with one design, was selected based on a full and open competition in the first quarter of FY 2008. The MRM schedule coincides with the Mounted Combat System's development schedule, supporting the Future Combat System (FCS) Initial Operational Capability (IOC) milestone. The EMD effort will integrate MRM into the Mounted Combat System. In FY 2010, the MRM is terminated due to restructuring of the MGCV portion of the FCS program and the refocusing to spin out FCS technologies faster to the IBCT.

This strategy will deliver a proven, fully capable multi-mode munition that will meet the FCS MCS requirements and support the FCS IOC milestone.

# ARMY RDT&E COST ANALYSIS (R3)

May 2009

BUDGET ACTIVITY			PE NUMBER AND TITLE							PROJECT		
4 - Advanced Component Development and Prototypes			0603639A - Tank and Medium Caliber Ammunition							656		
I. Product Development	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	FY 2010 Cost	FY 2010 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Raytheon	CPIF/AF	Tucson, AZ		35800	1Q	36590	1Q				72390	245530
PM-MAS		Picatinny Arsenal, NJ		1290	1-4Q	900	1-4Q			2929	5119	5688
Subtotal:				37090		37490				2929	77509	251218
II. Support Costs	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	FY 2010 Cost	FY 2010 Award Date	Cost To Complete	Total Cost	Target Value of Contract
ARDEC / Benet Weapons Labs		Picatinny Arsenal, NJ		4580	1Q	1100	1-4Q			10068	15748	22760
Miscellaneous Support				1064	1-4Q						1064	
Subtotal:				5644		1100				10068	16812	22760
III. Test And Evaluation	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	FY 2010 Cost	FY 2010 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Yuma Proving Ground		Yuma AZ		200	4Q	500	1-4Q			9226	9926	12881
Army Research Lab		Aberdeen PG, MD/White Sands, NM		119	3Q	350	3Q			2400	2869	5908
Redstone Arsenal		Huntsville, AL				100	1Q				100	
Miscellaneous		Multiple		15	3Q	50	3Q				65	1042
Subtotal:				334		1000				11626	12960	19831
IV. Management Services	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	FY 2010 Cost	FY 2010 Award Date	Cost To Complete	Total Cost	Target Value of Contract

# ARMY RDT&E COST ANALYSIS (R3)

May 2009

BUDGET ACTIVITY			PE NUMBER AND TITLE							PROJECT		
<b>4 - Advanced Component Development and Prototypes</b>			<b>0603639A - Tank and Medium Caliber Ammunition</b>							<b>656</b>		
	Type				Date		Date		Date		Contract	
Miscellaneous.	MIPR	Multiple				1141					1141	956
Subtotal:						1141					1141	956
<b>Project Total Cost:</b>				<b>43068</b>		<b>40731</b>				<b>24623</b>	<b>108422</b>	<b>294765</b>

# Schedule Profile (R4 Exhibit)

May 2009

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																														
<b>4 - Advanced Component Development and Prototypes</b>	<b>0603639A - Tank and Medium Caliber Ammunition</b>	<b>656</b>																														
Event Name	FY 08				FY 09				FY 10				FY 11				FY 12				FY 13				FY 14				FY 15			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Engineering and Manufacturing Development (EMD)	EMD																															
(1) Initial Cartridge Integration Test									 Initial Cartridge Integration Test																							

**Schedule Detail (R4a Exhibit)**

**May 2009**

BUDGET ACTIVITY <b>4 - Advanced Component Development and Prototypes</b>		PE NUMBER AND TITLE <b>0603639A - Tank and Medium Caliber Ammunition</b>					PROJECT <b>656</b>	
<u>Schedule Detail</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>
Engineering and Manufacturing Development (EMD)	1Q - 4Q	1Q - 4Q						
Initial Cartridge Integration Test		1Q						

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**May 2009**

<b>BUDGET ACTIVITY</b> <b>4 - Advanced Component Development and Prototypes</b>		<b>PE NUMBER AND TITLE</b> <b>0603639A - Tank and Medium Caliber Ammunition</b>			<b>PROJECT</b> <b>694</b>
COST (In Thousands)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	Cost to Complete	Total Cost
694 MEDIUM CALIBER AMMUNITION	3092				3092

**A. Mission Description and Budget Item Justification:** This project will develop Medium Caliber Ammunition for the Bradley Fighting Vehicle System (BFVS), the Future Combat System (FCS) and other systems using Medium Caliber Armaments.

FY2008 Congressional funding supported the development of the 25mm High Explosive Airburst (HEAB) cartridge.

<b><u>Accomplishments/Planned Program:</u></b>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>
Continue design efforts of the 25mm High Explosive Airburst (HEAB) Scalable Fuze.	3092		
Total	3092		

**B. Other Program Funding Summary** Not applicable for this item.

**C. Acquisition Strategy** There is no budget beyond FY 2008 Congressional funding.