

# UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army										Date: February 2015		
Appropriation/Budget Activity 2040: Research, Development, Test & Evaluation, Army / BA 7: Operational Systems Development					R-1 Program Element (Number/Name) PE 0607865A / Patriot Product Improvement							
COST (\$ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	33.935	57.962	105.816	-	105.816	131.365	167.013	129.318	115.517	Continuing	Continuing
DV8: Patriot Product Improvement	-	33.935	57.962	105.816	-	105.816	131.365	167.013	129.318	115.517	Continuing	Continuing
Note FY15 Congressional reduction; program increase only for counter-EA improvements FY16 Across the board reductions to the planned efforts.												
A. Mission Description and Budget Item Justification PATRIOT is an advanced Surface-to-Air guided missile system with a high probability of kill, capable of operation in the presence of Electronic Countermeasures (ECM) and able to conduct multiple simultaneous engagements against high performance air breathing targets and ballistic missiles likely to be encountered by U.S. Forces. The PATRIOT Product Improvement Program provides for the upgrade of the PATRIOT System through individual materiel changes and upgrades to the PATRIOT system to address operational lessons learned, enhancements to joint force interoperability, and other system performance improvements to provide overmatch capability with the emerging threat. Efforts will be made to expedite PATRIOT materiel solutions (e.g. Radar Digital Processor, Communications Upgrades, address Tactical Ballistic Missile (TBM) capability, Combat ID, and Advanced ECM improvements) to both enhance capability and facilitate integration into the Integrated Air and Missile Defense (IAMD) architecture. Near term efforts are modifications and FY15 initiates competitive modernization through development of the Lower Tier Air & Missile Defense-Capability (LTAMD-C).  The software funding provides improvements to the PATRIOT system against the evolving threat. This effort supports work with national agencies to evaluate, assess, and develop means to mitigate threat trends and specific threat developments potentially impacting system performance, and prioritize the improvements in the overall development cycle. Specific improvements may be developed and fielded under this task if warranted. The effort maintains the Mission Tailoring Database, responding to immediate tactical concerns; Database updates are fielded between major software upgrades as necessary.  FY2016 base dollars continue Software Improvement for Threat Evolution, Upper Tier Debris Mitigation (UTDM), Radar Digital Processor (RDP) Development, RDP Waveform Suite, THAAD PATRIOT Interoperability, Advanced Electronic Counter Measures (AECM), Tasks 2, 6, and 7 activities, Combat ID Enhancements, Common Warfighter Machine Interface (CWMI), Lower Tier Air & Missile Defense-Capability (LTAMD-C), Concept Development and Anti-Radiation Missile (ARM) Asset Defense for the PATRIOT Product Improvement Program (PIP).												

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Appropriation/Budget Activity		R-1 Program Element (Number/Name)			
2040: Research, Development, Test & Evaluation, Army / BA 7: Operational Systems Development		PE 0607865A / Patriot Product Improvement			
B. Program Change Summary (\$ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	35.034	152.991	143.939	-	143.939
Current President's Budget	33.935	57.962	105.816	-	105.816
Total Adjustments	-1.099	-95.029	-38.123	-	-38.123
• Congressional General Reductions	-	-0.029			
• Congressional Directed Reductions	-	-95.000			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.099	-			
• Adjustments to Budget Years	-	-	-38.123	-	-38.123

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Exhibit R-2A, RDT&E Project Justification: PB 2016 Army										Date: February 2015		
Appropriation/Budget Activity 2040 / 7					R-1 Program Element (Number/Name) PE 0607865A / Patriot Product Improvement				Project (Number/Name) DV8 / Patriot Product Improvement			
COST (\$ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
DV8: Patriot Product Improvement	-	33.935	57.962	105.816	-	105.816	131.365	167.013	129.318	115.517	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

**Note**

Continues effort funded in PE 273801A - PATRIOT PROD IMP PGM (Project 036).

**A. Mission Description and Budget Item Justification**

Software Improvements for threat evolution: Performs necessary analysis and development efforts to maintain PATRIOT system effectiveness against evolving threat technologies and specific threat capabilities. This effort identifies evolving threats and threat characteristics that might present a challenge to PATRIOT's current capabilities and develops initial concepts to maintain system effectiveness relative to these threats.

Upper-Tier Debris Mitigation (UTDM): Implements algorithms to mitigate system impacts of debris from Upper Tier intercepts associated with operating in the Ballistic Missile Defense System (BMDS) environment. Debris from Upper Tier intercepts can cause significant radar loading effects and the potential for erroneous engagements and missile wastage on debris.

Radar Digital Processor (RDP) Development: Incorporates improvements to mitigate radar hardware obsolescence, improves Reliability, Availability and Maintainability (RAM) and improves performance of the PATRIOT Radar Set against evolving threat sets. This program includes the implementation of Identification Friend or Foe (IFF) Mode 5 Level 1 / Level 2, and a Non-Cooperative Target Recognition (NCTR) Combat ID technique to mitigate potential fratricide risk, and the development of CONOPS to incorporate the new Combat ID capabilities into system operation. The RDP also provides the necessary radar processing capability to support follow-on Evolutionary Development Program (EDP) Tasks 6 and 7 to counter emerging threats and provide data necessary to support migration to IAMD. The RDP is a pre-requisite for migration to an IAMD Netted Sensor.

RDP Waveform Suite: Develops a comprehensive set of waveforms in the RDP to improve PATRIOT radar capabilities against current and evolving threats, including support to Task 6 and 7 efforts(see below),and implements advanced data collection enabled by the RDP to support further system improvements. The RDP implementation allows significant radar waveform improvements necessary to counter evolving threats.

SIPRNet/NIPRNet Access Point/Troposcatter (SNAP/TROPO): Provides hardware interfaces to support extended range communications within the battalion (TROPO) and Force Operations interfaces to satellite for access to SIPR/NIPR worldwide communication networks.

THAAD/PATRIOT Interoperability: Implements improvements to THAAD/PATRIOT Interoperability and addresses Joint Defense Network (JDN) deficiencies that impact Tactical Ballistic Missile (TBM) battle management and force/engagement operations. Efforts will be concentrated on joint, collaborative force operations (defense design and planning) and enhanced Tactical Digital Information Link - Joint (TADIL J) interoperability.

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<b>Appropriation/Budget Activity</b> 2040 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0607865A / <i>Patriot Product Improvement</i>	<b>Project (Number/Name)</b> DV8 / <i>Patriot Product Improvement</i>
<p>Advanced Electronic Counter Measures (AECM): This task investigates the implications of advanced technology Digital Radio Frequency Memory (DRFM) available on airborne platforms that enables new ECM techniques which could adversely affect Air and Missile Defense System effectiveness.</p> <p>Task 2: Implements improved ground system and interceptor capabilities (PATRIOT Advanced Capability-2 / Guidance Enhanced Missiles(PAC-2/GEM), PATRIOT Advanced Capability-3 (PAC-3), and Missile Segment Enhancement (MSE)) to counter stressing TBM threats.</p> <p>Task 6: Software improvements enhance discrimination of higher altitude TBM Re-entry Vehicles (RVs) from associated objects to support the full engagement capabilities of the interceptor. Longer-range detection, track, and improved high-altitude discrimination are required to achieve the required lethality performance against the RV and to mitigate missile wastage against separation debris. This task leverages the signal processing capabilities of the RDP, and supports the high altitude engagements required by the PATRIOT Advanced Capability-3 (PAC-3) and PAC-3 Missile Segment Enhancement (MSE) missiles.</p> <p>Task 7: Software improvements analyze existing and evolving TBM countermeasures and their effects on PATRIOT system effectiveness. Develops concepts to address countermeasure effects and ensure the PATRIOT system maintains its effectiveness. Develops detailed system requirements to implement concepts; design/code/test software implementation leveraging RDP, Modernized Adjunct Processor (MAP), Enhanced Weapons Control Computer - Emulator (EWCC-E) and Flight Solution Computer - Redesign (FSC-R) processing capabilities.</p> <p>Combat ID Enhancements: Develop and implement improvements to the RDP-C Combat ID capabilities and additional NCTR technique to further mitigate misclassification and fratricide risk, and to provide the Warfighter with improved situational awareness.</p> <p>Common Warfighter-Machine Interface (CWMI): Leverages modern manstation capabilities to implement CWMI concepts to improve training commonality and cost-efficiency, and to provide better situational awareness. Brings the man-machine interface under development for the IBCS program into the legacy PATRIOT system so that while the IAMD Battle Command System (IBCS) is fielding, the warfighter has the same interface whether he/she is fighting the battle from legacy PATRIOT or from the IBCS. The incorporation of CWMI significantly mitigates the impact to the Institutional Training Base (ITB) and manning requirements during the 8-year transition from legacy PATRIOT to the IBCS system.</p> <p>Lower Tier Air &amp; Missile Defense-Capability (LTAMD-C), Concept Study: This task provides studies for initial concepts and performance capabilities related to the implementation of an Active Electronically Scanned Array (AESA) transmitter/antenna into the PATRIOT radar. These assessments are needed to refine user community expectations and requirements, and to prepare a viable set of requirements to support a competitive modernization competition.</p> <p>Anti-Radiation Missile (ARM) Asset Defense: Provides improved capability for PATRIOT to protect other Army and Joint Services Sensors from ARM attacks. Builds on an initial capability provided in Post-Deployment Build (PDB)-7 by determining remaining gaps, identifying and evaluating alternatives, and implementing further improvements.</p>		

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Appropriation/Budget Activity 2040 / 7				R-1 Program Element (Number/Name) PE 0607865A / Patriot Product Improvement				Project (Number/Name) DV8 / Patriot Product Improvement			
Lower Tier Air & Missile Defense-Capability (LTAMD-C): LTAMD Capability tasks include all the programmatic and engineering activities needed for the LTAMD Capability Materiel Development Decision (MDD), Analysis of Alternatives (AOA), and Business Case Analyses/Trades. Once the material solution has been determined, the development effort for LTAMD-C will be accomplished. These activities will continue through the Technology Maturation and Risk Reduction (TMRR) and Engineering and Manufacturing Development (EMD) phase to enable the prototyping, development, and testing of the LTAMD Capability.											
B. Accomplishments/Planned Programs (\$ in Millions)								FY 2014	FY 2015	FY 2016	
Title: PATRIOT Product Improvement								33.935	57.962	105.816	
Description: Software Improvement for Threat Evolution											
FY 2014 Accomplishments: Continued Software Improvement for Threat Evolution. Radar Digital Processor (RDP) continued development to support U.S. FY 2016 fielding. Supported improvements for the Advanced Electronic Counter Measures (AECM), SIPRNet/NIPRNet Access Point/Troposcatter (SNAP/TROPO), Lower Tier Air & Missile Defense-Capability (LTAMD-C), Concept Development, Combat ID Enhancements, and Task 6 efforts for the PATRIOT Product Improvement Program (PIP).											
FY 2015 Plans: Continues Software Improvement for Threat Evolution. Radar Digital Processor development continues efforts to support U.S. FY 2016 fielding, providing the field with additional capability and growth potential to counter stressing threats. Continues efforts for AECM, Combat ID Enhancements, Tasks 2, 6, and 7 activities, SNAP/TROPO, Lower Tier Air & Missile Defense-Capability (LTAMD-C), and Concept Development for the PATRIOT Product Improvement Program (PIP).											
FY 2016 Plans: Continues Software Improvement for Threat Evolution. Continues efforts for AECM, RDP Development, Lower Tier Air & Missile Defense-Capability (LTAMD-C), Concept Development, Combat ID Enhancements, THAAD/ PATRIOT Interoperability, and Tasks 2, 6, and 7 activities. Begins RDP Waveform Suite development, Anti-Radiation Missile (ARM) Asset Defense, Common Warfighter-Machine Interface (CWMI) and Upper-Tier Debris Mitigation for the PATRIOT Product Improvement Program (PIP).											
Accomplishments/Planned Programs Subtotals								33.935	57.962	105.816	
C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
• C50700: Patriot Mods (C50700)	326.438	183.838	241.883	-	241.883	207.692	321.879	354.907	197.147	Continuing	Continuing
Remarks The improvements/enhancements developed through the PATRIOT Product Improvement Program (PIP) are procured and installed under the Missile Procurement, Army (MIPA) appropriation's PATRIOT Mods program.											

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<p><b><u>D. Acquisition Strategy</u></b></p> <p>The design objective of the PATRIOT system was to provide a baseline system capable of modification to cope with continuing threat evolution. This program minimizes technological risks and provides a means of enhancing system capability through planned upgrades of deployed systems. The PATRIOT Product Improvement Program upgrades the PATRIOT system to address operational lessons learned, enhancements to joint force interoperability and communications, and other system performance improvements to provide overmatch capability against the emerging threat. Upgrades are implemented through individual hardware and software materiel changes and fielded incrementally. This program encompasses several changes which will require the use of a variety of acquisition methods to develop, test, procure and field. Future software capabilities will be incorporated into future PDB releases.</p> <p><b><u>E. Performance Metrics</u></b></p> <p>N/A</p>		

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2016 Army												Date: February 2015			
Appropriation/Budget Activity 2040 / 7						R-1 Program Element (Number/Name) PE 0607865A / Patriot Product Improvement				Project (Number/Name) DV8 / Patriot Product Improvement					
Management Services (\$ in Millions)				FY 2014		FY 2015		FY 2016 Base		FY 2016 OCO		FY 2016 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Program Management	Various	RSA, AL : MIPR	0.538	0.600	Oct 2013	0.762	Oct 2014	0.400	Oct 2015	-		0.400	Continuing	Continuing	Continuing
U.S. Contracts	C/FFP	Intuitive Research and Technology Corp. (IRTC) : Huntsville, AL	0.361	-		1.800	Feb 2015	1.600	Feb 2016	-		1.600	Continuing	Continuing	Continuing
Subtotal			0.899	0.600		2.562		2.000		-		2.000	-	-	-
Product Development (\$ in Millions)				FY 2014		FY 2015		FY 2016 Base		FY 2016 OCO		FY 2016 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Software Improvement for Threat Evolution	Various	Multiple : Multiple	5.370	7.500	Jan 2014	8.900	Jan 2015	9.600	Jan 2016	-		9.600	Continuing	Continuing	-
Upper Tier Debris Mitigation (UTDM)	Various	Multiple : Multiple	0.000	-		-		5.000	Jan 2016	-		5.000	Continuing	Continuing	-
Radar Digital Processor (RDP) Development	Various	Raytheon : Andover, Massachusetts	23.300	16.335	Aug 2014	8.700	Jan 2015	1.500	Jan 2016	-		1.500	Continuing	Continuing	-
SNAP/TROPO	Various	Multiple : Multiple	0.000	2.000	Feb 2014	0.400	Feb 2015	-		-		-	Continuing	Continuing	-
RDP Waveform Suite	Various	Raytheon : Andover, Massachusetts	0.000	-		-		2.000	Jan 2016	-		2.000	Continuing	Continuing	-
THAAD PATRIOT Interoperability	Various	Multiple : Multiple	1.200	-		-		2.000	Jan 2016	-		2.000	Continuing	Continuing	-
Advanced Electronic Counter Measures (AECM)	Various	Multiple : Multiple	3.700	3.000	Jan 2014	20.000	Jan 2015	10.000	Jan 2016	-		10.000	Continuing	Continuing	-
Task 2 Non-Ballistic Tactical Ballistic Missile (TBM)	Various	Multiple : Multiple	5.200	-		5.500	Jan 2015	12.000	Jan 2016	-		12.000	Continuing	Continuing	-
Task 6 Discrimination Improvements	Various	Multiple : Multiple	2.100	2.000	Feb 2014	2.400	Feb 2015	18.616	Feb 2016	-		18.616	Continuing	Continuing	-

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Appropriation/Budget Activity 2040 / 7						R-1 Program Element (Number/Name) PE 0607865A / Patriot Product Improvement				Project (Number/Name) DV8 / Patriot Product Improvement					
Product Development (\$ in Millions)				FY 2014		FY 2015		FY 2016 Base		FY 2016 OCO		FY 2016 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Task 7 Tactical Ballistic Missile (TBM) Countermeasures	Various	Multiple : Multiple	0.000	-		1.000	Jan 2015	15.000	Jan 2016	-		15.000	Continuing	Continuing	-
Combat ID Enhancements	Various	Multiple : Multiple	0.000	0.800	Feb 2014	1.000	Feb 2015	13.500	Feb 2016	-		13.500	Continuing	Continuing	-
Common Warfighter-Machine Interface (CWMI)	Various	Multiple : Multiple	0.000	-		-		10.000	Jan 2016	-		10.000	Continuing	Continuing	-
Lower Tier Air & Missile Defense-Capability (LTAMD-C),Concept Development	Various	Multiple : Multiple	0.000	0.300	Jan 2014	1.000	Jan 2015	2.000	Jan 2016	-		2.000	Continuing	Continuing	-
Anti-Radiation Missile (ARM) Asset Defense	Various	Multiple : Multiple	0.000	-		-		2.000	Jan 2016	-		2.000	Continuing	Continuing	-
Lower Tier Air & Missile Defense-Capability (LTAMD-C)	Various	Multiple : Multiple	0.000	-		5.000	Feb 2015	-		-		-	-	5.000	-
Subtotal			40.870	31.935		53.900		103.216		-		103.216	-	-	-
Remarks															
The contract method type Sole Source/Various is Fixed Price Level of Effort which includes Cost Plus Fixed Fee for material, ODC, and travel.															
Test and Evaluation (\$ in Millions)				FY 2014		FY 2015		FY 2016 Base		FY 2016 OCO		FY 2016 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
RDEC and Other Govt Agencies	Various	RSA, AL : MIPR	0.412	1.400	Jan 2014	1.500	Jan 2015	0.600	Jan 2016	-		0.600	Continuing	Continuing	Continuing
Subtotal			0.412	1.400		1.500		0.600		-		0.600	-	-	-
			Prior Years	FY 2014		FY 2015		FY 2016 Base		FY 2016 OCO		FY 2016 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			42.181	33.935		57.962		105.816		-		105.816	-	-	-



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Exhibit R-3, RDT&E Project Cost Analysis: PB 2016 Army							Date: February 2015			
Appropriation/Budget Activity 2040 / 7				R-1 Program Element (Number/Name) PE 0607865A / Patriot Product Improvement			Project (Number/Name) DV8 / Patriot Product Improvement			
	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	Cost To Complete	Total Cost	Target Value of Contract	
Remarks										

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Exhibit R-4, RDT&E Schedule Profile: PB 2016 Army

Date: February 2015

Appropriation/Budget Activity

2040 / 7

R-1 Program Element (Number/Name)

PE 0607865A / Patriot Product Improvement

Project (Number/Name)

DV8 / Patriot Product Improvement

Event Name	FY 2014				FY 2015				FY 2016				FY 2017				FY 2018				FY 2019				FY 2020			
	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
Software Build	Software Build																											
Advanced Electronic Counter Measures (AECM)	AECM																											
Software Improvement for Threat Evolution	Software Threat																											
Combat ID Enhancements	Combat ID Enhancements																											
(1) PDB 8 IOC																												
PDB 8 Fielding	PDB-8 Fielding																											
Task 2 Non-Ballistic Tactical Ballistic Missile (TBM)	Task 2 Non-Ballistic TBM																											
Task 6 Discrimination Improvements	Task 6 Discrimination Improvements																											
Task 7 Tactical Ballistic Missile (TBM) Countermeasures	Task 7 TBM Countermeasures																											
Common Warfighter-Machine Interface (CWMI)	CWMI																											
Radar Digital Processor Development	RDP Development																											
Lower Tier Air & Missile Defense-Capability (LTAMD-C), Concept Development	LTAMD-C, Concept Development																											
Lower-Tier Air & Missile Defense - Capability	LTAMD-C																											

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2016 Army			<b>Date:</b> February 2015
<b>Appropriation/Budget Activity</b> 2040 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0607865A / <i>Patriot Product Improvement</i>	<b>Project (Number/Name)</b> DV8 / <i>Patriot Product Improvement</i>	

**Schedule Details**

<b>Events</b>	<b>Start</b>		<b>End</b>	
	<b>Quarter</b>	<b>Year</b>	<b>Quarter</b>	<b>Year</b>
Software Build	4	2005	4	2020
Advanced Electronic Counter Measures (AECM)	1	2014	4	2019
Software Improvement for Threat Evolution	1	2014	4	2020
Combat ID Enhancements	1	2014	4	2019
PDB 8 IOC	4	2017	4	2017
PDB 8 Fielding	4	2017	4	2020
Task 2 Non-Ballistic Tactical Ballistic Missile (TBM)	1	2015	4	2020
Task 6 Discrimination Improvements	1	2014	4	2017
Task 7 Tactical Ballistic Missile (TBM) Countermeasures	1	2015	4	2018
Common Warfighter-Machine Interface (CWMI)	1	2016	4	2017
Radar Digital Processor Development	1	2012	3	2016
Lower Tier Air & Missile Defense-Capability (LTAMD-C), Concept Development	1	2014	4	2016
Lower-Tier Air & Missile Defense - Capability	4	2016	4	2020