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Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army **Date:** February 2016

Appropriation/Budget Activity 2040: Research, Development, Test & Evaluation, Army / BA 7: Operational Systems Development					R-1 Program Element (Number/Name) PE 0607137A / Chinook Product Improvement Program							
COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
Total Program Element	-	35.424	32.407	91.848	-	91.848	118.435	89.491	13.121	13.321	Continuing	Continuing
ES4: Chinook Product Improvement Program	-	35.424	32.407	91.848	-	91.848	118.435	89.491	13.121	13.321	Continuing	Continuing

Note

Funds in this Program Element (PE) were realigned from PE 0203744A Aircraft Modifications/Product Improvement Programs, Project Number 430 Impr Cargo Helicopter.

A. Mission Description and Budget Item Justification

The CH-47 Chinook is the Army's only heavy lift helicopter and is an essential element of the current Army Aviation master plan. This program funds improvements to the CH-47F System that include: T55-GA-714A engine control and component upgrades to increase power to support emerging 6K/95 requirements, continued development and testing of the Advanced Chinook Rotor Blades (ACRB) which will provide increased lift in high/hot conditions and reduce Operation and Support (O&S) costs. Production of the ACRB will begin in Fiscal Year (FY) 2018. Funding supports the transition from individual Engineering Change Proposals (ECPs) into a CH-47F Block II Engineering/Manufacturing Design (EMD) effort with Milestone B planned for May 2017. Funding also initiates advanced flight control and drive train component improvements to improve aircraft performance. Development of requirements specifications, studies and risk reduction prototyping are also part of this effort.

B. Program Change Summary (\$ in Millions)

	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	35.424	37.407	79.339	-	79.339
Current President's Budget	35.424	32.407	91.848	-	91.848
Total Adjustments	0.000	-5.000	12.509	-	12.509
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-5.000			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	17.709	-	17.709
• Execution Rephase	-	-	-5.200	-	-5.200

Change Summary Explanation

The FY 2017 funds increase of \$12.509 million is based on: +\$19.144 million for an EMD Block II revised cost estimate; -\$5.2 million due to the availability of prior year execution balances; and -\$1.435 million due to revised economic assumptions.

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Appropriation/Budget Activity 2040 / 7					R-1 Program Element (Number/Name) PE 0607137A / <i>Chinook Product Improvement Program</i>				Project (Number/Name) ES4 / <i>Chinook Product Improvement Program</i>			
COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
ES4: <i>Chinook Product Improvement Program</i>	-	35.424	32.407	91.848	-	91.848	118.435	89.491	13.121	13.321	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

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A. Mission Description and Budget Item Justification

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B. Accomplishments/Planned Programs (\$ in Millions)

Title: Modernization Integration	FY 2015	FY 2016	FY 2017
Description: Modernization Integration is an Airframe Component Improvement Program (ACIP) effort that provides system engineering, program management, and planning for manufacturing/modification, test, and logistics that will facilitate the integration of multiple ECPs.	11.396	4.181	15.404
FY 2015 Accomplishments: Conducted preliminary engineering for equipment placement and conducted a virtual review and completed the Integrated Baseline Review to ensure effort is defined and schedule is executable.			
FY 2016 Plans: This effort will provide technical readiness assessment support, test planning support, and Ground Test Vehicle (GTV) design. Continue non-recurring engineering and conduct system level Program Decision Review (PDR).			
FY 2017 Plans:			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
Continue system integration non-recurring engineering prior to EMD.				
<p>Title: CH-47F Block II Engineering and Manufacturing Development</p> <p>Description: The EMD Phase will begin after a 2017 Milestone (MS) B decision and the subsequent contract will develop affordable and executable manufacturing processes; complete system fabrication; remanufacture three production representative CH-47F Block II Chinook test articles; and reduce program risk.</p> <p>FY 2017 Plans: The Block II EMD contract planned for award in third quarter FY17 will integrate separate, on-going non-recurring engineering changes into the CH-47F Block II configuration to satisfy the Army's heavy lift requirement. The four-year EMD contract will provide design, development, integration, qualification, remanufacture and delivery of three production representative CH-47F Block II test articles; conduct and support aircraft developmental and limited user testing; delivery of documentation that demonstrates requirements verification; and a production configuration baseline.</p>		-	-	38.453
<p>Title: Advanced Chinook Rotor Blade (ACRB)</p> <p>Description: This effort provides an ACRB which is a redesign of the current rotor blade to provide improved capability. It improves high/hot performance, reduces Operations and Support (O&S) costs and is a form, fit, function replacement for the legacy blade.</p> <p>FY 2015 Accomplishments: Engineering design and manufacturing to support the first production representative ACRB to validate tooling. Produce-ability reviews for leading edge, heel, spar and aft fairing assemblies as well as numerous manufacturing readiness reviews to assess contractor readiness to proceed into manufacturing.</p> <p>FY 2016 Plans: Build 17 additional blades to support, safety of flight component level testing, flight testing and full component level testing. First flight design review will be conducted in preparation of flight testing at Mesa, AZ.</p> <p>FY 2017 Plans: Complete ACRB flight and live fire testing leading to component level full qualification as well as the finalization of the technical data package.</p>		8.350	10.345	12.828
Title: Improved Drive Train		5.396	7.266	6.842

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
<p>Description: This effort addresses O&S cost reduction while simultaneously re-qualifying the combining, forward, and aft transmissions to a higher power level to maximize engine power available at sea-level conditions. Funding completes preliminary design review and begins preparation for critical design review effort.</p> <p>FY 2015 Accomplishments: Completed design analysis for the forward and aft transmission and sub-system preliminary design review for the improved drive train. Defined test requirements and conducted re-qualification of the combining transmission to a higher horsepower.</p> <p>FY 2016 Plans: Test preparation including purchase of test materials. Conduct initial bench testing, aft transmission static/dynamics strain surveys test, aft transmission destruct testing, and the forward transmission scuffing test.</p> <p>FY 2017 Plans: Continue test preparation including purchase of test materials. Initiate forward transmission, static/dynamics strain surveys test, sync shaft fatigue tests, and the material coupon testing to assess material properties of component.</p>				
<p>Title: Electronic Control Unit (ECU) Software Upgrade</p> <p>Description: Software upgrade improves engine communication with the aircraft monitoring system to increase aircrew situational awareness and reduce workload. In addition software enhancements accommodate increased capability of the Improved Drive Train (IDT). Software upgrades will occur at designated intervals to allow efficient and expedient fielding of any improvements/enhancements.</p> <p>FY 2015 Accomplishments: Completed the design, development, and qualification of Version 3 ECU software enhancements.</p> <p>FY 2016 Plans: Design and development of the V3+ enhancements. Preparation for testing/Qualification.</p> <p>FY 2017 Plans: Testing and qualification of the software enhancements. Test Readiness Review (TRR) followed by the formal qualification and testing.</p>		3.505	2.485	2.697
<p>Title: Ratio Detector Power Supply (RDPS)</p> <p>Description: The RDPS is a component of the engine torque measuring system. The RDPS addresses obsolescence related to one of the microprocessors and accuracy of the torque measurement signal. The redesigned RDPS improves the accuracy of the engine signal to the torque measuring system and provides improved mission planning capability to the aviators.</p>		2.665	3.010	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
<p>FY 2015 Accomplishments: Contract Requirements Package submitted and official proposal received.</p> <p>FY 2016 Plans: Contract Award. Design and development of a replacement T55-GA-714A Engine RDPS.</p>				
<p>Title: In-house and Program Management Administration</p> <p>Description: This funding provides support costs for various government agencies.</p> <p>FY 2015 Accomplishments: This funding provides support costs for various government agencies.</p> <p>FY 2016 Plans: This funding provides support costs for various government agencies.</p> <p>FY 2017 Plans: This funding provides support costs for various government agencies to include the increased effort in support of Block II.</p>		1.771	1.620	4.592
<p>Title: Testing and Evaluation</p> <p>Description: This effort incorporates all testing requirements to integrate numerous ECPs into one system level requirement to include the ACRB.</p> <p>FY 2015 Accomplishments: Finalized the Live Fire Strategy and Test & Evaluation Master Plan (TEMP) and contractor participation in the Test and Evaluation Working-level Integrated Product Team (T&E WIPT) meetings. Initiated test planning activity, Computational fluid dynamics (CFD) modeling and analysis.</p> <p>FY 2016 Plans: Conduct component level airworthiness qualification and Live Fire Testing for ACRB and developmental ECP components. Continue test planning activity, CFD modeling software and analysis to support EMD flight test qualification and participate the T&E WIPT meetings.</p> <p>FY 2017 Plans: Continue component level airworthiness qualification and Live Fire Testing for ACRB and developmental ECP components to characterize performance improvements. Finalize test planning activity for EMD ground test and continue test planning activity for EMD flight test.</p>		2.341	3.500	11.032
Accomplishments/Planned Programs Subtotals		35.424	32.407	91.848

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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>FY 2017</u>			<u>FY 2018</u>	<u>FY 2019</u>	<u>FY 2020</u>	<u>FY 2021</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• AA0252: <i>CH-47 CARGO HELICOPTER MODS</i>	32.092	90.330	102.943	-	102.943	188.968	122.257	89.884	25.394	Continuing	Continuing
• A05105: <i>CH-47 SLEP (Including Adv Proc)</i>	758.622	746.111	564.964	-	564.964	132.804	135.110	190.208	426.915	Continuing	Continuing
• A05008: <i>CH-47 CARGO HELICOPTER NEW BUILD</i>	236.243	357.820	-	-	-	450.525	-	-	-	Continuing	Continuing

Remarks

The CH-47F program replaces the aging CH-47D aircraft by FY 2020, incorporates a new machined airframe, and includes a new Common Avionics Architecture System (CAAS) cockpit with digital communication/navigation capability allowing improved interoperability on the digital battlefield. The CH-47F program includes recapitalization of key dynamic components, bringing them to a near zero time.

D. Acquisition Strategy

Given the need to maintain the fleet's relevance through 2060, the PM is proposing a block strategy to facilitate incremental upgrades to the Chinook fleet. Using the CH-47F as a baseline, the H-47 Block II is the first increment of this potential multi-block strategy. The Block II program will restore performance lost due to the added weight of safety and survivability equipment incorporated since initial fielding in 2007. Additional objectives of the Block II program include: Efficiently incorporating multiple engineering changes; Accomplishing required mid-life airframe recapitalization; Converging the special operations and conventional Army designs; Establishing a foundation for future block upgrades; and Maintaining the industrial base until Future Vertical Lift (FVL)-Heavy is realized.

E. Performance Metrics

N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Army												Date: February 2016			
Appropriation/Budget Activity 2040 / 7				R-1 Program Element (Number/Name) PE 0607137A / Chinook Product Improvement Program				Project (Number/Name) ES4 / Chinook Product Improvement Program							
Product Development (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 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
Modernization Integration	SS/CPFF	Boeing Ridley : Park PA	0.000	11.396	May 2015	4.181	Dec 2015	15.404	Dec 2016	-		15.404	Continuing	Continuing	Continuing
Engineering and Manufacturing Development (Pre-Decisional)	SS/CPIF	Boeing Ridley : Park, PA	0.000	-		-		38.453	May 2017	-		38.453	Continuing	Continuing	Continuing
Advanced Chinook Rotor Blade (ACRB)	SS/CPFF	Boeing Ridley : Park PA	0.000	8.350	Jun 2015	10.345	Dec 2015	12.828	Dec 2016	-		12.828	Continuing	Continuing	Continuing
Improved Drive Train	SS/CPFF	Boeing Ridley : Park, PA	0.000	5.396	Nov 2015	7.266	Dec 2015	6.842	Dec 2016	-		6.842	Continuing	Continuing	Continuing
Electronic Control Unit (ECU) Software Upgrade	SS/CPFF	Honeywell : Phoenix, AZ	0.000	3.505	May 2015	2.485	Feb 2016	2.697	Feb 2017	-		2.697	Continuing	Continuing	Continuing
Ratio Detector Power Supply (RDPS)	SS/CPFF	Boeing Ridley : Park, PA	0.000	2.665	Jun 2015	3.010	Dec 2015	-		-		-	0	5.675	0
Subtotal			0.000	31.312		27.287		76.224		-		76.224	-	-	-
Support (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 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
PMO/OGA	Various	Various Government : Redstone Arsenal AL	0.000	1.771	Mar 2015	1.620	Mar 2016	4.592	Mar 2017	-		4.592	Continuing	Continuing	Continuing
Subtotal			0.000	1.771		1.620		4.592		-		4.592	-	-	-
Test and Evaluation (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 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
Testing of configuration update ECPs to include	SS/CPFF	Boeing Ridley : Park PA	0.000	2.341	May 2015	3.500	Jan 2016	11.032	Jan 2017	-		11.032	Continuing	Continuing	Continuing

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Exhibit R-4, RDT&E Schedule Profile: PB 2017 Army **Date:** February 2016

Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0607137A / <i>Chinook Product Improvement Program</i>	Project (Number/Name) ES4 / <i>Chinook Product Improvement Program</i>
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Event Name	FY 2015				FY 2016				FY 2017				FY 2018				FY 2019				FY 2020				FY 2021			
	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
	Modernization Integration	Modernization Integration																										
CH-47F Block II EMD (Pre-Decisional)									CH-47F Block II EMD																			
Advanced Chinook Rotor Blade	Advanced Chinook Rotor Blade																											
Improved Drive Train					Improved Drive Train																							
Electronic Control Unit (ECU) Software Upgrade (Engine)									ECU Software Upgrade																			
Ratio Detector Power Supply (RDPS) (Engine)	RDPS																											
In-house and Program Management Administration									In-house and Program Management Administration																			
Testing and Evaluation									Testing and Evaluation																			

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Army		Date: February 2016
Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0607137A / <i>Chinook Product Improvement Program</i>	Project (Number/Name) ES4 / <i>Chinook Product Improvement Program</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
Modernization Integration	3	2015	3	2017
CH-47F Block II EMD (Pre-Decisional)	3	2017	3	2021
Advanced Chinook Rotor Blade	1	2008	4	2017
Improved Drive Train	3	2014	2	2018
Electronic Control Unit (ECU) Software Upgrade (Engine)	4	2010	4	2021
Ratio Detector Power Supply (RDPS) (Engine)	3	2015	3	2016
In-house and Program Management Administration	1	2015	4	2021
Testing and Evaluation	3	2015	4	2021