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Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Air Force										Date: February 2019		
Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 7: Operational Systems Development					R-1 Program Element (Number/Name) PE 0302015F I E-4B National Airborne Operations Center (NAOC)							
COST (\$ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
Total Program Element	-	37.481	57.758	70.173	0.000	70.173	3.474	0.000	0.000	0.000	0.000	168.886
674777: E-4B Aircraft Modernization	-	37.481	57.758	70.173	0.000	70.173	3.474	0.000	0.000	0.000	0.000	168.886
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

## Note

FY18 E-4B Recapitalization efforts are executed under PE0604288F, Project 646507, BA4

## A. Mission Description and Budget Item Justification

The four (4) aircraft E-4B National Airborne Operations Center (NAOC) fleet satisfies the military need for an airborne operations center with communications capabilities permitting military and civilian leadership to monitor and control military and civil national assets during all phases of conflict (nuclear and non-nuclear) or natural disaster. The E-4B NAOC fleet also satisfies the military requirement to provide a highly survivable node of the National Military Command System (NMCS).

This program's developmental modifications include, but are not limited to, upgrades and enhancements to aircraft structures, propulsion system, fuel system, environmental control system, electrical generation and distribution systems, flight safety and navigation systems (with their associated communications equipment). Additionally, modifications may enhance the aircraft's operations center facilities, to include but not limited to those necessary for the Senior Leadership Command, Control and Communications System (SL3CS), National Leadership Command Capability (NLCC), Nuclear Command, Control, and Communications (NC3) and other communications necessary for the E-4B fleet to execute its mission. Funds may also be used to explore and develop modifications, upgrades, and future systems required to meet evolving mission requirements. This budget supports the following developmental modifications and studies/projects currently underway or planned for accomplishment:

- The Advanced Extremely High Frequency (AEHF) Compatible Terminal/ Presidential National Voice Conferencing (PNVC) Program integrates AEHF Compatible Command Post Terminals and PNVC capability onto the E-4B NAOC platform. This integration is necessary to replace the legacy Military Strategic, Tactical and Relay (MILSTAR) terminal, and provide access to protected wideband AEHF satellite networks. PNVC replaces the Survivable Emergency Conferencing Network (SECN), which will not be supported once the AEHF satellite network is in place.
- The Low Frequency Transmit System (LFTS) program replaces the currently installed Very Low Frequency/Low Frequency (VLF/LF) Transmit system, which is no longer sustainable after over 35 years of operation. In order to meet existing Presidential Policy Directive (PPD)-35 requirements and ensure there is assured connectivity between civilian and military leadership and military forces during real world situations, this system must be replaced. The transmit system consists of three primary equipment groups: a Control/Monitor group, a Power Amplifier/Coupler (PA/C) group, and a Trailing Wire Antenna (TWA) group.
- The MUOS program upgrades the E-4B's Ultra-High Frequency Radio transmitters to be MUOS capable to meet E-4B Capability Development Document (CDD) and CJCSI 6251\_01D requirements. MUOS provides securable data and full duplex voice communications while simultaneously monitoring a second frequency. The

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MUOS upgrade will provide interoperability with MUOS waveforms for voice and data communications and with other nuclear and national C2 centers and aircraft by replacing the legacy USC-42 UHF SATCOM radios with a MUOS capable radio.						
- Survivable SHF will upgrade and replace portions of the E-4B's SHF system to meet existing Presidential Policy Directive (PPD)-35 and National Security Presidential Directive (NSPD)-51/Homeland Security Presidential Directive (HSPD)-20 requirements and to ensure continued connectivity and interoperability as satellite and communications infrastructure evolves. Expected modifications include, but are not limited to, component and sub-system upgrades and replacement of portions of the current SHF system that are obsolete or near end of service life. A replacement to the SHF system is required as secure, survivable communications capability transitions from the Defense Satellite Communications System (DSCS).						
This program element may include necessary civilian pay expenses required to manage, execute, and deliver E-4B weapon system capability; furthermore, it may include support funding for emerging modification requirements to support PMA, A&AS, equipment and other government cost.						
This program element may include necessary civilian pay expenses required to manage, execute, and deliver E-4B weapon system capabilities. The use of such program funds would be in addition to the civilian pay expenses budgeted in program elements 0605826F, 0605827F, 0605828F, 0605829F, 0605830F, 0605831F, 0605832F, 0605898F, and 0605833F.						
As directed in the FY 2018 NDAA, Sec 825, amendment to PL 114-92 FY 2016 NDAA, Sec 828 Penalty for Cost Overruns, the FY 2018 Air Force penalty total is \$14.373M. The calculated percentage reduction to each research, development, test and evaluation and procurement account will be allocated proportionally from all programs, projects, or activities under such account.						
This program is in Budget Activity 7, Operational System Development because this budget activity includes development efforts to upgrade systems that have been fielded or have received approval for full rate production and anticipate production funding in the current or subsequent fiscal year.						
B. Program Change Summary (\$ in Millions)		FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget		35.467	57.758	70.173	0.000	70.173
Current President's Budget		37.481	57.758	70.173	0.000	70.173
Total Adjustments		2.014	0.000	0.000	0.000	0.000
• Congressional General Reductions		0.000	0.000			
• Congressional Directed Reductions		0.000	0.000			
• Congressional Rescissions		0.000	0.000			
• Congressional Adds		0.000	0.000			
• Congressional Directed Transfers		0.000	0.000			
• Reprogrammings		3.299	0.000			
• SBIR/STTR Transfer		-1.285	0.000			
• Other Adjustments		0.000	0.000	0.000	0.000	0.000

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Change Summary Explanation FY18 was increased by \$3.299M for AEHF through a Below Threshold Reprogramming (BTR) Action. The FY18 funding was reduced by \$1.285M due to Small Business Innovation Research Transfer (SBIR)				
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2018	FY 2019	FY 2020
<b>Title:</b> Advanced Extremely High Frequency (AEHF) Compatible Terminal/Presidential National Voice Capability (PNVC) <b>Description:</b> Integrate AEHF Compatible Terminal/PNVC capability onto the E-4B NAOC platform to replace the existing MILSTAR/SECN system.  <b>FY 2019 Plans:</b> Install first prototype kit and conduct remaining activities leading up to the installation of the second prototype kit. Milestone C anticipated by 4QFY19.  <b>FY 2020 Plans:</b> Install second prototype kit and conduct remaining activities leading up to the installation of the first production kit.  <b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Funding decreases from FY19 to FY20 with development coming to an end and procurement starting.		18.737	24.745	15.087
<b>Title:</b> E-4B Low Frequency Transmit System (LFTS) <b>Description:</b> Replaces the E-4B's legacy Very Low Frequency/Low Frequency (VLF/LF) Transmit System, which is over 35 years old and is past its useful life. This capability is required to comply with Presidential Policy Directive (PPD)-35 to ensure there is assured connectivity between civilian and military leadership and military forces during all stages of conflict and/or national emergencies.  <b>FY 2019 Plans:</b> Complete ground and flight test activities on first prototype install at Offutt AFB after Programmed Depot Maintenance (PDM) completion.  <b>FY 2020 Plans:</b> N/A  <b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Development activities end in FY19 as program moves into production.		18.744	25.167	0.000
<b>Title:</b> E-4B Mobile User Objective System (MUOS) <b>Description:</b> The MUOS program upgrades E-4B Ultra-High Frequency Radio transmitters to be MUOS capable to meet the E-4B CDD and CJCSI 6251_01D. MUOS provides securable data and full duplex voice communications while simultaneously		0.000	5.757	0.000

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C. Accomplishments/Planned Programs (\$ in Millions)										FY 2018	FY 2019	FY 2020
monitoring a second frequency. The MUOS upgrade will provide interoperability with MUOS waveforms for voice and data communications and with other nuclear and national C2 centers and aircraft by replacing the legacy USC-42 UHF SATCOM radio system.  <b>FY 2019 Plans:</b> Prepare for Acquisition Strategy decision and Milestone B document development. Develop initial kit, integrate and test MUOS system on one E-4B.  <b>FY 2020 Plans:</b> N/A  <b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> All development activities funded with FY19 RDT&E.												
<b>Title:</b> Survivable SHF  <b>Description:</b> SHF Modernization will upgrade and replace portions of the E-4B's SHF system to meet existing Presidential Policy Directive (PPD)-35 and National Security Presidential Directive (NSPD)-51/Homeland Security Presidential Directive (HSPD)-20 requirements and to ensure continued connectivity and interoperability as satellite and communications infrastructure evolves.  <b>FY 2019 Plans:</b> Perform obsolesce, reliability, and maintainability study to determine scope of modification.  <b>FY 2020 Plans:</b> Conduct design, integration, and prototype development activities.  <b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Funding increases from FY19 to FY20 with majority of development activities occurring in FY20.										0.000	2.089	55.086
Accomplishments/Planned Programs Subtotals										37.481	57.758	70.173
D. Other Program Funding Summary (\$ in Millions)												
Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost	
• RDTE 04 PE0604288F BA04: National Airborne Operations Center (NAOC) Recap	6.141	7.440	16.669	-	16.669	102.739	136.684	138.000	141.000	0.000	548.673	

# UNCLASSIFIED

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<b>Appropriation/Budget Activity</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force I BA 7: Operational Systems Development</i>						<b>R-1 Program Element (Number/Name)</b> PE 0302015F / <i>E-4B National Airborne Operations Center (NAOC)</i>					
<b>D. Other Program Funding Summary (\$ in Millions)</b>											
<b>Line Item</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
• APAF 05 Line Item E00400: <i>E-4B Nat Airborne Ops Center (NAOC)</i>	25.914	67.858	58.477	-	58.477	73.905	52.293	38.868	41.213	0.000	358.528
• APAF 06 Line Item 000999: <i>Initial Spares/Repair Parts</i>	0.972	1.061	0.332	-	0.332	0.339	0.346	0.352	0.358	0.000	3.760
<b>Remarks</b>											
<b>E. Acquisition Strategy</b> Acquisition Strategy: The acquisition strategy for each specific modification differs based on the urgency of the requirement, definition of the capability, and technology readiness level of the components.  Management Strategy: Program management for all aircraft modifications is executed by the Commercial Derivative Aircraft Division at Tinker AFB. The Program Executive Officer (PEO) for Presidential and Executive Airlift provides management oversight.  Contracting Strategy: Contracting strategy differs for each individual modification, but normally includes an initial engineering study contract followed by a development contract. Production installations and sustainment are typically accomplished with the E-4B Contractor Logistics Support (CLS) contract.											
<b>F. Performance Metrics</b> Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.											

**UNCLASSIFIED**

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Air Force												Date: February 2019			
Appropriation/Budget Activity 3600 / 7						R-1 Program Element (Number/Name) PE 0302015F / E-4B National Airborne Operations Center (NAOC)						Project (Number/Name) 674777 / E-4B Aircraft Modernization			
Product Development (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 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
AEHF/PNVC Integration	C/CPFF	Raytheon : Largo, FL	-	18.737	Mar 2018	24.745	Jul 2019	15.087	Oct 2019	-		15.087	0.000	58.569	44.471
LFTS Development	SS/CPIF	Boeing : OKC, OK	-	18.744	Nov 2017	25.167	Jun 2019	-		-		-	0.000	43.911	103.857
MUOS	TBD	Raytheon : Largo, FL	-	-		5.757	Jun 2019	-		-		-	0.000	5.757	-
Survivable SHF	TBD	L-3 : SLC, UT	-	-		2.089	Jun 2019	55.086	Dec 2019	-		55.086	0.000	57.175	-
Subtotal			-	37.481		57.758		70.173		-		70.173	0.000	165.412	N/A
			Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			-	37.481		57.758		70.173		-		70.173	0.000	165.412	N/A
Remarks															
FY18, FY19, & FY20 AEHF funding incrementally funds AEHF EMD and prototype integration efforts under DMEA contract.															
FY18 & FY19 LFTS funding supports integration and test of prototype LFTS system under Boeing's ESS contract.															
FY19 MUOS funding supports integration and test of prototype MUOS system under Raytheon IDIQ contract.															
FY19 & FY20 SSHF funding supports development, integration, and test of prototype SSHF system under L-3 IDIQ contract.															

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<b>Exhibit R-4, RDT&amp;E Schedule Profile:</b> PB 2020 Air Force			<b>Date:</b> February 2019		
<b>Appropriation/Budget Activity</b> 3600 / 7		<b>R-1 Program Element (Number/Name)</b> PE 0302015F / <i>E-4B National Airborne Operations Center (NAOC)</i>			<b>Project (Number/Name)</b> 674777 / <i>E-4B Aircraft Modernization</i>

	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	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
<b><i>E-4B Aircraft Modernization</i></b>																												
AEHF Compatible Terminal/PNVC Integration and Testing																												
AEHF Compatible Terminal/PNVC PDR																												
AEHF Compatible Terminal/PNVC CDR																												
AEHF Compatible Terminal/PNVC Milestone Decision C																												
LFTS Modification Integration and Testing																												
MUOS Modification Milestone Decision B																												
MUOS Modification Integration and Testing																												
MUOS Modification Milestone Decision C																												
Survivable SHF Integration and Testing																												
Survivable SHF Rapid Prototype Decision																												
Survivable SHF Prototype Modification Decision																												
Survivable SHF Rapid Fielding Decision																												

**UNCLASSIFIED**

<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2020 Air Force			<b>Date:</b> February 2019
<b>Appropriation/Budget Activity</b> 3600 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0302015F / <i>E-4B National Airborne Operations Center (NAOC)</i>	<b>Project (Number/Name)</b> 674777 / <i>E-4B Aircraft Modernization</i>	

**Schedule Details**

<b>Events by Sub Project</b>	<b>Start</b>		<b>End</b>	
	<b>Quarter</b>	<b>Year</b>	<b>Quarter</b>	<b>Year</b>
<b><i>E-4B Aircraft Modernization</i></b>				
AEHF Compatible Terminal/PNVC Integration and Testing	1	2018	3	2021
AEHF Compatible Terminal/PNVC PDR	3	2018	3	2018
AEHF Compatible Terminal/PNVC CDR	4	2018	4	2018
AEHF Compatible Terminal/PNVC Milestone Decision C	3	2019	3	2019
LFTS Modification Integration and Testing	1	2018	3	2019
MUOS Modification Milestone Decision B	4	2019	4	2019
MUOS Modification Integration and Testing	4	2019	4	2020
MUOS Modification Milestone Decision C	4	2020	4	2020
Survivable SHF Integration and Testing	2	2019	1	2022
Survivable SHF Rapid Prototype Decision	3	2019	3	2019
Survivable SHF Prototype Modification Decision	4	2020	4	2020
Survivable SHF Rapid Fielding Decision	1	2022	1	2022