Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Air Force											Date: May 2021	
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*					R-1 Program Element (Number/Name) PE 0302015F / *E-4B National Airborne Operations Center (NAOC)*							
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
Total Program Element	-	58.059	3.462	26.331	0.000	26.331	-	-	-	-	-	-
674777: *E-4B Aircraft Modernization*	-	58.059	3.462	26.331	0.000	26.331	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

This program, BA 7, PE 0302015F, project 674777, E-4B Mobile User Objective System (MUOS), is a new start.
This program, BA 7, PE 0302015F, project 674777, E-4B Full Motion Flight Deck Simulator, is a new start.
This program, BA 7, PE 0302015F, project 674777, Low Frequency Transmit System (LFTS), is a new start.

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), Flight deck simulator, and Systems Integration Lab. 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. FY20 was the last year of funding for this program.

- The Mobile User Objective System (MUOS) program upgrades the E-4B's Ultra-High Frequency (UHF) Radio transmitters to be MUOS capable to meet E-4B Capability Development Document (CDD) and CJCSI 6250.01F requirements. MUOS provides securable data and full duplex voice communications while simultaneously 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 radios with a MUOS capable radio. FY22 is the last year of funding for this program.

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Air Force	Date: May 2021
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0302015F / *E-4B National Airborne Operations Center (NAOC)*

- Survivable Super High Frequency (SSHF) will upgrade and replace portions of the E-4B's Jam-Resistant Secure Communications (JRSC) 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). A risk-reduction study was completed in FY19 to further define the acquisition strategy of the SSHF program. The program will be acquired in 2 increments: Increment 1 will include technical solutions such as upgrading the existing modems, systems integration lab, and Ka-band system. Increment 2 will include new modem technology, new Ku-band system, common workstation, and upgrades to the X-band system.

- E-4B Full Motion Flight Deck Simulator program will develop an E-4B full motion 747-200 flight crew simulator, configured to represent the E-4B cockpit configuration for the pilot and flight engineer stations and be representative of day and night aerial refueling with simulation of fuel on-load characteristics. This capability will fill a critical training gap for pilots and flight engineers once the already limited current training options are decommissioned (Sep 24). This training capability shortfall will directly impact E-4B flight operations and aircraft availability as use of the aircraft for this purpose reduces already limited aircraft availability required for operational missions resulting in insufficient flight time for pilots to maintain certifications. FY20 new start approved in Sep 20. FY22 is last year of funding for this program.

The Low Frequency Transmit System (LFTS) program 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. 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 LFTS System requires a trainer to allow the users to become proficient in operating the system and to certify all operators.

This program element may include necessary emergent or unanticipated civilian pay expenses required to manage, execute, and deliver E-4B weapon system capability for emergent or unanticipated weapon system capability. The use of such program funds would be in addition to the civilian pay expenses budgeted in program element 0605831F.

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Air Force	Date: May 2021
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0302015F / *E-4B National Airborne Operations Center (NAOC)*

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	60.173	3.468	0.000	0.000	0.000
Current President's Budget	58.059	3.462	26.331	0.000	26.331
Total Adjustments	-2.114	-0.006	26.331	0.000	26.331
• Congressional General Reductions	0.000	-0.006			
• 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	0.000	0.000			
• SBIR/STTR Transfer	-2.114	0.000			
• Other Adjustments	0.000	0.000	26.331	0.000	26.331

Change Summary Explanation

FY22 funding increased to fix E4B SSHF funding.

C. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Advanced Extremely High Frequency (AEHF) Compatible Terminal/Presidential National Voice Capability (PNVC) ***Description:*** Integrate AEHF Compatible Terminal/PNVC capability onto the E-4B NAOC platform to replace the existing MILSTAR/SECN system. ***FY 2021 Plans:*** N/A ***FY 2022 Plans:*** Anticipate program completion.	14.476	0.000	0.000
Title: E-4B Mobile User Objective System (MUOS) ***Description:*** The MUOS program upgrades E-4B Ultra-High Frequency (UHF) Radio transmitters to be MUOS capable to meet the E-4B CDD and CJCSI 6250.01F. MUOS provides securable data and full duplex voice communications while simultaneously 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 Satellite Communication (SATCOM) radio system. ***FY 2021 Plans:***	9.010	0.000	0.050

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Air Force	Date: May 2021
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0302015F / *E-4B National Airborne Operations Center (NAOC)*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
N/A ***FY 2022 Plans:*** Includes PMA/Travel. Complete development and test efforts in support of first prototype installation. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Additional funds required to support program through completion of development effort.			
Title: Survivable SHF ***Description:*** Survivable Super High Frequency (SSHF) will upgrade and replace portions of the E-4B's Jam-Resistant Secure Communications (JRSC) 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). A risk-reduction study was completed in FY19 to further define the acquisition strategy of the SSHF program. The program will be acquired in 2 increments: Increment 1 will include technical solutions such as upgrading the existing modems, systems integration lab, and Ka-band system. Increment 2 will include new modem technology, new Ku-band system, common workstation, and upgrades to the X-band system. ***FY 2021 Plans:*** - Complete SSHF Increment 1 development, prototyping, integration, and test activities. - Complete systems integration lab development and installation. - Complete upgrade to existing modems and Ka-band system airworthiness. - Start Increment 2 development activities. ***FY 2022 Plans:*** - Continue Increment 2 development activities. - Begin design of new Ku-band system and common workstation. - Initiate development of new modem technology. - Start development and design of X-band system upgrades. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** FY21 is the end of Increment 1 activities and most of the cost of Increment 1 is in FY20. FY21 begins activities for Increment 2.	24.583	3.462	25.581
Title: E-4B Full Motion Flight Deck Simulator	9.990	0.000	0.450

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Air Force	Date: May 2021
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0302015F / *E-4B National Airborne Operations Center (NAOC)*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Description: E-4B Full Motion Flight Deck Simulator program will develop an E-4B full motion 747-200 flight crew simulator, configured to represent the E-4B cockpit configuration for the pilot and flight engineer stations and be representative of day and night aerial refueling with simulation of fuel on-load characteristics. The Simulator is necessary to meet operational flight training requirements and fill a critical training gap for pilots and flight engineers once the already limited current training options are decommissioned. This training capability shortfall will directly impact E-4B flight operations and aircraft availability as use of the aircraft for this purpose reduces already limited aircraft availability required for operational missions resulting in insufficient flight time for pilots to maintain certifications. ***FY 2021 Plans:*** N/A ***FY 2022 Plans:*** Delivery of Flight Simulator ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Additional funds required to support program through completion.			
Title: Low Frequency Transmit System (LFTS) ***Description:*** 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. ***FY 2021 Plans:*** N/A ***FY 2022 Plans:*** -Complete data analysis of LFTS High-altitude Electromagnetic Plus (HEMP) testing/certification to meet IOC requirement and other contract closeout actions. -Initiate design and development of LFTS Trainer. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Additional funding required for completion of delayed test activities, and initial design and development work for LFTS trainer.	0.000	0.000	0.250
Accomplishments/Planned Programs Subtotals	58.059	3.462	26.331

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Air Force	Date: May 2021
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0302015F / *E-4B National Airborne Operations Center (NAOC)*

D. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• APAF 05 Line Item E00400: *E-4B Nat Airborne Ops Center (NAOC)*	58.477	58.803	52.240	-	52.240	-	-	-	-	-	-
• APAF 06 Line Item 000999: *Initial Spares/Repair Parts*	2.365	2.704	3.050	-	3.050	-	-	-	-	-	-

Remarks

E. Acquisition Strategy

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.

The Acquisition Strategy for Survivable SHF was approved as a Section 804 Middle Tier Acquisition in April 2019.

Management Strategy: Program management for all aircraft modifications is executed by the Commercial Derivative Aircraft Division at Tinker AFB, Oklahoma. The Program Executive Officer (PEO) for Presidential and Executive Airlift, at Wright Patterson, Ohio provides management oversight.

Contracting Strategy: The 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.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Air Force		Date: May 2021
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)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
AEHF/PNVC Integration	C/CPFF	Raytheon : Largo, FL	-	14.476	Apr 2020	-		-		-		-	-	-	44.471
MUOS	SS/CPIF	Raytheon : Largo, FL	-	9.010	Nov 2019	-		0.050	Sep 2022	-		0.050	-	-	13.000
E-4B Full Motion Flight Deck Simulator	SS/FFP	CymSTAR : Broken Arrow, OK	-	9.990	Sep 2020	-		0.450	Dec 2021	-		0.450	-	-	9.450
Survivable SHF	C/CPFF	L-3 : SLC, UT	-	24.583	Oct 2020	3.462	Jun 2021	25.581	Jan 2022	-		25.581	-	-	120.000
LFTS Development	SS/CPIF	Boeing : OKC, OK	-	-		-		0.250	Mar 2022	-		0.250	-	-	0.250
		Subtotal	-	58.059		3.462		26.331		-		26.331	-	-	N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	58.059		3.462		26.331		-		26.331	-	-	N/A

Remarks

FY20 AEHF funding incrementally funded AEHF EMD and prototype integration efforts under DMEA contract.

FY20 MUOS funding supported integration and test of prototype MUOS system under Raytheon IDIQ contract.

FY20, FY21 & FY22 SSHF funding supports development, integration, and test of prototype SSHF system under L-3 IDIQ contract.

FY20 E-4B Full Motion Flight Deck Simulator funding supports development of simulator under CymSTAR contract.

FY22 LFTS funding supports contract closeout of integration and test of prototype LFTS system under Boeing's ESS contract.

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Air Force		Date: May 2021
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*

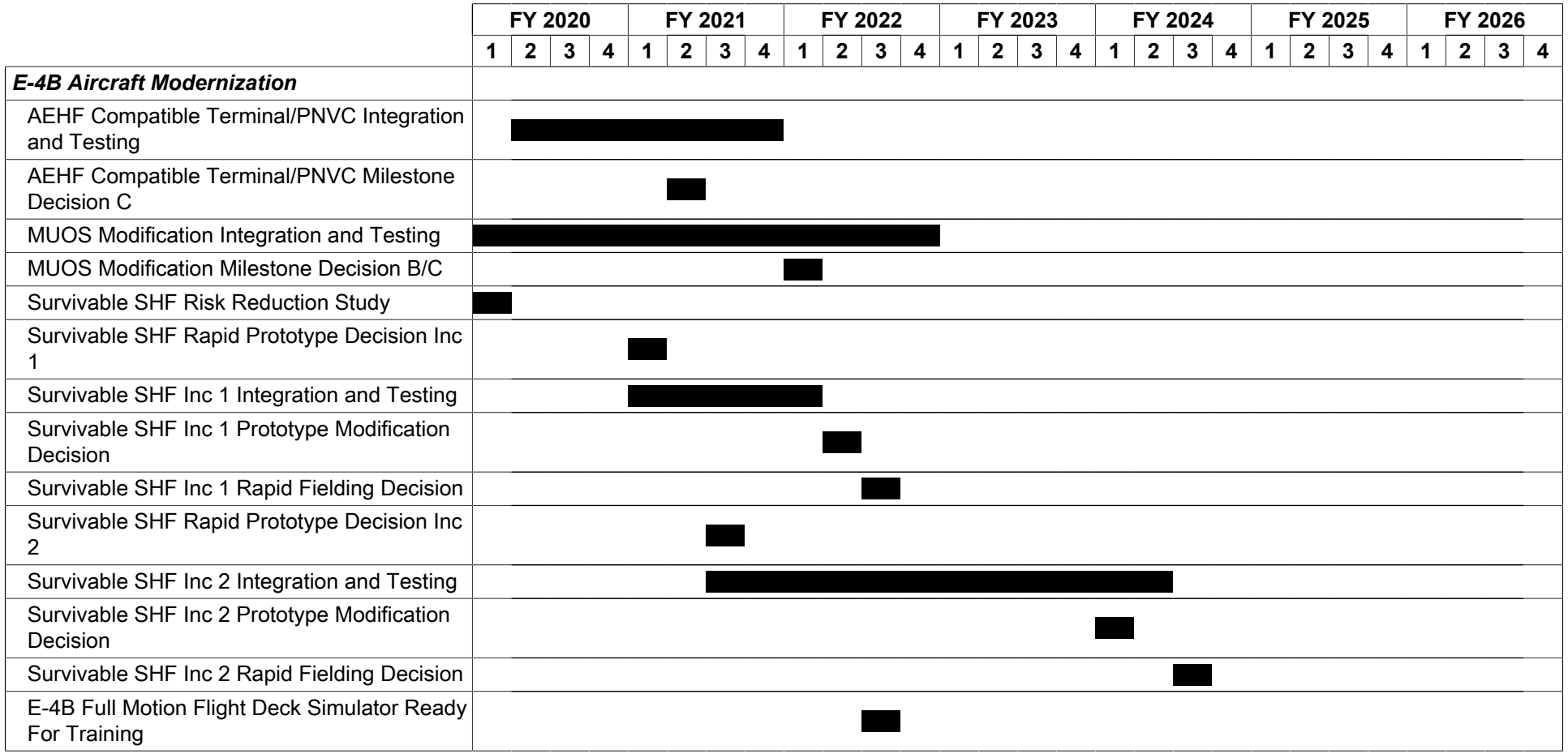

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Air Force		Date: May 2021
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0302015F / *E-4B National Airborne Operations Center (NAOC)*	**Project (Number/Name)** 674777 / *E-4B Aircraft Modernization*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
E-4B Aircraft Modernization				
AEHF Compatible Terminal/PNVC Integration and Testing	2	2020	4	2021
AEHF Compatible Terminal/PNVC Milestone Decision C	2	2021	2	2021
MUOS Modification Integration and Testing	1	2020	4	2022
MUOS Modification Milestone Decision B/C	1	2022	1	2022
Survivable SHF Risk Reduction Study	1	2020	1	2020
Survivable SHF Rapid Prototype Decision Inc 1	1	2021	1	2021
Survivable SHF Inc 1 Integration and Testing	1	2021	1	2022
Survivable SHF Inc 1 Prototype Modification Decision	2	2022	2	2022
Survivable SHF Inc 1 Rapid Fielding Decision	3	2022	3	2022
Survivable SHF Rapid Prototype Decision Inc 2	3	2021	3	2021
Survivable SHF Inc 2 Integration and Testing	3	2021	2	2024
Survivable SHF Inc 2 Prototype Modification Decision	1	2024	1	2024
Survivable SHF Inc 2 Rapid Fielding Decision	3	2024	3	2024
E-4B Full Motion Flight Deck Simulator Ready For Training	3	2022	3	2022