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Selected Acquisition Report (SAR)

RCS: DD-A&T(Q&A)823-261



Advanced Extremely High Frequency Satellite (AEHF)

As of FY 2020 President's Budget

Defense Acquisition Management
Information Retrieval
(DAMIR)

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Sensitivity Originator

No originator info Available at this time.

Common Acronyms and Abbreviations for MDAP Programs

Acq O&M - Acquisition-Related Operations and Maintenance
ACAT - Acquisition Category
ADM - Acquisition Decision Memorandum
APB - Acquisition Program Baseline
APPN - Appropriation
APUC - Average Procurement Unit Cost
\$B - Billions of Dollars
BA - Budget Authority/Budget Activity
Blk - Block
BY - Base Year
CAPE - Cost Assessment and Program Evaluation
CARD - Cost Analysis Requirements Description
CDD - Capability Development Document
CLIN - Contract Line Item Number
CPD - Capability Production Document
CY - Calendar Year
DAB - Defense Acquisition Board
DAE - Defense Acquisition Executive
DAMIR - Defense Acquisition Management Information Retrieval
DoD - Department of Defense
DSN - Defense Switched Network
EMD - Engineering and Manufacturing Development
EVM - Earned Value Management
FOC - Full Operational Capability
FMS - Foreign Military Sales
FRP - Full Rate Production
FY - Fiscal Year
FYDP - Future Years Defense Program
ICE - Independent Cost Estimate
IOC - Initial Operational Capability
Inc - Increment
JROC - Joint Requirements Oversight Council
\$K - Thousands of Dollars
KPP - Key Performance Parameter
LRIP - Low Rate Initial Production
\$M - Millions of Dollars
MDA - Milestone Decision Authority
MDAP - Major Defense Acquisition Program
MILCON - Military Construction
N/A - Not Applicable
O&M - Operations and Maintenance
ORD - Operational Requirements Document
OSD - Office of the Secretary of Defense
O&S - Operating and Support
PAUC - Program Acquisition Unit Cost

PB - President's Budget
PE - Program Element
PEO - Program Executive Officer
PM - Program Manager
POE - Program Office Estimate
RDT&E - Research, Development, Test, and Evaluation
SAR - Selected Acquisition Report
SCP - Service Cost Position
TBD - To Be Determined
TY - Then Year
UCR - Unit Cost Reporting
U.S. - United States
USD(AT&L) - Under Secretary of Defense (Acquisition, Technology and Logistics)
USD(A&S) - Under Secretary of Defense (Acquisition and Sustainment)

Program Information

Program Name

Advanced Extremely High Frequency Satellite (AEHF)

DoD Component

Air Force

Joint Participants

Canada; The Netherlands; United Kingdom

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Date Assigned: June 1, 2018

References

SAR Baseline (Production Estimate)

Defense Acquisition Executive (DAE) Approved Acquisition Program Baseline (APB) dated October 23, 2012

Approved APB

Defense Acquisition Executive (DAE) Approved Acquisition Program Baseline (APB) dated October 23, 2012

Mission and Description

Advanced Extremely High Frequency Satellite (AEHF) is a joint service satellite communications system that provides global, survivable, secure, protected, and jam-resistant communications for high priority military ground, sea, and air assets. The system consists of four operational satellites in Geosynchronous Earth Orbit that provide 10 times the capacity of the 1990s-era Military Strategic and Tactical Relay Block II satellites. The system provides continuous 24-hour Extremely High Frequency Extended Data Rate coverage between 65 degrees north and 65 degrees south latitude. AEHF allows the National Security Council and Combatant Commanders to control their tactical and strategic forces at all levels of conflict up to and including general nuclear war, and it supports the attainment of information superiority.

The AEHF operational system is composed of three segments: space, terminals, and mission control. The space segment consists of a cross-linked constellation of satellites to provide worldwide coverage. The terminal segment includes fixed and mobile ground terminals, ship and submarine terminals, and airborne terminals. The mission control segment controls satellites on orbit, monitors satellite health, and provides communication system planning and monitoring. This segment is also survivable, with both fixed and mobile control stations.

International Cooperative Program – The three countries that have signed Memoranda of Understanding are as follows: Canada, November 16, 1999; the Netherlands, November 8, 2002; and the United Kingdom, September 9, 2003. These bilateral agreements allocate a portion of protected communication resources in exchange for financial participation in development. The Netherlands, Canada, and the United Kingdom signed Memoranda of Understanding in preparation for entering into a Foreign Military Sales case to purchase International Partnership variants of AEHF terminals.

Executive Summary

Program Highlights Since Last Report

AEHF 1-3 are fully integrated into the Military Strategic and Tactical Relay AEHF constellation and are performing well with AEHF-1 operating from 4 degrees East (covering Europe, the Middle East, and Western Asia), AEHF-2 operating from 68 degrees West (covering Eastern United States and the Atlantic Ocean), and AEHF-3 operating from 152 degrees East (covering the Pacific Ocean).

AEHF-4 successfully launched from Cape Canaveral Air Force Station, Florida, on October 17, 2018. AEHF-4 is scheduled to complete orbit-raising phase in March 2019 followed by on-orbit checkout in April 2019.

AEHF 5/6 production steadily progressed since contract definitization on October 31, 2013 with a value of \$2.2B. A program delay occurred when an on-contract Scaleable Power Regulator Unit (SPRU) requirement was not met. The MDA approved a Program Deviation Report in October 2017, which addressed these delays. Thus, the AEHF-5 APB launch availability threshold date of December 2018 was unachievable due to the SPRU delays and addition of Acoustic Testing.

AEHF-5 SPRU repairs were completed and re-installed May 2, 2018. The Lockheed Martin satellite bus and the Northrop Grumman payload for AEHF-5 have several closeout tasks remaining. AEHF-5 is scheduled to complete all factory work and begin satellite packaging in March 2019 and ship to the launch base in April 2019.

AEHF-6 SPRU repairs were completed and installed on December 4, 2018. The Lockheed Martin satellite buses for combined AEHF 5/6 effort are 94% complete and the Northrop Grumman payloads for the combined effort are 92% complete. AEHF-6 remains on track to meet Initial Launch Capability.

Launch Availability for AEHF-5 and AEHF-6 are currently March 2019 and December 2019, respectively.

There are no significant software-related issues with this program at this time.

History of Significant Developments Since Program Initiation	
History of Significant Developments Since Program Initiation	
Date	Significant Development Description
May 1999	The DAE signed the Milestone I ADM approving entry into Phase I, System Definition.
August 1999	Two competitive System Definition contracts were awarded to Lockheed/Thompson Ramo Wooldridge (now Northrop Grumman) and Hughes (now Boeing Satellite Systems) teams. Following the System Requirements Review and the Military Strategic and Tactical Relay (Milstar) flight 3 launch failure, the AEHF competition was re-established into a National Team consisting of all three contractors with Lockheed as the prime integration contractor. A "pathfinder" concept was put into effect to mitigate the loss of Milstar 3 capability. This concept included the acceleration of a Milstar II capable AEHF satellite followed by delivery of four additional fully capable AEHF satellites.
May 2000	An ADM was approved by USD(AT&L) that authorized a sole source Firm Fixed Price pathfinder concept award to a team of contractors.
May 2002	Due to fiscal constraints the program was initially broken into two production cycles. The first cycle consisted of AEHF 1-2 and the Mission Control Segment (MCS) development for an FY 2008 IOC. The second cycle included AEHF 3-5 production for a FOC in FY 2012. After FY 2002 Congressional reductions and the initiation of the Transformational Communications Satellite (TSAT) program, the Deputy Secretary of Defense directed a change to the acquisition strategy in December 2002 removing AEHF 4-5 from the baseline.
December 2002	The contract launch dates for AEHF 1-2 were December 2006 and December 2007, and AEHF-3 was projected to be launched in April 2009. The definitized contract breached the APB IOC schedule threshold and overall program cost. An updated APB incorporating the new August 2009 IOC and revised strategy was signed in December 2002.
March 2005	A revised APB to include the launch slip and approval of AEHF-3 procurement was signed. Due to funding constraints, the FY 2004 PB introduced a one-year production gap between AEHF-2 and AEHF-3. In addition to the cost of delaying AEHF-3 production, other subsequent cost drivers, including payload hardware testing, information assurance product delivery delays and replacement of critical electronic parts, drove a one-year launch delay. A Nunn-McCurdy significant unit cost breach was sent to Congress on December 2, 2004.
May 2007	The AEHF 1-2 and MCS developments were well underway. The program successfully completed run-for-record intersegment tests for AEHF/Milstar compatibility. Lockheed Martin successfully demonstrated the ability of the AEHF Satellite Mission Control Subsystem (ASMCS) to command and control the AEHF payload engineering model and the Interim Command and Control (C2) Terminal for Milstar.
September 2008	A Nunn-McCurdy critical unit cost breach notification occurred on September 5, 2008 due to the addition of AEHF-4 to the program and the AEHF 1-2 launch slips' cascading cost and schedule impacts on AEHF-3. The Government had concluded the production gap of four years for AEHF-4 would cause significant cost impacts to obsolescence issues such as Monolithic Microwave Integrated Circuits. The Nunn-McCurdy breach was caused by additional funding required for obsolescence, a seven month schedule delay due to AEHF-1 hardware issues, additional Thermal Vacuum tests, greater than expected AEHF 1-2 integration costs, and an overall IOC schedule slip. The USD(AT&L) signed an ADM on December 29, 2008 certifying the AEHF program to proceed with a fully-funded four-satellite baseline. The ADM established new launch dates of September 2010, 2011, 2012, and 2016.
June 2009	After the cancellation of the TSAT program, the DoD directed the procurement of additional AEHF satellites. The AEHF-4 contract was awarded for \$1.4B in December 2010 and the MDA approved the AEHF 1-4 APB in June 2011. In December 2011, the MDA approved the AEHF 5/6 Acquisition Strategy as a DoD Efficient Space Procurement and the APB designating AEHF 5/6 as a subprogram was

	approved by MDA on October 23, 2012. On October 31, 2013 the Fixed Price Incentive Fee contract was definitized for the block buy of AEHF 5/6.
May 2010	The AEHF program office completed the C2 transition of the five-satellite Milstar constellation from a legacy C2 system to the new AEHF C2 system. In December 2011 an Interim Contractor Support contract was awarded to Lockheed Martin to provide sustainment of the space and ground segments until IOC is achieved.
August 2010	AEHF-1 was successfully launched from Cape Canaveral Air Force Station (CCAFS) on August 14, 2010. AEHF-1 experienced an anomaly that resulted in the failure of a Liquid Apogee Engine. Orbit raising was completed using the Reaction Engine Assemblies on October 24, 2011 after a 14-months effort. Satellite Control Authority (SCA) was transferred on March 12, 2012.
May 2012	AEHF-2 was successfully launched from CCAFS on May 4, 2012 and the space vehicle successfully completed on-orbit testing on September 24, 2012. SCA was transferred on November 7, 2012.
September 2013	AEHF-3 was successfully launched from CCAFS on September 18, 2013.
October 2013	AEHF 5/6 contract definitized with a value of \$2.2B on October 31, 2013.
March 2014	AEHF-3 completed on-orbit testing on January 6, 2014. SCA was completed on March 21, 2014.
May 2014	U.S. Strategic Command declared early operational use of AEHF 1-3 on May 12, 2014. All three satellites fully integrated into the Milstar constellation.
October 2014	On October 16, 2014, the program received PEO certification for the systems (ground and space vehicle) to enter Air Force Operational Test and Evaluation Center System Dedicated Operational Test which began November 3, 2014 and ran through mid-January 2015.
January 2015	Multi-service Operational Test and Evaluation (MOT&E) completed on January 16, 2015 and AEHF-3 began repositioning from its interim MOT&E location of 155 degrees West on January 21, 2015.
March 2015	AEHF-3 arrived at its new operating location of 152 degrees East (covering the Western Pacific Ocean) on March 18, 2015.
July 2015	Air Force Space Command Commander declared AEHF IOC on July 28, 2015.
September 2015	USD(AT&L) redesignated AEHF as an ACAT IC on September 11, 2015.
October 2015	AEHF-2 arrived at its new operating location of 19 degrees East (covering Western Europe and Africa) on October 21, 2015.
January 2016	MCS Increment 7.6 software was operationally accepted.
July 2016	Awarded the Mission Planning Element (MPE) Increment 8.1 development contract.
September 2016	Delivered and installed the AEHF-5 Configurable On-Board Router. Awarded the AEHF 5/6 contract modification to add acoustic testing.
October 2016	Delivered the new AEHF-5 Lithium-Ion batteries and Battery Isolation Switch Unit. Completed AEHF-5 Payload mate. Completed Critical Design Review for Operational Resiliency on AEHF-6 in November 2016.
March 2017	The Military Satellite Communications program office accepted delivery of the MPE Increment 8.0 development software and delivered it to the 4th Space Operations Squadron.
June 2017	Air Force Space Command (AFSPC)/PEO directed Lockheed Martin to fix the AEHF 4-6 Scaleable Power Regulator Unit (SPRU) following a Space and Missile Systems Center Enterprise issue and investigation with the SPRU.
October 2017	The Assistant Secretary of the Air Force for Acquisition, Technology and Logistics approved the AEHF APB Program Deviation Report. The Lockheed Martin Ground Technology Refresh is operational.
December 2017	AFSPC operationally accepted MPE Increment 8.0.
October 2018	AEHF-4 successfully launched from CCAFS, Florida, on October 17, 2018.
December 2018	All AEHF 5/6 SPRU issues are closed and AFSPC operationally accepted MPE Increment 8.1.

Threshold Breaches

APB Breaches

Schedule		<input checked="" type="checkbox"/>
Performance		<input type="checkbox"/>
Cost	RDT&E	<input type="checkbox"/>
	Procurement	<input type="checkbox"/>
	MILCON	<input type="checkbox"/>
	Acq O&M	<input type="checkbox"/>
O&S Cost		<input type="checkbox"/>
Unit Cost	PAUC	<input type="checkbox"/>
	APUC	<input type="checkbox"/>

Explanation of Breach

The schedule breach was previously reported in the December 2017 SAR.

Nunn-McCurdy Breaches

Current UCR Baseline		
	PAUC	None
	APUC	None
Original UCR Baseline		
	PAUC	None
	APUC	None

Schedule



Schedule Events					
Events	SAR Baseline Production Estimate	Current APB Production Objective/Threshold	Current Estimate		
AEHF SV 5-6 Production Decision	May 2012	May 2012	May 2012	May 2012	
Launch Availability AEHF SV-5	Jun 2018	Jun 2018	Dec 2018	Mar 2019¹	(Ch-1)
Launch Availability AEHF SV-6	Jun 2019	Jun 2019	Dec 2019	Dec 2019	(Ch-1)

¹ APB Breach

Change Explanations

(Ch-1) The current estimate for Launch Availability AEHF SV-5 changed from January 2019 to March 2019, and for AEHF SV-6 changed from September 2019 to December 2019 as a result of further refinement of Acoustic Testing and SPRU hardware repairs, and to better align with the initial launch capability window.

Notes

Per APB, Launch Availability is defined as "all factory work has been completed and satellite can be readied for shipment to the launch base."

Acronyms and Abbreviations

SPRU - Scalable Power Regulator Unit
 SV - Space Vehicle

Performance

Performance Characteristics				
SAR Baseline Production Estimate	Current APB Production Objective/Threshold	Demonstrated Performance	Current Estimate	
Capacity				
1.2 Gbps CMTW, 600 Mbps Strategic	1.2 Gbps CMTW, 600 Mbps Strategic	Support at least 500 Mbps for CMTW Scenario and at least 350 Mbps for Strategic Scenario	1.0 Gbps CMTW Scenario, 600 Mbps Strategic Scenario - verified required capability as part of system requirement sell-off prior to AEHF-1 launch.	1.2 Gbps CMTW, 600 Mbps Strategic
Nuclear Protection				
Provide assured communications to survivable nuclear forces exposed to the environment specified in NCGS-89-06, and for those critical networks that support the following critical functions: situation monitoring, decision making, force direction, force management, and planning	Provide assured communications to survivable nuclear forces exposed to the environment specified in NCGS-89-06, and for those critical networks that support the following critical functions: situation monitoring, decision making, force direction, force management, and planning	Provide assured communications to survivable nuclear forces exposed to the environment specified in NCGS-89-06, and for those critical networks that support the following critical functions: situation monitoring, decision making, force direction, force management, and planning	Verified required capability as part of system requirement sell-off prior to AEHF-2 launch.	Provide assured communications to survivable nuclear forces exposed to the environment specified in NCGS-89-06, and for those critical networks that support the following critical functions: situation monitoring, decision making, force direction, force management, and planning.
Access and Control				
Provide users ability to plan, control, & reconfigure their apportioned resources; critical functions such as situation monitoring, decision making, force direction, force management, & planning shall not be disrupted by communications configuration changes to noncritical functions	Provide users ability to plan, control, & reconfigure their apportioned resources; critical functions such as situation monitoring, decision making, force direction, force management, & planning shall not be disrupted by communications configuration changes to noncritical functions	Provide users ability to plan, control, & reconfigure their apportioned resources; critical functions such as situation monitoring, decision making, force direction, force management, & planning shall not be disrupted by communications configuration changes to noncritical functions	Verified required capability as part of system requirement sell-off prior to AEHF-2 launch. Demonstrated LDR operationally ready capability in AEHF-1 on-orbit test.	Provide users ability to plan, control, & reconfigure their apportioned resources; critical functions such as situation monitoring, decision making, force direction, force management, & planning shall not be disrupted by communications configuration changes to noncritical functions.

AEHF Interoperability

Support joint interoperable war-fighter communications among all military branches EHF terminals	Support joint interoperable war-fighter communications among all military branches EHF terminals	Support joint interoperable war-fighter communications among all military branches EHF terminals	Verified required capability as part of system requirement sell-off prior to AEHF-2 launch. Demonstrated operationally ready capability in AEHF-1 on-orbit test.	Support joint interoperable war-fighter communications among all military branches EHF terminals
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Milstar Backward Compatible

Operate with the Milstar system, at all LDR and MDR terminal supported data rates, throughout the Milstar transition to the AEHF system	Operate with the Milstar system, at all LDR and MDR terminal supported data rates, throughout the Milstar transition to the AEHF system	Operate with the Milstar system, at all LDR and MDR terminal supported data rates, throughout the Milstar transition to the AEHF system	Verified required capability as part of system requirement sell-off prior to AEHF-1 launch. Demonstrated operationally ready capability in AEHF-1 on-orbit test.	Operate with the Milstar system, at all LDR and MDR terminal supported data rates, throughout the Milstar transition to the AEHF system
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Classified Performance information is provided in the classified annex to this submission.

Requirements Reference

Operational Requirements Document (ORD), dated October 1, 2000

Change Explanations

None

Acronyms and Abbreviations

CMTW - Combined Major Theater Warfare
 EHF - Extremely High Frequency
 Gbps - Gigabits per second
 LDR - Low Data Rate
 Mbps - Megabits per second
 MDR - Medium Data Rate
 Milstar - Military Strategic and Tactical Relay
 NCGS - Nuclear Criteria Group Secretariat

Track to Budget

General Notes

In December 2014, the Office of Management and Budget directed the DoD to establish a new space procurement appropriation. Beginning in FY 2016, Air Force major procurement funding formerly under 3020F (Missile Procurement, Air Force) BA 05 will now be under 3021F (Space Procurement, Air Force) BA 01, a three-year procurement account.

RDT&E

Appn	BA	PE	
Air Force	3600	04	0603430F
	Project	Name	
	644050	AEHF MILSATCOM (Space)	(Sunk)
	Notes:	FY 2011 only	
	64A030	Evolved AEHF MILSATCOM (EAM)	(Sunk)
	Notes:	FY 2013 only	
Air Force	3600	05	0605431F
	Project	Name	
	657104	Evolved AEHF MILSATCOM (EAM)	(Sunk)
	Notes:	FY 2014 - 2015 only	

Notes

Projects 64A030 and 657104 also fund the Military Satellite Communications (MILSATCOM) Space Modernization Initiative. AEHF RDT&E funding is for the AEHF SV 6 KI-54D cryptographic device. Project 644050 is FY 2011 only. Project 64A030 is FY 2013 only. Project 657104 is for FY 2014 - 2015 only.

Procurement

Appn	BA	PE	
Air Force	3020	05	0303604F
	Line Item	Name	
	ADV555	Advanced EHF	(Sunk)
Air Force	3021	01	0303604F
	Line Item	Name	
	ADV555	Advanced EHF	(Sunk)
	Notes:	Ends in FY 2017	
Air Force	3021	01	1203604F
	Line Item	Name	
	ADV555	Advanced EHF	
	Notes:	FY 2018 - FY 2021	

Notes

Due to the creation of a new appropriation for Space Procurement (3021), satellite vehicle (SV) quantities are accounted for under 3020 annual funding section.

Cost and Funding

Cost Summary

Total Acquisition Cost							
Appropriation	BY 2002 \$M			BY 2002 \$M	TY \$M		
	SAR Baseline Production Estimate	Current APB Production Objective/Threshold		Current Estimate	SAR Baseline Production Estimate	Current APB Production Objective	Current Estimate
RDT&E	59.1	59.1	65.0	50.3	73.8	73.8	63.2
Procurement	2656.0	2656.0	2921.6	2006.1	3414.4	3414.4	2602.8
Flyaway	--	--	--	2006.1	--	--	2602.8
Recurring	--	--	--	2006.1	--	--	2602.8
Non Recurring	--	--	--	0.0	--	--	0.0
Support	--	--	--	0.0	--	--	0.0
Other Support	--	--	--	0.0	--	--	0.0
Initial Spares	--	--	--	0.0	--	--	0.0
MILCON	0.0	0.0	--	0.0	0.0	0.0	0.0
Acq O&M	0.0	0.0	--	0.0	0.0	0.0	0.0
Total	2715.1	2715.1	N/A	2056.4	3488.2	3488.2	2666.0

Cost Notes

If an Independent Cost Estimate, Component Cost Estimate, or Program Office Estimate has been completed for the program in the previous year, list any program risks identified in the estimates, the potential impacts of the risks on program cost, and approaches to mitigate the risks.

Each month a Government Estimate at Complete (EAC) is produced based on actual data collected through Earned Value Management reporting. The Government EAC considers threats and opportunities associated with the contract and the likelihood of occurrence. As of January 2019 month end data, the most likely technical risk is 0.03M while the worst case is 0.14M. The largest cost associated with our program risk is a delay in launch from the current government forecast; however, this is low probability.

Total Quantity				
Quantity	SAR Baseline Production Estimate	Current APB Production	Current Estimate	
RDT&E		0	0	0
Procurement		2	2	2
Total		2	2	2

Cost and Funding

Funding Summary

Appropriation Summary									
FY 2020 President's Budget / December 2018 SAR (TY\$ M)									
Appropriation	Prior	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	To Complete	Total
RDT&E	63.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	63.2
Procurement	2523.9	29.8	31.9	17.2	0.0	0.0	0.0	0.0	2602.8
MILCON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acq O&M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PB 2020 Total	2587.1	29.8	31.9	17.2	0.0	0.0	0.0	0.0	2666.0
PB 2019 Total	2612.1	29.8	31.8	17.2	0.0	0.0	0.0	0.0	2690.9
Delta	-25.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-24.9

Quantity Summary										
FY 2020 President's Budget / December 2018 SAR (TY\$ M)										
Quantity	Undistributed	Prior	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	To Complete	Total
Development	0	0	0	0	0	0	0	0	0	0
Production	0	2	0	0	0	0	0	0	0	2
PB 2020 Total	0	2	0	0	0	0	0	0	0	2
PB 2019 Total	0	2	0	0	0	0	0	0	0	2
Delta	0	0	0	0	0	0	0	0	0	0

Cost and Funding

Annual Funding By Appropriation

Annual Funding							
3600 RDT&E Research, Development, Test, and Evaluation, Air Force							
Fiscal Year	Quantity	TY \$M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2011	--	--	--	--	--	--	13.8
2012	--	--	--	--	--	--	--
2013	--	--	--	--	--	--	15.0
2014	--	--	--	--	--	--	14.4
2015	--	--	--	--	--	--	20.0
Subtotal	--	--	--	--	--	--	63.2

Annual Funding							
3600 RDT&E Research, Development, Test, and Evaluation, Air Force							
Fiscal Year	Quantity	BY 2002 \$M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2011	--	--	--	--	--	--	11.4
2012	--	--	--	--	--	--	--
2013	--	--	--	--	--	--	12.0
2014	--	--	--	--	--	--	11.3
2015	--	--	--	--	--	--	15.6
Subtotal	--	--	--	--	--	--	50.3

Annual Funding 3020 Procurement Missile Procurement, Air Force							
Fiscal Year	Quantity	TY \$M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2011	--	227.2	--	--	227.2	--	227.2
2012	2	524.1	--	--	524.1	--	524.1
2013	--	408.0	--	--	408.0	--	408.0
2014	--	268.4	--	--	268.4	--	268.4
2015	--	233.2	--	--	233.2	--	233.2
Subtotal	2	1660.9	--	--	1660.9	--	1660.9

Annual Funding 3020 Procurement Missile Procurement, Air Force							
Fiscal Year	Quantity	BY 2002 \$M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2011	--	185.6	--	--	185.6	--	185.6
2012	2	421.2	--	--	421.2	--	421.2
2013	--	320.4	--	--	320.4	--	320.4
2014	--	207.7	--	--	207.7	--	207.7
2015	--	178.4	--	--	178.4	--	178.4
Subtotal	2	1313.3	--	--	1313.3	--	1313.3

Cost Quantity Information		
3020 Procurement Missile Procurement, Air Force		
Fiscal Year	Quantity	End Item Recurring Flyaway (Aligned With Quantity) BY 2002 \$M
2011	--	--
2012	2	1313.3
2013	--	--
2014	--	--
2015	--	--
Subtotal	2	1313.3

Annual Funding							
3021 Procurement Space Procurement, Air Force							
Fiscal Year	Quantity	TY \$M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2012	--	--	--	--	--	--	--
2013	--	--	--	--	--	--	--
2014	--	--	--	--	--	--	--
2015	--	--	--	--	--	--	--
2016	--	230.7	--	--	230.7	--	230.7
2017	--	581.0	--	--	581.0	--	581.0
2018	--	51.3	--	--	51.3	--	51.3
2019	--	29.8	--	--	29.8	--	29.8
2020	--	31.9	--	--	31.9	--	31.9
2021	--	17.2	--	--	17.2	--	17.2
Subtotal	--	941.9	--	--	941.9	--	941.9

Annual Funding							
3021 Procurement Space Procurement, Air Force							
Fiscal Year	Quantity	BY 2002 \$M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2012	--	--	--	--	--	--	--
2013	--	--	--	--	--	--	--
2014	--	--	--	--	--	--	--
2015	--	--	--	--	--	--	--
2016	--	173.4	--	--	173.4	--	173.4
2017	--	427.8	--	--	427.8	--	427.8
2018	--	36.9	--	--	36.9	--	36.9
2019	--	21.0	--	--	21.0	--	21.0
2020	--	22.0	--	--	22.0	--	22.0
2021	--	11.7	--	--	11.7	--	11.7
Subtotal	--	692.8	--	--	692.8	--	692.8

FY 2016-2018 and FY 2020 changes reflect realignment of funds between AEHF subprogram 1-4 and AEHF subprogram 5/6 and Congressional General Reductions.

APPN 3021 is a continuation of our APPN 3020 funding that ended in 2015. There is no quantity to align with this funding due to the subprograms between AEHF 1-4 and AEHF5/6. The quantity is captured under APPN 3020 and in FY 2012. All funding is aligned to support quantities in FY 2012 for amounts in APPN 3020 and APPN 3021.

Cost Quantity Information 3021 Procurement Space Procurement, Air Force		
Fiscal Year	Quantity	End Item Recurring Flyaway (Aligned With Quantity) BY 2002 \$M
2012	--	692.8
2013	--	--
2014	--	--
2015	--	--
2016	--	--
2017	--	--
2018	--	--
2019	--	--
2020	--	--
2021	--	--
Subtotal	--	692.8

Low Rate Initial Production

There is no LRIP for this program.

Foreign Military Sales

None

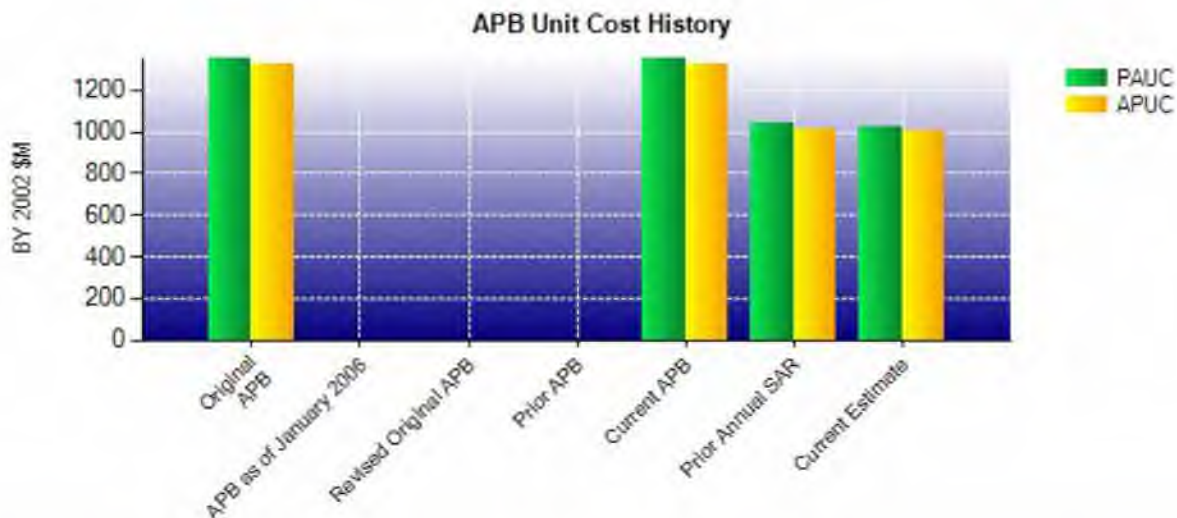
Nuclear Costs

None

Unit Cost

Current UCR Baseline and Current Estimate (Base-Year Dollars)			
Item	BY 2002 \$M	BY 2002 \$M	% Change
	Current UCR Baseline (Oct 2012 APB)	Current Estimate (Dec 2018 SAR)	
Program Acquisition Unit Cost			
Cost	2715.1	2056.4	
Quantity	2	2	
Unit Cost	1357.550	1028.200	-24.26
Average Procurement Unit Cost			
Cost	2656.0	2006.1	
Quantity	2	2	
Unit Cost	1328.000	1003.050	-24.47

Original UCR Baseline and Current Estimate (Base-Year Dollars)			
Item	BY 2002 \$M	BY 2002 \$M	% Change
	Revised Original UCR Baseline (Oct 2012 APB)	Current Estimate (Dec 2018 SAR)	
Program Acquisition Unit Cost			
Cost	2715.1	2056.4	
Quantity	2	2	
Unit Cost	1357.550	1028.200	-24.26
Average Procurement Unit Cost			
Cost	2656.0	2006.1	
Quantity	2	2	
Unit Cost	1328.000	1003.050	-24.47



APB Unit Cost History					
Item	Date	BY 2002 \$M		TY \$M	
		PAUC	APUC	PAUC	APUC
Original APB	Mar 2014	1357.550	1328.000	1744.100	1707.200
APB as of January 2006	N/A	N/A	N/A	N/A	N/A
Revised Original APB	N/A	N/A	N/A	N/A	N/A
Prior APB	N/A	N/A	N/A	N/A	N/A
Current APB	Mar 2014	1357.550	1328.000	1744.100	1707.200
Prior Annual SAR	Dec 2016	1043.550	1018.400	1353.850	1322.250
Current Estimate	Dec 2018	1028.200	1003.050	1333.000	1301.400

SAR Unit Cost History

Current SAR Baseline to Current Estimate (TY \$M)									
PAUC Production Estimate	Changes								PAUC Current Estimate
	Econ	Qty	Sch	Eng	Est	Oth	Spt	Total	
1744.100	29.300	0.000	0.000	0.000	-440.400	0.000	0.000	-411.100	1333.000

Current SAR Baseline to Current Estimate (TY \$M)									
Initial APUC Production Estimate	Changes								APUC Current Estimate
	Econ	Qty	Sch	Eng	Est	Oth	Spt	Total	
1707.200	28.950	0.000	0.000	0.000	-434.750	0.000	0.000	-405.800	1301.400

SAR Baseline History				
Item	SAR Planning Estimate	SAR Development Estimate	SAR Production Estimate	Current Estimate
Milestone A	N/A	N/A	N/A	N/A
Milestone B	N/A	N/A	N/A	N/A
Milestone C	N/A	N/A	N/A	N/A
IOC	N/A	N/A	N/A	N/A
Total Cost (TY \$M)	N/A	N/A	3488.2	2666.0
Total Quantity	N/A	N/A	2	2
PAUC	N/A	N/A	1744.100	1333.000

Cost Variance

Summary TY \$M				
Item	RDT&E	Procurement	MILCON	Total
SAR Baseline (Production Estimate)	73.8	3414.4	--	3488.2
Previous Changes				
Economic	+0.7	+50.9	--	+51.6
Quantity	--	--	--	--
Schedule	--	--	--	--
Engineering	--	--	--	--
Estimating	-11.3	-837.6	--	-848.9
Other	--	--	--	--
Support	--	--	--	--
Subtotal	-10.6	-786.7	--	-797.3
Current Changes				
Economic	--	+7.0	--	+7.0
Quantity	--	--	--	--
Schedule	--	--	--	--
Engineering	--	--	--	--
Estimating	--	-31.9	--	-31.9
Other	--	--	--	--
Support	--	--	--	--
Subtotal	--	-24.9	--	-24.9
Total Changes	-10.6	-811.6	--	-822.2
CE - Cost Variance	63.2	2602.8	--	2666.0
CE - Cost & Funding	63.2	2602.8	--	2666.0

Summary BY 2002 \$M				
Item	RDT&E	Procurement	MILCON	Total
SAR Baseline (Production Estimate)	59.1	2656.0	--	2715.1
Previous Changes				
Economic	--	--	--	--
Quantity	--	--	--	--
Schedule	--	--	--	--
Engineering	--	--	--	--
Estimating	-8.8	-626.3	--	-635.1
Other	--	--	--	--
Support	--	--	--	--
Subtotal	-8.8	-626.3	--	-635.1
Current Changes				
Economic	--	--	--	--
Quantity	--	--	--	--
Schedule	--	--	--	--
Engineering	--	--	--	--
Estimating	--	-23.6	--	-23.6
Other	--	--	--	--
Support	--	--	--	--
Subtotal	--	-23.6	--	-23.6
Total Changes	-8.8	-649.9	--	-658.7
CE - Cost Variance	50.3	2006.1	--	2056.4
CE - Cost & Funding	50.3	2006.1	--	2056.4

Previous Estimate: December 2017

Procurement	\$M	
	Base Year	Then Year
Current Change Explanations		
Revised escalation indices. (Economic)	N/A	+7.0
Adjustment for current and prior escalation. (Estimating)	-4.8	-6.6
Revised estimate due to realignment of funds between AEHF SV 1-4 subprogram and AEHF SV 5/6 subprogram. (Estimating)	-17.9	-24.0
Revised estimate due to Congressional General Reduction in FY 2018. (Estimating)	-0.9	-1.3
Procurement Subtotal	-23.6	-24.9

Contracts

Contract Identification

Appropriation: Procurement
Contract Name: AEHF 5-6 Production and Launch
Contractor: Lockheed Martin
Contractor Location: 1111 Lockheed Martin Way
 Sunnyvale, CA 94089
Contract Number: FA8808-12-C-0010/1
Contract Type: Fixed Price Incentive(Firm Target) (FPIF)
Award Date: May 12, 2012
Definitization Date: October 31, 2013

Contract Price							
Initial Contract Price (\$M)			Current Contract Price (\$M)			Estimated Price At Completion (\$M)	
Target	Ceiling	Qty	Target	Ceiling	Qty	Contractor	Program Manager
1914.4	2001.6	2	2048.6	2136.1	2	2018.0	1994.1

Target Price Change Explanation

The difference between the Initial Contract Price Target and the Current Contract Price Target is due to the addition of the AEHF 5/6 acoustic test study (CLIN 4000) for \$2.2M, the AEHF-5 Lithium-Ion (Lilon) battery test study (CLIN 0410) for \$0.5M, the addition of the AEHF-6 Lilon battery test study (CLIN 0410) for \$0.4M, the addition of AEHF 5/6 acoustic testing for \$95.1M, the addition of the OR2/Atlas 551 contract for \$21.9M, the Request for Equitable Adjustment for Liquid Apogee Engine 4 corners testing of \$12.1M, Payload Adapter Harnesses Procurement for \$0.5M, and negotiated Atlas V 551 Configuration for \$1.2M.

Contract Variance		
Item	Cost Variance	Schedule Variance
Cumulative Variances To Date (1/27/2019)	+110.9	-12.5
Previous Cumulative Variances	+66.9	-18.5
Net Change	+44.0	+6.0

Cost and Schedule Variance Explanations

The favorable net change in the cost variance is due to efficiencies as a result of learning curve and resource sharing with other Lockheed Martin Space programs programs.

The favorable net change in the schedule variance is due to the initial Scaleable Power Regulator Unit impact on AEHF, but afterwards the negative variance had eroded.

Deliveries and Expenditures

Deliveries				
Delivered to Date	Planned to Date	Actual to Date	Total Quantity	Percent Delivered
Development	0	0	0	--
Production	0	0	2	0.00%
Total Program Quantity Delivered	0	0	2	0.00%

Expended and Appropriated (TY \$M)			
Total Acquisition Cost	2666.0	Years Appropriated	9
Expended to Date	2215.6	Percent Years Appropriated	81.82%
Percent Expended	83.11%	Appropriated to Date	2616.9
Total Funding Years	11	Percent Appropriated	98.16%

The above data is current as of March 11, 2019.

Operating and Support Cost

Cost Estimate Details

Date of Estimate:	January 24, 2019
Source of Estimate:	POE
Quantity to Sustain:	1
Unit of Measure:	System
Service Life per Unit:	14.00 Years
Fiscal Years in Service:	FY 2015 - FY 2030

Current estimate updated to reflect changes based on actual costs and content of the Combined Orbital Operations Logistics Sustainment (COOLS) contracts. The AEHF system being sustained consists of a six satellite (four operational satellites (AEHF 1-4) and two on-orbit spares (AEHF 5/6)) constellation and associated ground segment.

Sustainment Strategy

The O&S costs supports a six satellite (four operational satellites (AEHF 1-4) and two on-orbit spares (AEHF 5/6)) constellation and associated ground segment from FY 2015 through FY 2030. There is a study under way to expand the constellation and include SVs 5 and 6 in the active constellation. The estimates assume that the 4th Space Operations Squadron at Schriever Air Force Base (AFB) will operate AEHF and Milstar in parallel. Due to its proprietary nature of the AEHF Space Satellite (on-orbit) Segment is not core and the Depot Source of Repair is Contractor Logistics Support for the life of the satellites. Sustainment of the AEHF Space Satellite (on-orbit) Segment transferred to the COOLS contract post-IOC. All other AEHF workloads are core. Tobyhanna Army Depot is the selected depot for hardware with formal stand up of depot support scheduled for June 2019. Ogden Air Logistics Center, Hill AFB UT is the selected depot for software. A Public Private Partnership is in place under COOLS and will continue to ramp up ground software capability over the life of the contract.

Antecedent Information

The antecedent system for AEHF is Milstar which consists of a five satellite constellation and associated ground segment. The cost estimate is based on validated requirements in the Air Force Space Command Logistics Support Requirements Brochures built for the FY 2004 President's Budget. The Milstar O&S costs cover all operational activities for both the space and ground segment for FY 2009 - FY 2018. The antecedent Milstar program office estimate is from April 2003 finalized in Air Force Space Command's budget request to Headquarters Air Force.

Annual O&S Costs BY2002 \$M			
Cost Element	AEHF SV 5-6		Milstar (Antecedent)
	Average Annual Cost Per System		Average Annual Cost Per System
Unit-Level Manpower		17.901	16.900
Unit Operations		2.040	13.200
Maintenance		3.354	3.900
Sustaining Support		40.464	39.000
Continuing System Improvements		66.458	0.000
Indirect Support		5.785	7.200
Other		0.000	0.000
Total		136.002	80.200

AEHF Average Annual Cost Per System numbers above reflect costs for planning usage and monitoring health of the AEHF constellation.

Item	Total O&S Cost \$M			
	AEHF SV 5-6			Milstar (Antecedent)
	Current Production APB Objective/Threshold		Current Estimate	
Base Year	881.3	969.4	947.0	801.5
Then Year	1453.8	N/A	1400.3	N/A

Equation to Translate Annual Cost to Total Cost

$(\text{AEHF SV1-4 Total O\&S Cost} + \text{AEHF 5-6 Total O\&S Cost}) / 16 \text{ years} = \text{Average Annual O\&S cost}$
 $(\$1,228.8\text{M} + \$946.9\text{M}) / 16 = \$136.0\text{M}$

The O&S estimate covers the 14 year design life of the AEHF system (4 active satellite constellation, two spares, and associated ground segment) starting in FY 2017 and going through FY 2030. The 16 year divisor in the equation is based on the O&S start date in FY 2015 carrying through FY 2030. Sustainment of the system executed under the RDT&E Interim Contractor Support contract when the first AEHF satellite launched in FY 2010 and transitioned to O&S funding once IOC was declared on July 28, 2015.

O&S Cost Variance		
Category	BY 2002 \$M	Change Explanations
Prior SAR Total O&S Estimates - Dec 2017 SAR	959.8	
Programmatic/Planning Factors	0.0	
Cost Estimating Methodology	0.0	
Cost Data Update	-12.8	Actual Contract Costs (COOLS), Depot SW Maintenance Requirements
Labor Rate	0.0	

Energy Rate	0.0
Technical Input	0.0
Other	0.0
Total Changes	-12.8
Current Estimate	947.0

Disposal Estimate Details

Date of Estimate:	January 24, 2019
Source of Estimate:	POE
Disposal/Demilitarization Total Cost (BY 2002 \$M):	0.9

Total costs for disposal of all System are \$0.9M.