RCS: DD-A&T(Q&A)823-121

Enhanced Polar System (EPS)

As of FY 2021 President's Budget

Defense Acquisition Management
Information Retrieval
(DAMIR)

Table of Contents

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

Enhanced Polar System (EPS)

DoD Component

Air Force

Joint Participants

Norwegian Ministry of Defence

This is a United States Space Force program.

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References

SAR Baseline (Development Estimate)

Defense Acquisition Executive (DAE) Approved Acquisition Program Baseline (APB) dated April 30, 2014

Approved APB

Component Acquisition Executive (CAE) Approved Acquisition Program Baseline (APB) dated June 21, 2019

Mission and Description

The Enhanced Polar System (EPS) provides continuous protected communication (low probability of interception and detection) over the North Polar Region using two communications payloads on classified host satellites in highly elliptical Molniya orbits.

EPS is composed of four segments: the Extended Data Rate Payload (integrated onto a classified host), the User Terminals (acquired separately by the users), the Gateway (GW) (a fixed installation), and the Control and Planning Segment (CAPS) (another fixed installation). The Payload segment provides protected Extremely High Frequency communications in the North Polar Region. The Terminal segment provides the communication link to the EPS users. The GW segment provides connectivity between the north polar users and the mid-latitude users via the Defense Information System Network / Global Information Grid. CAPS acts as the Satellite Operations Center with command and control, mission and crypto planning, test and sustainment, training, ephemeris, and key distribution workload.

The Enhanced Polar System - Recapitalization (EPS-R) is a continuation of EPS and will prevent a coverage gap in protected polar satellite communications, until the early/mid 2030s, for warfighters in the North Polar Region, in benign and contested environments; will fly in a Three Apogee orbit; and the EPS-R payloads will be hosted on two Space Norway-procured space vehicles, which is the first international collaboration of its kind. The approved APB includes delivery of the EPS-R payloads and tactical ground system but does not include the strategic capability.

On December 20, 2019, the President of the United States established the United States Space Force which assumed the responsibility for all major space acquisition programs. This program is now a United States Space Force program.

Executive Summary

Program Highlights Since Last Report

The Air Force program manager is responsible for fielding and integrating EPS/EPS-R, which includes the Control and Planning Segment (CAPS), Payload, and Gateway (GW); each terminal program office is responsible for its user terminals.

The June 21, 2019 approved EPS APB update adds EPS-R tactical capability deliveries to the EPS program baseline.

EPS:

The Air Force acquired two payloads through a classified host in accordance with the approved EPS ADM dated December 8, 2007. CAPS completed development and installation in 2015. The Air Force issued a two-year Authority to Operate (ATO) for CAPS in May 2018. The GW Segment completed hardware installation at Clear Air Force Station (CAFS), Alaska and Camp Roberts, California in 2015. The Air Force renewed a 2-year GW ATO in November 2019. Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL) provided the Telemetry and Command (T&C) Terminal (T&C-T) for telemetry and command of the payload. The Navy Multiband Terminal, funded and fielded by the Navy, is the only EPS-R-compatible user terminal at this time.

Developmental integrated system testing successfully completed in December 2017. Lead Developmental Test Organization testing commenced in January 2018 and completed in December 2018. Multi-Service Operational Test and Evaluation began in March 2019 and successfully completed in June 2019. On September 19, 2019, the Air Force declared Operational Acceptance, IOC, and FOC for the original EPS program. United States Space Command accepted EPS for operational use on November 19, 2019. The original EPS program is transitioning to sustainment.

EPS-R:

EPS-R added two payloads to the EPS program. The Air Force awarded a sole-source contract to Northrop Grumman Aerospace Systems for two EPS-R payloads on February 6, 2018 and definitized the contract on August 10, 2018. The Payload segment successfully completed Preliminary Design Review (PDR) in November 2018 and Critical Design Review in October 2019. In addition, the Air Force awarded a sole-source contract to Northrop Grumman Mission Systems on May 2, 2019 to update the CAPS software for EPS-R. The program office completed a successful CAPS System Requirements Review in August 2019 and PDR in November 2019.

The Space Force continues to leverage the Naval Information Warfare Center Pacific as the organic Gateway upgrade developer. A second MIT/LL T&C-T will be installed at CAFS to support the T&C function.

The Space Force is collaborating with Norway to host the two EPS-R payloads on Space Norway-procured space vehicles. The Arctic Memorandum of Agreement (MOA), approved May 28, 2019, establishes the framework for this collaboration. In July 2019, Space Norway signed a contract with Northrop Grumman Innovation Systems to be the space vehicle developer and with Space Exploration Technologies Corporation for a commercial dual-launch service. The Air Force coordinated and supported the inaugural Arctic MOA Steering Committee meeting between the United States and Norway on September 10, 2019. A dual-launch of both EPS-R hosted payloads is scheduled for first quarter FY 2023.

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

History of Significant Developments Since Program Initiation

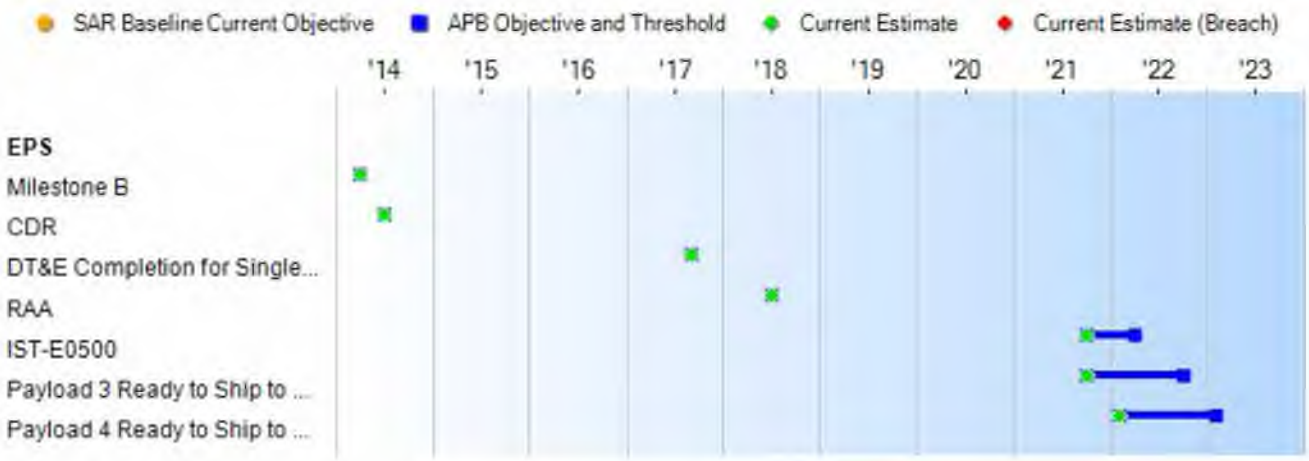
History of Significant Developments Since Program Initiation	
Date	**Significant Development Description**
September 2006	The original EPS CDD was JROC approved September 26, 2006.
May 2007	Predecessor Interim Polar System (IPS) payloads 2 and 3 became available in 2007 and 2008.
May 2008	Predecessor IPS Payload 1 was placed into on-orbit spare status.
July 2008	EPS payload contract awarded July 7, 2008.
December 2009	OSD CAPE conducted an Analysis of Alternatives (AoA) sufficiency review of EPS and determined that no further effort should be expended on polar communications studies. An AoA sufficiency memo was signed by OSD CAPE on December 18, 2009.
September 2010	The need for a polar Military Satellite Communications capability traces to the Joint Space Communications Layer ICD dated September 28, 2010.
January 2011	The CDD updated to reflect a reduced requirement set January 25, 2011.
January 2014	The EPS SCP was completed January 28, 2014.
April 2014	The original EPS APB was completed April 30, 2014 and Milestone B was achieved in April 2014.
July 2014	System Critical Design Review was completed in July 2014.
September 2017	The EPS-R ADM dated September 7, 2017 directed the Air Force to begin procurement of a third and fourth EPS Payload and provide an update to the original EPS APB dated April 30, 2014.Developmental Test and Evaluation Single String included one Hosted Payload, Interim Command and Control, Control and Planning Segment (CAPS), and the Gateway system with one Navy Multiband Terminal completed in September 2017.
July 2018	EPS final APB milestone (Required Assets Available) achieved.
August 2018	EPS-R payload contract definitized August 10, 2018.
November 2018	Payload delta Preliminary Design Review was completed November 28, 2018.
December 2018	The EPS-R SCP was completed December 10, 2018.
March 2019	Achieved PEO Certification to enter Multi-Service Operational test and Evaluation (MOT&E) on March 7, 2019 and MOT&E commenced on March 25, 2019.
May 2019	EPS-R CAPS contract awarded May 2, 2019.
May 2019	Arctic Memorandum of Agreement signed by Air Force and Norwegian Ministry of Defence May 28, 2019.
June 2019	EPS MOT&E successfully completed June 11, 2019.
June 2019	EPS APB updated to include EPS-R June 21, 2019.
September 2019	Air Force Operational Test and Evaluation Center and Director, Operational Test and Evaluation test reports concluded EPS is Operationally Effective and Suitable. Air Force Space Command declared EPS Operational Acceptance and Initial/Full Operational Capability with no liens or deficiencies on September 19, 2019.
October 2019	EPS-R payload delta Critical Design Review completed October 9, 2019.
November 2019	United States Space Command Operationally Accepted EPS on November 19, 2019.
November 2019	EPS-R CAPS delta Preliminary Design Review was completed on November 25, 2019.

Threshold Breaches

APB Breaches		
Schedule		☐
Performance		☐
Cost	RDT&E	☐
	Procurement	☐
	MILCON	☐
	Acq O&M	☐
O&S Cost		☐
Unit Cost	PAUC	☐
	APUC	☐

Nunn-McCurdy Breaches		
Current UCR Baseline		
	PAUC	None
	APUC	None
Original UCR Baseline		
	PAUC	None
	APUC	None

Schedule



Schedule Events				
Events	SAR Baseline Development Estimate	Current APB Development Objective/Threshold		Current Estimate
Milestone B	Apr 2014	Apr 2014	Apr 2014	Apr 2014
CDR	Aug 2014	Jul 2014	Jul 2014	Jul 2014
DT&E Completion for Single String	May 2017	Sep 2017	Sep 2017	Sep 2017
RAA	Jun 2018	Jul 2018	Jul 2018	Jul 2018
IST-E0500	N/A	Oct 2021	Apr 2022	Oct 2021
Payload 3 Ready to Ship to Host	N/A	Oct 2021	Oct 2022	Oct 2021
Payload 4 Ready to Ship to Host	N/A	Feb 2022	Feb 2023	Feb 2022

Change Explanations

None

Notes

DT&E Completion for Single String included one Hosted Payload, IC2, CAPS, and the Gateway system with one NMT as defined by Section 12.0 of the EPS CDD dated September 15, 2011 in support of IOC. This milestone was completed as of September 2017.

RAA is the date two hosted payloads, IC2, CAPS, and the Gateway system with the three NMTs are available for operational use per Section 12.3 of the EPS CDD dated September 15, 2011 in support of FOC. This milestone was completed in July 2018.

IST-E0500 is a factory level Intersegment Test between the Payload Engineering Model Testbed, the Host simulator, and EPS-R CAPS. Completion of this test is needed to burn down risk prior to shipment of Payload 3 and 4 to the satellite vehicle contractor for integration and test.

Payload Ready to Ship is defined as all factory work has been completed and payload can be readied for shipment to the satellite vehicle contractor facility for integration and test prior to launch. The threshold date margin of one year is due to the significant dependence on the Space Norway procurement schedule and the ability of Space Norway's selected space vehicle contractor to meet EPS-R payload development schedule.

Acronyms and Abbreviations

CAPS - Control and Planning Segment
CDR - Critical Design Review
DT&E - Developmental Test and Evaluation
IC2 - Interim Command and Control
IST - Integrated System Test
NMT - Navy Multiband Terminal
RAA - Required Assets Available

Performance

Performance Characteristics				
SAR Baseline Development Estimate	**Current APB Development Objective/Threshold**		**Demonstrated Performance**	**Current Estimate**
Coverage				
Provide continuous 24-hour coverage anywhere from 65° North latitude to 90° North latitude and CONUS.	Provide continuous 24 -hour coverage anywhere from 65° North latitude to 90° North latitude and CONUS.	Provide continuous 24 -hour coverage anywhere from 65° North latitude to 90° North latitude.	Verification performed to the threshold level; threshold parameter was met.	Provide continuous 24 -hour coverage anywhere from 65° North latitude to 90° North latitude and CONUS.
Capacity				
EPS shall have an 18 Mbps capacity to support the CCDR's mission capabilities in the North Polar Region.	EPS shall have an 18 Mbps capacity to support the CCDR's mission capabilities in the North Polar Region.	Provide the capacity to support the CCDR's minimum mission capabilities in the North Polar Region.	Verification performed to the threshold level; threshold parameter was met.	EPS shall have an 18 Mbps capacity to support the CCDR's mission capabilities in the North Polar Region.
Protection - AJ				
Provide anti-jam protection against the medium probability far-term fixed and transportable jammers.	Provide anti-jam protection against the medium probability far -term fixed and transportable jammers.	(T=O) Provide anti-jam protection against the medium probability far-term fixed and transportable jammers.	Verification performed to the threshold level; threshold parameter was met.	Provide AJ protection against the medium probability far-term fixed and transportable jammers.
Protection - LPI/LPD				
LPI/LPD - Satisfy CEVR require-ments.	LPI/LPD - Satisfy CEVR requirements.	(T=O) LPI/LPD - Satisfy CEVR requirements.	Verification performed to the threshold level; threshold parameter was met.	LPI/LPD - Satisfy CEVR requirements.
Operational Management - Users				
Provide users a capability to plan, control, and reconfigure their assigned resources.	Provide users a capability to plan, control, and reconfigure their assigned resources.	(T=O) Provide users a capability to plan, control, and reconfigure their assigned resources.	Verification performed to the threshold level; threshold parameter was met.	Provide users a capability to plan, control, and reconfigure their assigned resources.
Operational Management - System				
Plan, configure, monitor, manage and control the	Plan, configure, monitor, manage and control the payload,	(T=O) Plan, configure, monitor, manage and control the payload,	Verification performed to the threshold level;	Plan, configure, monitor, manage and control the payload,

payload, network and terminal resources.	network and terminal resources.	network and terminal resources.	threshold parameter was met.	network and terminal resources.
Net Readiness				
100 percent of interfaces; services; policy-enforcement controls; and data correctness, availability and processing requirements in the Joint integrated architecture.	100 percent of interfaces; services; policy-enforcement controls; and data correctness, availability and processing requirements in the Joint integrated architecture.	100 percent of interfaces; services; policy-enforcement controls; and data correctness, availability and processing requirements designated as enterprise-level or critical in the Joint integrated architecture.	Verification performed to the threshold level; threshold parameter was met.	100 percent of interfaces; services; policy-enforcement controls; and data correctness, availability and processing requirements in the Joint integrated architecture.
Interconnectivity				
The EPS system Gateway(s) shall simultan-eously provide continuous access to the rising and descending EPS payloads during communi-cations payload availability and simultaneous access to a GIG point of presence.	The EPS system Gateway(s) shall simultaneously provide continuous access to the rising and descending EPS payloads during communications payload availability and simultaneous access to a GIG point of presence.	(T=O) The EPS system Gateway(s) shall simultaneously provide continuous access to the rising and descending EPS payloads during communications payload availability and simultaneous access to a GIG point of presence.	Verification performed to the threshold level; threshold parameter was met.	The EPS system Gateway(s) shall simultaneously provide continuous access to the rising and descending EPS payloads during communications payload availability and simultaneous access to a GIG point of presence.

Requirements Reference

CDD dated September 15, 2011, Clarification Memo dated May 20, 2013, Clarification Memo dated June 25, 2018, and Clarification Memo dated July 25, 2018

Change Explanations

None

Notes

EPS MOT&E successfully completed June 11, 2019. AFOTEC and DOT&E test reports concluded that EPS is operationally effective and suitable with no deficiencies or liens. On September 19, 2019, AFSPC declared Operational Acceptance, IOC, and FOC. On November 19, 2019, USSPACECOM accepted EPS for operational use.

Acronyms and Abbreviations

AFOTEC - Air Force Operational Test and Evaluation Center
AFSPC - Air Force Space Command
AJ - Anti-Jamming
CCDR - Combatant Commander
CEVR - Circular Equivalent Vulnerability Radius
CONUS - Continental United States
DOT&E - Director Operational Test and Evaluation
GIG - Global Information Grid
LPD - Low Probability of Detection
LPI - Low Probability of Intercept
Mbps - Megabits per second
MOT&E - Multi-Service Operational Test and Evaluation
O - Objective
T - Threshold
USSPACECOM - United States Space Command

Track to Budget

General Notes

In December 2019, the Office of Management and Budget directed the DoD to establish new Space Force RDT&E and procurement appropriations. Beginning in FY 2021, space-related RDT&E funding, formerly under 3600F (RDT&E, Air Force) is contained in 3620SF (RDT&E, Space Force) and space procurement funding formerly under 3021F (Space Procurement, Air Force) is contained in 3022SF (Procurement, Space Force).

RDT&E

Appn	BA	PE	
Air Force	3600 04	0603432F	
	Project	**Name**	
	644052	Polar Satellite Communications	(Sunk)
Air Force	3600 05	0605432F	
	Project	**Name**	
	657105	Polar Satellite Communications	(Sunk)
Air Force	3600 05	1206432F	
	Project	**Name**	
	654215	EPS Recap	(Sunk)
	Notes:	EPS-R BPAC FY20	
	657105	Polar Satellite Communications	(Sunk)
Air Force	3600 04	1206434F	
	Project	**Name**	
	643720	EPS Recapitalization	(Sunk)
	Notes:	Project ended in FY19; Funds transferred to PE 1206432F, Project 654215	
Air Force	3620 05	1206432SF	
	Project	**Name**	
	654215	EPS Recap	

Cost and Funding

Cost Summary

Total Acquisition Cost							
Appropriation	BY 2014 $M			BY 2014 $M	TY $M		
	SAR Baseline Development Estimate	Current APB Development Objective/Threshold		Current Estimate	SAR Baseline Development Estimate	Current APB Development Objective	Current Estimate
RDT&E	1389.1	2548.7	2803.6	2488.8	1338.5	2649.7	2578.3
Procurement	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flyaway	--	--	--	0.0	--	--	0.0
Recurring	--	--	--	0.0	--	--	0.0
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	0.0
Acq O&M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	1389.1	2548.7	N/A	2488.8	1338.5	2649.7	2578.3

Current APB Cost Estimate Reference

Legacy EPS and EPS Recapitalization (EPS-R) SCP costs are combined for this APB update. All legacy EPS requirements remain unchanged. EPS SCP dated January 28, 2014 and EPS-R SCP dated December 10, 2018

Cost Notes

No cost estimate for the program has been completed in the previous year.

FY 2021 PB includes funding for EPS (FY 2006-2019) and EPS-R (FY 2017-2024).

Cost is based on the EPS actual costs and the EPS-R SCP.

Total Quantity			
Quantity	SAR Baseline Development Estimate	Current APB Development	Current Estimate
RDT&E	2	4	4
Procurement	0	0	0
Total	2	4	4

Quantity Notes

The four payloads (two EPS payloads and an additional two EPS-R payloads) are funded by RDT&E. EPS has no procurement funding or quantities.

The EPS APB update approved June 21, 2019 includes the addition of EPS-R.

Cost and Funding

Funding Summary

Appropriation Summary FY 2021 President's Budget / December 2019 SAR (TY$ M)									
Appropriation	Prior	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	To Complete	Total
RDT&E	1800.6	412.4	190.2	129.5	35.5	10.1	0.0	0.0	2578.3
Procurement	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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 2021 Total	1800.6	412.4	190.2	129.5	35.5	10.1	0.0	0.0	2578.3
PB 2018 Total	1331.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1331.2
Delta	469.4	412.4	190.2	129.5	35.5	10.1	0.0	0.0	1247.1

Funding Notes

The prior year funding does not include the Interim Polar System, consistent with the approved scope of the EPS program.

Quantity Summary FY 2021 President's Budget / December 2019 SAR (TY$ M)										
Quantity	Undistributed	Prior	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	To Complete	Total
Development	4	0	0	0	0	0	0	0	0	4
Production	0	0	0	0	0	0	0	0	0	0
PB 2021 Total	4	0	0	0	0	0	0	0	0	4
PB 2018 Total	2	0	0	0	0	0	0	0	0	2
Delta	2	0	0	0	0	0	0	0	0	2

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
2006	--	--	--	--	--	--	6.0
2007	--	--	--	--	--	--	34.0
2008	--	--	--	--	--	--	171.8
2009	--	--	--	--	--	--	220.8
2010	--	--	--	--	--	--	246.5
2011	--	--	--	--	--	--	131.6
2012	--	--	--	--	--	--	97.8
2013	--	--	--	--	--	--	77.2
2014	--	--	--	--	--	--	101.4
2015	--	--	--	--	--	--	92.8
2016	--	--	--	--	--	--	81.9
2017	--	--	--	--	--	--	50.3
2018	--	--	--	--	--	--	92.7
2019	--	--	--	--	--	--	395.8
2020	--	--	--	--	--	--	412.4
Subtotal	4	--	--	--	--	--	2213.0

Annual Funding 3600 | RDT&E | Research, Development, Test, and Evaluation, Air Force							
Fiscal Year	Quantity	BY 2014 $M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2006	--	--	--	--	--	--	6.8
2007	--	--	--	--	--	--	37.6
2008	--	--	--	--	--	--	186.5
2009	--	--	--	--	--	--	236.5
2010	--	--	--	--	--	--	260.8
2011	--	--	--	--	--	--	136.6
2012	--	--	--	--	--	--	99.8
2013	--	--	--	--	--	--	77.5
2014	--	--	--	--	--	--	100.4
2015	--	--	--	--	--	--	90.9
2016	--	--	--	--	--	--	79.1
2017	--	--	--	--	--	--	47.6
2018	--	--	--	--	--	--	85.9
2019	--	--	--	--	--	--	360.0
2020	--	--	--	--	--	--	367.6
Subtotal	4	--	--	--	--	--	2173.6

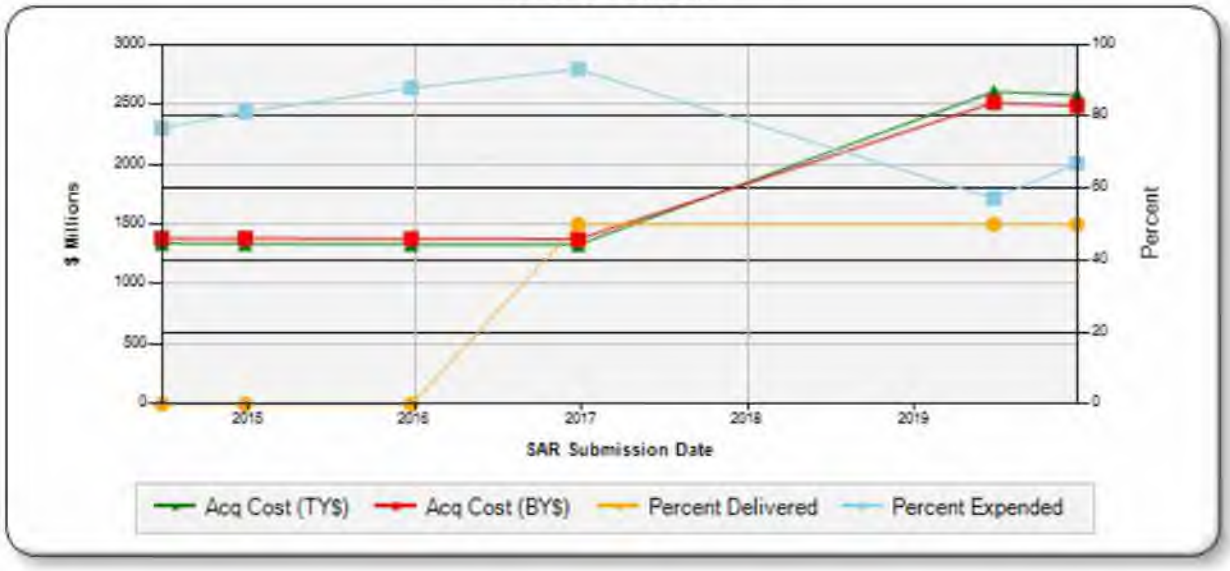
Annual Funding 3620 | RDT&E | Research, Development, Test, and Evaluation, Space Force, Air Force							
Fiscal Year	Quantity	TY $M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2021	--	--	--	--	--	--	190.2
2022	--	--	--	--	--	--	129.5
2023	--	--	--	--	--	--	35.5
2024	--	--	--	--	--	--	10.1
Subtotal	--	--	--	--	--	--	365.3

Annual Funding 3620 | RDT&E | Research, Development, Test, and Evaluation, Space Force, Air Force							
Fiscal Year	Quantity	BY 2014 $M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2021	--	--	--	--	--	--	166.2
2022	--	--	--	--	--	--	110.9
2023	--	--	--	--	--	--	29.8
2024	--	--	--	--	--	--	8.3
Subtotal	--	--	--	--	--	--	315.2

Charts

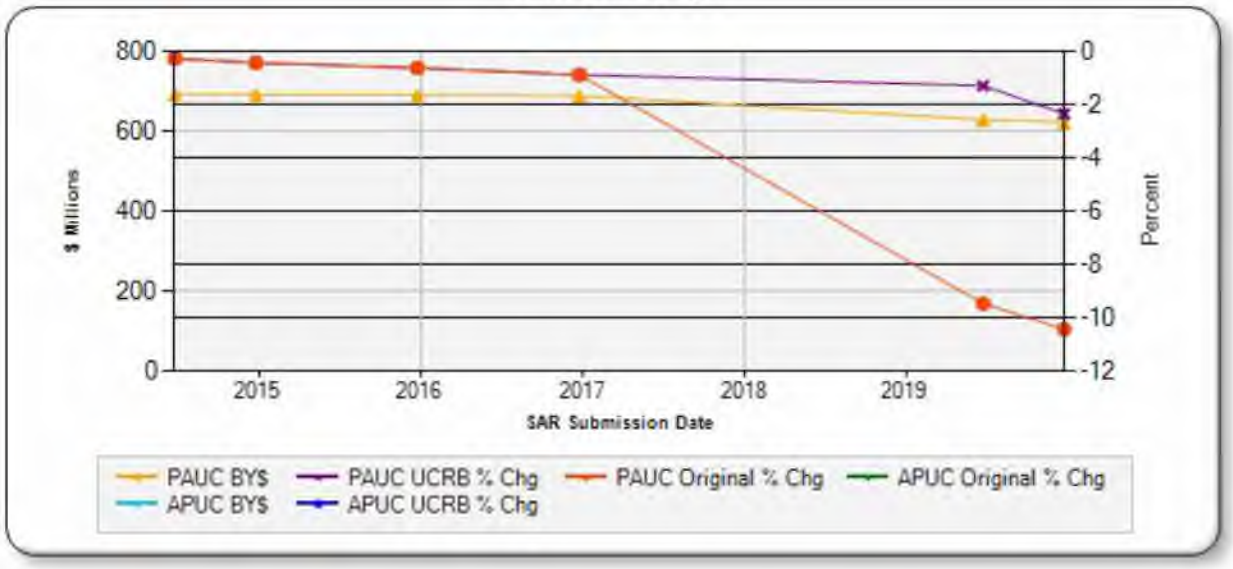
EPS first began SAR reporting in June 2014

Program Acquisition Cost - EPS
Base Year 2014 $M



Quantity - EPS

Unit Cost - EPS
Base Year 2014 $M



Risks

Significant Schedule and Technical Risks

Significant Schedule and Technical Risks	
Milestone B (April 2014)	
1.	Based on historical DoD experience with space system ground software efforts, the Control and Planning Segment (CAPS) software development effort was likely to experience difficulties during execution. CAPS schedule duration growth would result in contract cost growth and significantly reduce overall schedule margins. OSD exercised a limited Independent Program Assessment focused on CAPS software, but found no major issues or showstoppers.
Current Estimate (December 2019)	
1.	Meeting Space Norway Schedule Risk - If the program does not successfully complete delivery of payloads to the space vehicle factory and integration of the payloads onto the space vehicles in time to meet the Space Norway need date, then the program would impact the launch date resulting in cost and schedule impacts.
2.	No additional significant risks identified with the Critical Design Review.

Risks

Risk and Sensitivity Analysis

Risks and Sensitivity Analysis	
Current Baseline Estimate (June 2019)	
1.	Norway Collaboration Cost Risk - If Norway collaboration costs increase beyond the negotiated target cost, then the EPS Program Office will be required to identify additional funding, resulting in cost increases to the program.
Original Baseline Estimate (April 2014)	
1.	April 2014 EPS SCP included additional risk due to historical DoD experience with space system ground software efforts, similar to EPS Control and Planning Segment (CAPS), which often cause difficulties during development. EPS CAPS experienced only minimal cost growth and schedule delays, and the contract is over 90% complete.
Revised Original Estimate (N/A)	
1.	N/A
Current Procurement Cost (December 2019)	
1.	Total Acquisition Cost - $2488.0M (BY 2014); PAUC - $637.2M; Risks - Space vehicle integration, international collaboration, and an aggressive program schedule.

Low Rate Initial Production

There is no LRIP for this program.

Foreign Military Sales

Notes

The EPS program has no FMS; there is a Memorandum of Agreement codifying an international collaboration between the Air Force and Norwegian Ministry of Defence.

Nuclear Costs

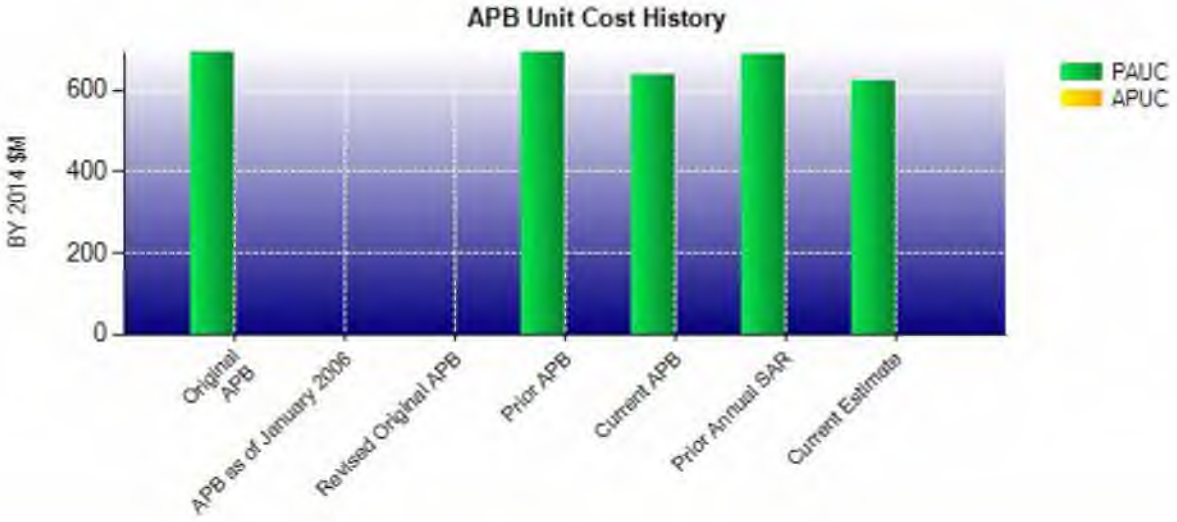
None

Unit Cost

Current UCR Baseline and Current Estimate (Base-Year Dollars)			
Item	BY 2014 $M Current UCR Baseline (Jun 2019 APB)	BY 2014 $M Current Estimate (Dec 2019 SAR)	% Change
Program Acquisition Unit Cost			
Cost	2548.7	2488.8	
Quantity	4	4	
Unit Cost	637.175	622.200	-2.35
Average Procurement Unit Cost			
Cost	0.0	0.0	
Quantity	0	0	
Unit Cost	--	--	--

Original UCR Baseline and Current Estimate (Base-Year Dollars)			
Item	BY 2014 $M Original UCR Baseline (Apr 2014 APB)	BY 2014 $M Current Estimate (Dec 2019 SAR)	% Change
Program Acquisition Unit Cost			
Cost	1389.1	2488.8	
Quantity	2	4	
Unit Cost	694.550	622.200	-10.42
Average Procurement Unit Cost			
Cost	0.0	0.0	
Quantity	0	0	
Unit Cost	--	--	--

The PAUC is based on RDT&E cost and quantities only. There is no APUC for this program because there are no procurement funds or quantities.



APB Unit Cost History					
Item	Date	BY 2014 $M		TY $M	
		PAUC	APUC	PAUC	APUC
Original APB	Apr 2014	694.550	N/A	669.250	N/A
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	Apr 2014	694.550	N/A	669.250	N/A
Current APB	Jun 2019	637.175	N/A	662.425	N/A
Prior Annual SAR	Dec 2016	688.400	N/A	665.600	N/A
Current Estimate	Dec 2019	622.200	N/A	644.575	N/A

SAR Unit Cost History

Current SAR Baseline to Current Estimate (TY $M)									
PAUC Development Estimate	Changes								PAUC Current Estimate
	Econ	Qty	Sch	Eng	Est	Oth	Spt	Total	
669.250	0.850	-23.675	0.000	0.000	-1.850	0.000	0.000	-24.675	644.575

Current SAR Baseline to Current Estimate (TY $M)									
Initial APUC Development Estimate	Changes								APUC Current Estimate
	Econ	Qty	Sch	Eng	Est	Oth	Spt	Total	
0.000	--	--	--	--	--	--	--	--	0.000

An APUC Unit Cost History is not available, since no Initial APUC Estimate had been calculated due to a lack of defined quantities.

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	Apr 2014	N/A	Apr 2014
Milestone C	N/A	N/A	N/A	N/A
RAA	N/A	Jun 2018	N/A	Jul 2018
Total Cost (TY $M)	N/A	1338.5	N/A	2578.3
Total Quantity	N/A	2	N/A	4
PAUC	N/A	669.250	N/A	644.575

Cost Variance

Summary TY $M				
Item	RDT&E	Procurement	MILCON	Total
SAR Baseline (Development Estimate)	1338.5	--	--	1338.5
Previous Changes				
Economic	+4.1	--	--	+4.1
Quantity	+1243.8	--	--	+1243.8
Schedule	--	--	--	--
Engineering	--	--	--	--
Estimating	+22.5	--	--	+22.5
Other	--	--	--	--
Support	--	--	--	--
Subtotal	+1270.4	--	--	+1270.4
Current Changes				
Economic	-0.7	--	--	-0.7
Quantity	--	--	--	--
Schedule	--	--	--	--
Engineering	--	--	--	--
Estimating	-29.9	--	--	-29.9
Other	--	--	--	--
Support	--	--	--	--
Subtotal	-30.6	--	--	-30.6
Total Changes	+1239.8	--	--	+1239.8
Current Estimate	2578.3	--	--	2578.3

Summary BY 2014 $M				
Item	RDT&E	Procurement	MILCON	Total
SAR Baseline (Development Estimate)	1389.1	--	--	1389.1
Previous Changes				
Economic	--	--	--	--
Quantity	+1106.9	--	--	+1106.9
Schedule	--	--	--	--
Engineering	--	--	--	--
Estimating	+19.5	--	--	+19.5
Other	--	--	--	--
Support	--	--	--	--
Subtotal	+1126.4	--	--	+1126.4
Current Changes				
Economic	--	--	--	--
Quantity	--	--	--	--
Schedule	--	--	--	--
Engineering	--	--	--	--
Estimating	-26.7	--	--	-26.7
Other	--	--	--	--
Support	--	--	--	--
Subtotal	-26.7	--	--	-26.7
Total Changes	+1099.7	--	--	+1099.7
Current Estimate	2488.8	--	--	2488.8

Previous Estimate: June 2019

RDT&E	$M	
Current Change Explanations	Base Year	Then Year
Revised escalation indices. (Economic)	N/A	-0.7
Revised estimate due to Small Business Innovation Research reductions in FY 2019 (Estimating)	-12.4	-13.7
Revised estimate due to Congressional reductions in FY 2020 which increases risk to the EPS-R ground program development and intersegment testing. (Estimating)	-13.3	-15.0
Revised estimate due to AF-wide funding adjustments in FY 2021. (Estimating)	-1.6	-1.8
Funds transferred within program from Research, Development, Test, and Evaluation, Air Force to newly added Research, Development, Test, and Evaluation, Space Force. (Estimating)	-315.2	-365.3
Funds transferred within program from Research, Development, Test, and Evaluation, Air Force to newly added Research, Development, Test, and Evaluation, Space Force. (Estimating)	+315.2	+365.3
Adjustment for current and prior escalation. (Estimating)	+0.6	+0.6
RDT&E Subtotal	-26.7	-30.6

Contracts

Contract Identification

Appropriation: RDT&E
Contract Name: EPS-R Payload
Contractor: Northrop Grumman Aerospace Systems
Contractor Location: 1 Space Park
Redondo Beach, CA 90278-1001
Contract Number: FA8808-18-C-0002
Contract Type: Cost Plus Incentive Fee (CPIF), Cost Plus Fixed Fee (CPFF)
Award Date: February 06, 2018
Definitization Date: August 10, 2018

Contract Price							
Initial Contract Price ($M)			Current Contract Price ($M)			Estimated Price At Completion ($M)	
Target	Ceiling	Qty	Target	Ceiling	Qty	Contractor	Program Manager
428.8	N/A	2	410.0	N/A	2	409.4	412.7

Target Price Change Explanation

The difference between the Initial Contract Price Target and the Current Contract Price Target is due to initial award via undefinitized contract action (UCA). As a result of negotiations leading to definitization, the resulting price decreased by $43.8M. The Government executed a UCA to meet Space Norway's accelerated schedule. Additionally, one special study was ordered under the contract, thus increasing the price after definitization by $2.5M. The $22.5M change to the Target Current Contract Price is due to the Host Accommodation Engineering Change Proposal.

Contract Variance		
Item	Cost Variance	Schedule Variance
Cumulative Variances To Date (12/31/2019)	-9.6	-21.2
Previous Cumulative Variances	-1.3	-7.4
Net Change	-8.3	-13.8

Cost and Schedule Variance Explanations

The unfavorable net change in the cost variance is due to additional effort to complete antenna development due to design complexities.

The unfavorable net change in the schedule variance is due to delays in manufacturing start up as a result of a delay in material deliveries.

Contract Identification

Appropriation: RDT&E
Contract Name: EPS-R CAPS
Contractor: Northrop Grumman Mission Systems
Contractor Location: 13825 Sunrise Valley Dr.
Herndon, VA 20171-4671
Contract Number: FA8808-19-C-0004
Contract Type: Cost Plus Incentive Fee (CPIF), Cost Plus Fixed Fee (CPFF)
Award Date: May 02, 2019
Definitization Date: May 02, 2019

Contract Price							
Initial Contract Price ($M)			Current Contract Price ($M)			Estimated Price At Completion ($M)	
Target	Ceiling	Qty	Target	Ceiling	Qty	Contractor	Program Manager
82.3	N/A	1	82.3	N/A	1	81.8	82.1

Contract Variance		
Item	Cost Variance	Schedule Variance
Cumulative Variances To Date (12/31/2019)	-0.1	-0.2
Previous Cumulative Variances	0.0	0.0
Net Change	-0.1	-0.2

Cost and Schedule Variance Explanations

The unfavorable cumulative cost variance is due to greater than expected EPS Program Office comments on delta Preliminary Design Review (dPDR) Contract data requirements lists (CDRLs) as well as Cyber/Information Assurance challenges resulting from Public Private Investment Program (PPIP) compliance documentation delays.

The unfavorable cumulative schedule variance is due to hardware delivery delay due to shifting supplier lead times.

Deliveries and Expenditures

Deliveries				
Delivered to Date	Planned to Date	Actual to Date	Total Quantity	Percent Delivered
Development	2	2	4	50.00%
Production	0	0	0	--
Total Program Quantity Delivered	2	2	4	50.00%

Expended and Appropriated (TY $M)			
Total Acquisition Cost	2578.3	Years Appropriated	15
Expended to Date	1726.1	Percent Years Appropriated	78.95%
Percent Expended	66.95%	Appropriated to Date	2213.0
Total Funding Years	19	Percent Appropriated	85.83%

The above data is current as of February 10, 2020.

Operating and Support Cost

Cost Estimate Details

Date of Estimate:	December 10, 2018
Source of Estimate:	SCP
Quantity to Sustain:	1
Unit of Measure:	System
Service Life per Unit:	10.00 Years
Fiscal Years in Service:	FY 2019 - FY 2033

The EPS system is defined as two EPS payloads and two EPS-R payloads, plus ground components. The Quantity to Sustain is one EPS system. A new sustainment estimate, based on the four payloads, will be performed this year.

Sustainment Strategy

The EPS/EPS-R sustainment strategy follows a path that is consistent with the product acquisition strategy. Current sustainment approach is to have Contractor Logistics Support (CLS) with planned Performance Based Logistics/Public Private Partnership contracts for the Control and Planning Segment (CAPS), and organic support for the Gateway Segment. The Gateway segment is acquired through the Naval Information Warfare Center Pacific (formerly Space and Naval Warfare Systems Center Pacific). The Telemetry & Command - Terminal was designed by Massachusetts Institute of Technology/Lincoln Laboratory. Northrop Grumman Mission Systems was selected through a competitive process to design and develop CAPS. The Payload segment is a subset of Advanced Extremely High Frequency payload capabilities, provided by Northrop Grumman Aerospace Systems. The Terminal segment employs the Navy Multiband Terminal by the user community as the only EPS-compatible terminal to date. Support for each of these segments maps back to the applicable Government or contractor agencies.

The Product Support Plan for the EPS employs both organization and depot maintenance. The operators and maintainers for the EPS system will be contractors. The EPS Program Office awarded a small business sole source contract to Arctic Slope Regional Corporation Federal on March 30, 2018 for Level 1 O&M of software and hardware at the two EPS ground sites (Clear Air Force Station, Alaska and Schriever Space Force Base, Colorado). Depot-level maintenance will be provided in accordance with the approved Depot Source of Repair. EPS will be using the designated EPS organic depots, which are:

- Ogden Air Logistics Center, Utah for CAPS software maintenance
- NIWC Pacific, California for Gateway maintenance
- Cryptologic and Cyber Systems Division Lackland Air Force Base, Texas for cryptographic devices

The EPS-R sustainment concept will utilize the current EPS sustainment approach described above and in the EPS Life Cycle Sustainment Plan.

Antecedent Information

The antecedent system is the Interim Polar System (IPS). IPS consists of three Low Data Rate Milstar packages on three classified host satellites as an expedited, interim solution for protected connectivity requirements in the north polar region. Two satellites with hosted packages are required to provide the necessary 24-hour coverage. Since the first IPS was no longer operational, the third package went into operations in November 2008 to sustain the 24-hour coverage.

Comparable O&S cost estimates for the antecedent system, IPS, are not available. The requirements of IPS vary

significantly from EPS, making a cost-only comparison between the systems very misleading. The technical differences between the fielded capabilities will be vast. EPS supports an eXtended Data Rate terminal fleet consisting of Navy Multiband Terminals, which can utilize both EPS and AEHF. This reduces the Navy platform footprint and support tail, providing a corresponding reduction in Navy O&S costs. EPS will support a current cryptographic architecture and the accompanying key planning, management, and distribution infrastructure. EPS is therefore positioned to address a modern and evolving cyber threat.

Annual O&S Costs BY2014 $M		
Cost Element	**EPS Average Annual Cost Per System**	**IPS (Antecedent) Average Annual Cost Per System**
Unit-Level Manpower	7.000	--
Unit Operations	0.800	--
Maintenance	3.900	--
Sustaining Support	2.900	--
Continuing System Improvements	11.000	--
Indirect Support	0.300	--
Other	0.000	--
Total	25.900	--

Item	Total O&S Cost $M			
	EPS			IPS (Antecedent)
	Current Development APB Objective/Threshold		Current Estimate	
Base Year	259.2	285.1	259.2	N/A
Then Year	404.9	N/A	404.9	N/A

Equation to Translate Annual Cost to Total Cost

Total O&S Costs = service life per system * number of systems * unitized cost

Total O&S Costs = 10 year design life * 1 EPS System * $25.9M/system/year

Total O&S Costs = $259.2M

O&S Cost Variance		
Category	**BY 2014 $M**	**Change Explanations**
Prior SAR Total O&S Estimates - Jun 2019 SAR	157.4	
Programmatic/Planning Factors	101.8	updated to reflect EPS-R O&S costs from Dec 2018 SCP.
Cost Estimating Methodology	0.0	
Cost Data Update	0.0	
Labor Rate	0.0	
Energy Rate	0.0	

Technical Input	0.0
Other	0.0
Total Changes	101.8
Current Estimate	259.2

Disposal Estimate Details

Date of Estimate: December 10, 2018
Source of Estimate: SCP
Disposal/Demilitarization Total Cost (BY 2014 $M): 0.3

The total cost for disposal of the system is $0.3M (BY 2014 $M) as detailed in the Dec 10, 2018 EPS/EPS-R Service Cost Position.