Selected Acquisition Report (SAR)

RCS: DD-A&T(Q&A)823-384

Air and Missile Defense Radar (AMDR)

As of FY 2020 President's Budget

Defense Acquisition Management
Information Retrieval
(DAMIR)

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Sensitivity Originator

No originator information is 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
Air and Missile Defense Radar (AMDR)

DoD Component
Navy

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Date Assigned: March 15, 2019

References

SAR Baseline (Production Estimate)

Under Secretary of Defense (Acquisition, Technology & Logistics) Approved Acquisition Program Baseline (APB) dated June 30, 2017

Approved APB

Under Secretary of Defense (Acquisition, Technology & Logistics) Approved Acquisition Program Baseline (APB) dated June 30, 2017

Mission and Description

Developed under the Air and Missile Defense Radar (AMDR) program, the AN/SPY-6(V)1 is the Navy's next generation radar system that will address Ballistic Missile Defense (BMD) and Air Defense (AD) capability gaps identified in the Maritime Air and Missile Defense of Joint Forces (MAMDJF) Initial Capabilities Document (ICD). AN/SPY-6(V)1 is an Integrated Air and Missile Defense (IAMD) radar providing sensitivity for long range detection and engagement of advanced threats. The AN/SPY-6(V)1 is currently planned to be deployed on the Arleigh Burke Class Guided Missile Destroyer Flight III with four arrays each populated with 37 Radar Modular Assemblies (RMAs) which achieves the Capability Production Document (CPD) threshold of SPY+16dB sensitivity with margin.

Executive Summary

Program Highlights Since Last Report

After completing Concept Studies and Technology Development phase contracts with Raytheon, Northrop Grumman, and Lockheed Martin, the Air and Missile Defense Radar (AMDR) program achieved Milestone B in September 2013 and received a signed ADM on October 4, 2013. After a full and open competition, a 48-month Engineering and Manufacturing Development (EMD) contract was awarded to Raytheon on October 10, 2013. The EMD phase focuses on the design of the system and development of an affordable and executable manufacturing process leading to a Production Readiness Review.

The AMDR hardware Critical Design Review (CDR) was completed December 3, 2014 and the System CDR was completed April 29, 2015. The CDR assessed the completeness of the detail design and how it supports the performance requirements. Software Build Review number five, of five planned for EMD phase, was successfully completed November 15, 2017. Build 6+ mainly supports alignment with AEGIS Combat System Baseline 10 Software Development.

The EMD phase includes integration and test of a single-faced AMDR-S/Radar Suite Controller (RSC) Engineering Development Model with an AN/SPQ-9B asset at the land-based test site at the Pacific Missile Range Facility (PMRF) in Kauai, HI. The Developmental Testing (DT)-3 Test Readiness Review was completed on July 12, 2016.

DT-3 live testing commenced on September 6, 2016, and has since included live Air, Surface, Electronic Attack/Electronic Protection (EA/EP), Ballistic Missile Defense (BMD), Integrated Air and Missile Defense (IAMD), missile communications test set, satellites and sphere tracking tests through the end of CY 2018. Five flight tests were conducted: Vigilant Hunter on March 15, 2017, Vigilant Titan on July 27, 2017, Vigilant Talon on September 7, 2017, Viglilant Janus on March 8, 2018, and Vigilant Nemesis on January 31, 2019. During Vigilant Hunter, the system searched for, detected, tracked and discriminated a short-range ballistic missile target. During Vigilant Titan, the system searched for, detected, tracked and discriminated a medium-range ballistic missile target. During Vigilant Talon the system searched for, detected, tracked and discriminated a short-range ballistic missile while simultaneously tracking two air-to-surface cruise missile targets. During Vigilant Janus, the radar failed to successfully track the target due to a software issue, which has subsequently been fixed and verified. The retest of the AN/SPY-6(V)1 radar for that mission was titled Vigilant Nemesis and was executed successfully in January 2019. The Vigilant Nemesis test event demonstrated the AN/SPY-6(V)1 capability to detect, track and discriminate an Aegis Readiness Assessment Vehicle-CZ (ARAV-CZ) complex short-range ballistic missile target and support the design of the Aegis Baseline 10 combat system. The AN/SPY-6(V)1 has also leveraged Missile Defense Agency, PEO Integrated Warfare Systems (IWS) Surface Ship Weapons Directorate and Department of Navy Targets of Opportunity (TOO) at PMRF by demonstrating radar capabilities in live BMD, surface, interceptor, and air target tests in CY 2017 and 2018. AN/SPY-6(V)1 testing will continue at PMRF against live Air, Surface, EA/EP, BMD, satellites and sphere targets and other agency TOOs through FY 2019.

The EMD phase contract includes options for up to nine Low Rate Initial Production (LRIP) units. The Long Lead Material option for the first AMDR LRIP unit was exercised on December 13, 2016. The program received Milestone C approval on April 27, 2017 and subsequently exercised contract options for three LRIP systems. In April 2018, an LRIP decision brief was conducted with ASN (RDA) and the AMDR program received an ADM that authorized award of one additional FY 2018 LRIP radar system, and upon successful Vigilant Nemesis test, authorized award of up to five additional LRIP radar systems.

The AMDR program is executing on schedule and within budget and is on track for delivery First Quarter FY 2020. Additionally, FY 2020 through FY 2024 funds are included to backfit an Active Electronically-Steered Array and digital beamforming technology on a Flt IIA DDG and to complete development and integrate Advanced Distributed Radar (ADR) capability into AMDR. ADR will enhance BMD detection performance, increase sensitivity at large scan angles, and insert algorithms to enable AMDR to operate in receive-only mode in cooperation with other radars. In addition to the BMD mission, this capability will also improve Anti-Air Warfare (AAW) warfighting capabilities and provide advanced electronic protection techniques. Funding will be used for a live demonstration of BMD Cued Search and Track, element-level testing of Receive

Only Cooperative Radar functionality, and accompanying modelling simulation to ensure capabilities are robust in varying conditions. This investment will result in: 1) improved detection and tracking of medium- to long-range ballistic missiles from larger ship operating areas, and 2) improved defense of high-value assets while increasing ship survivability in the Navy's distributed maritime operations (DMO) scenarios.

AMDR is a task based radar with design co-dependencies on the combat system that requires further planned software work in the post-EMD phase for integration with AEGIS Baseline 10 to fully task capabilities.

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

History of Significant Developments Since Program Initiation

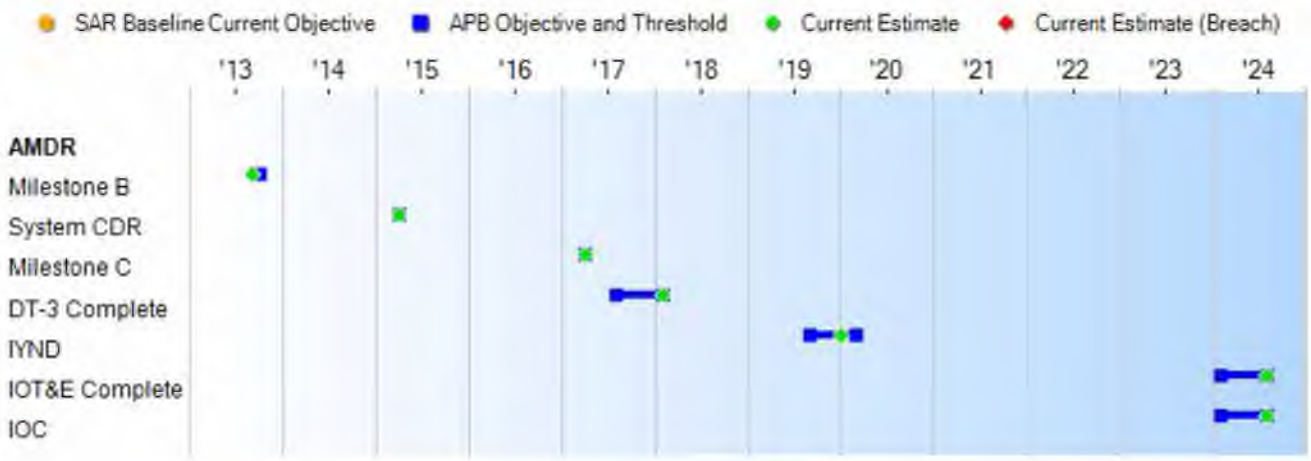
History of Significant Developments Since Program Initiation	
Date	**Significant Development Description**
June 2009	Awarded three 6-month Concept Studies contracts to Raytheon, Lockheed Martin, and Northrop Grumman
September 2010	Milestone A Acquisition Decision Memorandum
September 2010	Awarded three 24-month Technology Development contracts to Raytheon, Lockheed Martin, and Northrop Grumman
May 2012	Pre-Engineering and Manufacturing Development Defense Acquisition Board Review
October 2013	Milestone B Acquisition Decision Memorandum
October 2013	Awarded one 48-month Engineering and Manufacturing Development contract to Raytheon
August 2014	System Preliminary Design Review
April 2015	System Critical Design Review
September 2016	Start of Developmental Test 3 (DT-3)
December 2016	Exercised Long Lead Material contract option for first Low Rate Initial Production unit
March 2017	Vigilant Hunter flight test
April 2017	Milestone C Acquisition Decision Memorandum
May 2017	Exercised contract options for first three Low Rate Initial Production units
July 2017	Vigilant Titan flight test
September 2017	Vigilant Talon flight test
December 2017	Combined Systems Engineering Technical Review (Transition Critical Design Review, System Verification Review/Functional Configuration Audit, and Production Readiness Review)
March 2018	Vigilant Janus flight test
April 2018	Exercised contract option for a fourth Low Rate Initial Production unit
December 2018	Awarded Integration and Production Support contract to Raytheon
January 2019	Vigilant Nemesis flight test

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 Production Estimate	Current APB Production Objective/Threshold		Current Estimate	
Milestone B	Oct 2013	Oct 2013	Oct 2013	Sep 2013	
System CDR	Apr 2015	Apr 2015	Apr 2015	Apr 2015	
Milestone C	Apr 2017	Apr 2017	Apr 2017	Apr 2017	
DT-3 Complete	Aug 2017	Aug 2017	Feb 2018	Feb 2018	
IYND	Sep 2019	Sep 2019	Mar 2020	Jan 2020	
IOT&E Complete	Feb 2024	Feb 2024	Aug 2024	Aug 2024	(Ch-1)
IOC	Feb 2024	Feb 2024	Aug 2024	Aug 2024	(Ch-2)

Change Explanations

(Ch-1) Change to IOT&E estimate is to align with the SHIP's IOT&E planned date.
(Ch-2) Change to IOC estimate date based on AMDR Capability Development Document requirements to reach IOC and also align with the SHIP's planned date.

Notes

IOT&E Complete dates reflect the planned completion date for IOT&E/Combat System Ship Qualification Test for the DDG 51 Arleigh Burke Class Guided Missile Destroyer Flight III.

IOC date based on the AMDR Capability Development Document. Requirements to reach IOC include: (1) successful completion of IOT&E; (2) all maintenance and training materials, including embedded maintenance training and embedded technical manuals, are available to ship's crew; and (3) logistics support is in place, including onboard spares, supply support and shore-based distance support.

Acronyms and Abbreviations

CDR - Critical Design Review
DT - Developmental Test
IOT&E - Initial Operational Test and Evaluation
IYND - In Yard Need Date

Performance

Performance Characteristics					
SAR Baseline Production Estimate	**Current APB Production Objective/Threshold**		**Demonstrated Performance**	**Current Estimate**	
Availability					
Ao ≥0.99	Ao ≥0.99	Ao ≥0.98	TBD	Ao ≥0.99	(Ch-1)
System Training					
Maintenance technicians correctly perform ≥ 99% of critical tasks and ≥ 99% of non-critical tasks as defined in the TTL.	Maintenance technicians correctly perform ≥ 99% of critical tasks and ≥ 99% of non-critical tasks as defined in the TTL.	Maintenance technicians correctly perform ≥ 99% of critical tasks and ≥ 80% of non-critical tasks as defined in the TTL.	TBD	Maintenance technicians correctly perform ≥ 99% of critical tasks and ≥ 80% of non-critical tasks as defined in the TTL.	
Net Ready					
Will satisfy applicable Net Ready KPP elements for all operational activities and information exchanges.	Will satisfy applicable Net Ready KPP elements for all operational activities and information exchanges.	Will satisfy applicable Net Ready KPP elements for joint critical operational activities and information exchanges.	Compliant with Applicable Elements from CDD.	Will satisfy applicable Net Ready KPP elements for joint critical operational activities and information exchanges.	
Energy Efficiency					
Two reduced power states for AMDR-S, when commanded by the platform CMS: State 1 consumes no more than 1100 kW total prime power; State 2 consumes no more than 850 kW total prime power	Two reduced power states for AMDR-S, when commanded by the platform CMS: State 1 consumes no more than 1100 kW total prime power; State 2 consumes no more than 850 kW total prime power	Two reduced power states for AMDR-S, when commanded by the platform CMS: State 1 consumes no more than 1230 kW total prime power; State 2 consumes no more than 950 kW total prime power	TBD	Reduced Power Substate 1 consumes 1110kW total power; Reduced Power Substate 2 consumes 860kW total power	
Survivability					
(Objective = Threshold) Exemption - AMDR will be integrated into the DDG 51 hull with no decrease in survivability of the hull based on DDG 51 live fire equivalent testing (DDG 81 shock trial)	(Objective = Threshold) Exemption - AMDR will be integrated into the DDG 51 hull with no decrease in survivability of the hull based on DDG 51 live fire equivalent testing (DDG 81 shock trial)	Exemption - AMDR will be integrated into the DDG 51 hull with no decrease in survivability of the hull based on DDG 51 live fire equivalent testing (DDG 81 shock trial)	TBD	Exemption - AMDR will be integrated into the DDG 51 hull with no decrease in survivability of the hull based on DDG 51 live fire equivalent testing (DDG 81 shock trial)	

Force Protection				
(Objective = Threshold) Exemption - Will support host platform requirement	(Objective = Threshold) Exemption - Will support host platform requirement	Exemption - Will support host platform requirement	N/A - Exempt	Exemption - Will support host platform requirement

Classified Performance information is provided in the classified annex to this submission.

Requirements Reference

The AMDR CDD was signed by the Chief of Naval Operations on April 20, 2013 JROC Memorandum signed June 27, 2013. Specific KPP values have been established in the CDD and those requirements have been flowed down to the Top Level Radar Performance and Top Level Requirements documents developed by the program.

The Pre-EMD DAB's ADM, dated May 21, 2012, directed a change to the program structure so that it includes only the AMDR S-band array and the RSC. This APB represents only the S-band and RSC capabilities from the AMDR CDD. The X-band capabilities in the AMDR CDD will be addressed in a separate future Program of Record.

Change Explanations

(Ch-1) The Ao current estimate changed from .98 to .99 due to minor fluctuations related to increased fidelity of information provided to modeling efforts. The metric remains above the requirement and is monitored closely for negative trends.

Notes

Net Ready Demonstrated Performance updated because a valid Solution Architecture is established and Information Assurance requirements have been flowed and decomposed in System and Subsystem Specifications.

Acronyms and Abbreviations

Ao - Operational Availability
CMS - Combat Management System
DDG - Guided Missile Destroyer
kW - Kilowatt
TTL - Training Task List

Track to Budget

RDT&E

Appn	BA	PE
Navy	04	0603513N

Project	Name		
4019	Shipboard System Component Development - Radar Upgrades	(Shared)	(Sunk)

Notes: Applies to FY 2006 - 2007

Appn	BA	PE
Navy	05	0604307N

Project	Name		
3044	AEGIS Combat System Engineering - Solid State SPY Radar	(Shared)	(Sunk)

Notes: Applies to FY 2006 - 2007

Appn	BA	PE
Navy	05	0604501N

Project	Name		
3186	Advanced Above Water Sensors - Air and Missile Defense Radar	(Shared)	(Sunk)

Notes: Applies to FY 2008 - 2014

Appn	BA	PE
Navy	05	0604522N

Project	Name
3186	Air and Missile Defense Radar

Notes: Applies to FY 2015 - 2024 (program transitioned from PE0604501N to PE0604522N in FY 2015).

Procurement

Appn	BA	PE
Navy	02	0204222N

Line Item	Name	
2122	DDG 51	(Shared)

Notes: Applies to FY 2016 – 2026

MILCON

Appn	BA	PE
Navy	01	0805376N

Project	Name	
P422	Advanced Radar Detection Laboratory	(Sunk)

Notes: Applies to FY 2009

Cost and Funding

Cost Summary

Total Acquisition Cost							
Appropriation	BY 2013 $M			BY 2013 $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	1986.6	1986.6	2185.3	1920.7	2061.0	2061.0	2000.0
Procurement	3278.3	3278.3	3606.1	3270.0	4075.2	4075.2	4046.8
Flyaway	--	--	--	2674.2	--	--	3309.2
Recurring	--	--	--	2656.7	--	--	3289.2
Non Recurring	--	--	--	17.5	--	--	20.0
Support	--	--	--	595.8	--	--	737.6
Other Support	--	--	--	501.9	--	--	619.9
Initial Spares	--	--	--	93.9	--	--	117.7
MILCON	28.6	28.6	31.5	28.6	27.5	27.5	27.5
Acq O&M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	5293.5	5293.5	N/A	5219.3	6163.7	6163.7	6074.3

Current APB Cost Estimate Reference

The cost data in this APB represents the AN/SPY-6 AMDR Navy Estimate dated April 25, 2017

Cost Notes

No cost estimate for the program has been completed in the previous year. The current estimate is derived from the AN/SPY-6 AMDR Navy Estimate dated April 25, 2017 with adjustments based on the current DDG 51 ship building profile.

Total Quantity			
Quantity	SAR Baseline Production Estimate	Current APB Production	Current Estimate
RDT&E	0	0	0
Procurement	22	22	22
Total	22	22	22

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	1591.4	27.0	55.3	78.1	87.9	80.4	79.9	0.0	2000.0
Procurement	812.0	499.5	497.7	361.6	366.4	558.1	567.2	384.3	4046.8
MILCON	27.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.5
Acq O&M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PB 2020 Total	2430.9	526.5	553.0	439.7	454.3	638.5	647.1	384.3	6074.3
PB 2019 Total	2554.4	526.6	358.6	596.1	611.6	610.1	378.2	192.1	5827.7
Delta	-123.5	-0.1	194.4	-156.4	-157.3	28.4	268.9	192.2	246.6

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	4	3	3	2	2	3	3	2	22
PB 2020 Total	0	4	3	3	2	2	3	3	2	22
PB 2019 Total	0	5	3	2	3	3	3	2	1	22
Delta	0	-1	0	1	-1	-1	0	1	1	0

Cost and Funding

Annual Funding By Appropriation

Annual Funding 1319 | RDT&E | Research, Development, Test, and Evaluation, Navy							
Fiscal Year	Quantity	TY $M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2006	--	--	--	--	--	--	10.9
2007	--	--	--	--	--	--	35.3
2008	--	--	--	--	--	--	92.9
2009	--	--	--	--	--	--	92.5
2010	--	--	--	--	--	--	164.9
2011	--	--	--	--	--	--	204.2
2012	--	--	--	--	--	--	138.8
2013	--	--	--	--	--	--	193.9
2014	--	--	--	--	--	--	112.7
2015	--	--	--	--	--	--	126.3
2016	--	--	--	--	--	--	227.1
2017	--	--	--	--	--	--	142.3
2018	--	--	--	--	--	--	49.6
2019	--	--	--	--	--	--	27.0
2020	--	--	--	--	--	--	55.3
2021	--	--	--	--	--	--	78.1
2022	--	--	--	--	--	--	87.9
2023	--	--	--	--	--	--	80.4
2024	--	--	--	--	--	--	79.9
Subtotal	--	--	--	--	--	--	2000.0

Annual Funding 1319 | RDT&E | Research, Development, Test, and Evaluation, Navy							
Fiscal Year	Quantity	BY 2013 $M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2006	--	--	--	--	--	--	12.1
2007	--	--	--	--	--	--	38.4
2008	--	--	--	--	--	--	99.1
2009	--	--	--	--	--	--	97.4
2010	--	--	--	--	--	--	171.2
2011	--	--	--	--	--	--	207.0
2012	--	--	--	--	--	--	138.4
2013	--	--	--	--	--	--	191.3
2014	--	--	--	--	--	--	109.6
2015	--	--	--	--	--	--	121.4
2016	--	--	--	--	--	--	214.4
2017	--	--	--	--	--	--	131.9
2018	--	--	--	--	--	--	45.1
2019	--	--	--	--	--	--	24.0
2020	--	--	--	--	--	--	48.3
2021	--	--	--	--	--	--	66.8
2022	--	--	--	--	--	--	73.8
2023	--	--	--	--	--	--	66.1
2024	--	--	--	--	--	--	64.4
Subtotal	--	--	--	--	--	--	1920.7

RDT&E includes funding in:

1) FY17-18 to conduct a Ballistic Missile Defense (BMD) Mission Flight retest in FY19.

2) FY20-24 to integrate Advanced Distributed Radar (ADR) capability into AMDR. ADR will enhance BMD detection performance, increase sensitivity at large scan angles, and insert the core algorithms to enable AMDR to operate in receive-only mode, in cooperation with other radars. In addition to the BMD mission, this capability will also improve Anti-Air Warfare (AAW) warfighting capabilities and provide advanced electronic protection techniques.

3) FY21-23 to scale AMDR to backfit Active Electronically-Steered Array and digital beamforming technology on a Flt IIA DDG.

Annual Funding 1611 | Procurement | Shipbuilding and Conversion, Navy							
Fiscal Year	Quantity	TY $M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2016	1	148.8	--	--	148.8	96.5	245.3
2017	2	325.3	--	20.0	345.3	23.3	368.6
2018	1	156.0	--	--	156.0	42.1	198.1
2019	3	433.0	--	--	433.0	66.5	499.5
2020	3	428.8	--	--	428.8	68.9	497.7
2021	2	287.4	--	--	287.4	74.2	361.6
2022	2	293.1	--	--	293.1	73.3	366.4
2023	3	448.4	--	--	448.4	109.7	558.1
2024	3	457.4	--	--	457.4	109.8	567.2
2025	2	311.0	--	--	311.0	73.3	384.3
Subtotal	22	3289.2	--	20.0	3309.2	737.6	4046.8

Annual Funding 1611 | Procurement | Shipbuilding and Conversion, Navy							
Fiscal Year	Quantity	BY 2013 $M					
		End Item Recurring Flyaway	Non End Item Recurring Flyaway	Non Recurring Flyaway	Total Flyaway	Total Support	Total Program
2016	1	132.6	--	--	132.6	86.0	218.6
2017	2	284.0	--	17.5	301.5	20.3	321.8
2018	1	133.5	--	--	133.5	36.1	169.6
2019	3	363.3	--	--	363.3	55.8	419.1
2020	3	352.8	--	--	352.8	56.6	409.4
2021	2	231.8	--	--	231.8	59.8	291.6
2022	2	231.8	--	--	231.8	57.9	289.7
2023	3	347.6	--	--	347.6	85.1	432.7
2024	3	347.6	--	--	347.6	83.5	431.1
2025	2	231.7	--	--	231.7	54.7	286.4
Subtotal	22	2656.7	--	17.5	2674.2	595.8	3270.0

SCN funding included under PEO SHIPS Program Element (PE): 0204222N

Annual Funding 1205 | MILCON | Military Construction, Navy and Marine Corps	
Fiscal Year	TY $M Total Program
2009	27.5
Subtotal	27.5

Annual Funding 1205 | MILCON | Military Construction, Navy and Marine Corps	
Fiscal Year	BY 2013 $M Total Program
2009	28.6
Subtotal	28.6

Low Rate Initial Production

Item	Initial LRIP Decision	Current Total LRIP
Approval Date	10/4/2013	10/4/2013
Approved Quantity	16	16
Reference	Milestone B ADM	Milestone B ADM
Start Year	2016	2016
End Year	2023	2023

The Current Total LRIP Quantity is more than 10% of the total production quantity due to timing of Initial Operational Test and Evaluation, IOC, and the need to meet the shipbuilding plan. The Milestone B ADM dated October 4, 2013 included approval for a planned LRIP quantity not to exceed 16 units.

Foreign Military Sales

None

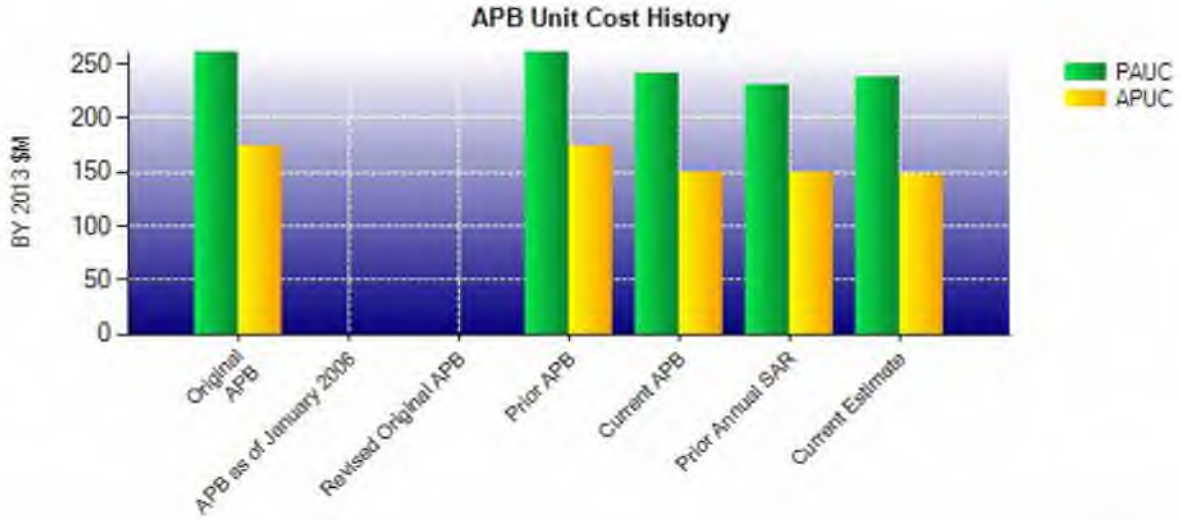
Nuclear Costs

None

Unit Cost

Current UCR Baseline and Current Estimate (Base-Year Dollars)			
Item	BY 2013 $M Current UCR Baseline (Jun 2017 APB)	BY 2013 $M Current Estimate (Dec 2018 SAR)	% Change
Program Acquisition Unit Cost			
Cost	5293.5	5219.3	
Quantity	22	22	
Unit Cost	240.614	237.241	-1.40
Average Procurement Unit Cost			
Cost	3278.3	3270.0	
Quantity	22	22	
Unit Cost	149.014	148.636	-0.25

Original UCR Baseline and Current Estimate (Base-Year Dollars)			
Item	BY 2013 $M Original UCR Baseline (Oct 2013 APB)	BY 2013 $M Current Estimate (Dec 2018 SAR)	% Change
Program Acquisition Unit Cost			
Cost	5735.7	5219.3	
Quantity	22	22	
Unit Cost	260.714	237.241	-9.00
Average Procurement Unit Cost			
Cost	3846.9	3270.0	
Quantity	22	22	
Unit Cost	174.859	148.636	-15.00



APB Unit Cost History					
Item	Date	BY 2013 $M		TY $M	
		PAUC	APUC	PAUC	APUC
Original APB	Oct 2013	260.714	174.859	302.845	214.727
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	Oct 2013	260.714	174.859	302.845	214.727
Current APB	Jun 2017	240.614	149.014	280.168	185.236
Prior Annual SAR	Dec 2017	231.305	150.400	264.895	182.073
Current Estimate	Dec 2018	237.241	148.636	276.105	183.945

SAR Unit Cost History

Initial SAR Baseline to Current SAR Baseline (TY $M)									
Initial PAUC Development Estimate	Changes								PAUC Production Estimate
	Econ	Qty	Sch	Eng	Est	Oth	Spt	Total	
302.845	0.750	0.000	0.677	15.214	-5.305	0.000	-34.013	-22.677	280.168

Current SAR Baseline to Current Estimate (TY $M)									
PAUC Production Estimate	Changes								PAUC Current Estimate
	Econ	Qty	Sch	Eng	Est	Oth	Spt	Total	
280.168	1.055	0.000	0.514	-6.169	-5.095	0.000	5.632	-4.063	276.105

Initial SAR Baseline to Current SAR Baseline (TY $M)									
Initial APUC Development Estimate	Changes								APUC Production Estimate
	Econ	Qty	Sch	Eng	Est	Oth	Spt	Total	
214.727	1.418	0.000	0.677	0.000	2.427	0.000	-34.013	-29.491	185.236

Current SAR Baseline to Current Estimate (TY $M)									
APUC Production Estimate	Changes								APUC Current Estimate
	Econ	Qty	Sch	Eng	Est	Oth	Spt	Total	
185.236	1.109	0.000	0.514	0.000	-8.545	0.000	5.632	-1.290	183.945

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	Jul 2013	Oct 2013	Sep 2013
Milestone C	N/A	Jul 2017	Apr 2017	Apr 2017
IOC	N/A	Sep 2023	Feb 2024	Aug 2024
Total Cost (TY $M)	N/A	6662.6	6163.7	6074.3
Total Quantity	N/A	22	22	22
PAUC	N/A	302.845	280.168	276.105

Cost Variance

Summary TY $M				
Item	RDT&E	Procurement	MILCON	Total
SAR Baseline (Production Estimate)	2061.0	4075.2	27.5	6163.7
Previous Changes				
Economic	-4.0	-36.8	--	-40.8
Quantity	--	--	--	--
Schedule	--	-36.5	--	-36.5
Engineering	-271.0	--	--	-271.0
Estimating	+8.6	+6.2	--	+14.8
Other	--	--	--	--
Support	--	-2.5	--	-2.5
Subtotal	-266.4	-69.6	--	-336.0
Current Changes				
Economic	+2.8	+61.2	--	+64.0
Quantity	--	--	--	--
Schedule	--	+47.8	--	+47.8
Engineering	+135.3	--	--	+135.3
Estimating	+67.3	-194.2	--	-126.9
Other	--	--	--	--
Support	--	+126.4	--	+126.4
Subtotal	+205.4	+41.2	--	+246.6
Total Changes	-61.0	-28.4	--	-89.4
CE - Cost Variance	2000.0	4046.8	27.5	6074.3
CE - Cost & Funding	2000.0	4046.8	27.5	6074.3

Summary BY 2013 $M				
Item	RDT&E	Procurement	MILCON	Total
SAR Baseline (Production Estimate)	1986.6	3278.3	28.6	5293.5
Previous Changes				
Economic	--	--	--	--
Quantity	--	--	--	--
Schedule	--	+18.9	--	+18.9
Engineering	-242.4	--	--	-242.4
Estimating	+7.1	+5.5	--	+12.6
Other	--	--	--	--
Support	--	+6.1	--	+6.1
Subtotal	-235.3	+30.5	--	-204.8
Current Changes				
Economic	--	--	--	--
Quantity	--	--	--	--
Schedule	--	+19.9	--	+19.9
Engineering	+113.7	--	--	+113.7
Estimating	+55.7	-152.8	--	-97.1
Other	--	--	--	--
Support	--	+94.1	--	+94.1
Subtotal	+169.4	-38.8	--	+130.6
Total Changes	-65.9	-8.3	--	-74.2
CE - Cost Variance	1920.7	3270.0	28.6	5219.3
CE - Cost & Funding	1920.7	3270.0	28.6	5219.3

Previous Estimate: December 2017

RDT&E	$M	
Current Change Explanations	Base Year	Then Year
Revised escalation indices. (Economic)	N/A	+2.8
Additional funding to conduct a Ballistic Missile Defense Mission Flight retest. (Estimating)	+17.7	+19.5
Additional funding to develop and integrate Advanced Distributed Radar (ADR) capability into AMDR. (Engineering)	+113.7	+135.3
Additional funding for continued development including other enhanced capabilities through IOC in FY 2024. (Estimating)	+42.7	+53.1
Realignment of funds to match latest program estimate. (Estimating)	-3.5	-4.1
Adjustment for current and prior escalation. (Estimating)	-1.2	-1.2
RDT&E Subtotal	+169.4	+205.4

Procurement	$M	
Current Change Explanations	Base Year	Then Year
Revised escalation indices. (Economic)	N/A	+61.2
Stretch-out of procurement buy profile to align with the DDG 51 Flight III shipbuilding profile in FY 2018-FY 2025. (Schedule)	+19.9	+47.8
Revised estimate associated with assuming more favorable pricing achieved through competition for production units after FY 2020. (Estimating)	-138.0	-177.3
Adjustment for current and prior escalation. (Estimating)	-14.8	-16.9
Adjustment for current and prior escalation. (Support)	-3.1	-3.9
Increase in Other Support related to extending test and evaluation efforts including waterfront test site support, combat system testing, and AEGIS Weapon System element testing. (Support)	+94.4	+124.2
Increase in Initial Spares reflects changes to align with the DDG 51 Flight III shipbuilding profile. (Support)	+2.8	+6.1
Procurement Subtotal	-38.8	+41.2

Contracts

Contract Identification

Appropriation: Procurement
Contract Name: AMDR Low Rate Initial Production (CLIN 0201)
Contractor: Raytheon Company
Contractor Location: 1001 Boston Post Rd E
Marlborough, MA 01752-3770
Contract Number: N00024-14-C-5315/2
Contract Type: Fixed Price Incentive(Firm Target) (FPIF)
Award Date: December 13, 2016
Definitization Date: December 13, 2016

Contract Price							
Initial Contract Price ($M)			Current Contract Price ($M)			Estimated Price At Completion ($M)	
Target	Ceiling	Qty	Target	Ceiling	Qty	Contractor	Program Manager
182.2	202.5	1	182.2	202.5	1	200.7	202.5

Contract Variance		
Item	Cost Variance	Schedule Variance
Cumulative Variances To Date (1/27/2019)	-25.6	-28.4
Previous Cumulative Variances	--	--
Net Change	-25.6	-28.4

Cost and Schedule Variance Explanations

The unfavorable cumulative cost variance is due to higher labor costs for added complexity of Digital Receiver Exciter (DREX) and Digital Beamforming (DBF) test setup efforts, higher material costs for processing hardware, and Transmit/Receive Integrated Microwave Modules (TRIMMs) first time build issues.

The unfavorable cumulative schedule variance is due to schedule burn down for early receipt of the Array Structure and Power Distribution Unit (PDU) materials, first time build issues for DC-to-DC converters, and late receipt of the Array and DREXs.

Notes

Integrated Baseline Review was conducted on November 2, 2017 for the first three LRIP units.

Contract Identification

Appropriation: Procurement
Contract Name: AMDR Low Rate Initial Production (CLIN 0303AA)
Contractor: Raytheon Company
Contractor Location: 1001 Boston Post Rd E
Marlborough, MA 01752-3770
Contract Number: N00024-14-C-5315/3
Contract Type: Fixed Price Incentive(Firm Target) (FPIF)
Award Date: May 01, 2017
Definitization Date: May 01, 2017

Contract Price							
Initial Contract Price ($M)			Current Contract Price ($M)			Estimated Price At Completion ($M)	
Target	Ceiling	Qty	Target	Ceiling	Qty	Contractor	Program Manager
128.5	142.8	1	128.5	142.8	1	142.8	142.8

Contract Variance		
Item	Cost Variance	Schedule Variance
Cumulative Variances To Date (1/27/2019)	-9.5	-1.0
Previous Cumulative Variances	--	--
Net Change	-9.5	-1.0

Cost and Schedule Variance Explanations

The unfavorable cumulative cost variance is due to higher labor costs for added complexity of Digital Receiver Exciter (DREX) and Digital Beamforming (DBF) test setup efforts, higher material costs for processing hardware, and updated pricing for new supplier Array Cooling System (ARC).

The unfavorable cumulative schedule variance is due to DREX late starts, delays with LRU material, and T/R Modules first time build issues.

Notes

Integrated Baseline Review was conducted on November 2, 2017 for the first three LRIP units.

Contract Identification

Appropriation: Procurement
Contract Name: AMDR Low Rate Initial Production (CLIN 0303AB)
Contractor: Raytheon Company
Contractor Location: 1001 Boston Post Rd E
Marlborough, MA 01752-3770
Contract Number: N00024-14-C-5315/4
Contract Type: Fixed Price Incentive(Firm Target) (FPIF)
Award Date: May 01, 2017
Definitization Date: May 01, 2017

Contract Price							
Initial Contract Price ($M)			Current Contract Price ($M)			Estimated Price At Completion ($M)	
Target	Ceiling	Qty	Target	Ceiling	Qty	Contractor	Program Manager
126.5	140.6	1	126.5	140.6	1	140.3	140.6

Contract Variance		
Item	Cost Variance	Schedule Variance
Cumulative Variances To Date (1/27/2019)	-7.1	+1.2
Previous Cumulative Variances	--	--
Net Change	-7.1	+1.2

Cost and Schedule Variance Explanations

The unfavorable cumulative cost variance is due to higher labor costs for added complexity of DREX and DBF test setup efforts, higher material costs, and first time build challenges.

The favorable cumulative schedule variance is due to early receipt of Radiator Major Sub Material, Power Distribution Unit (PDU) material, and Non-LRU RF hardware.

Notes

Integrated Baseline Review was conducted on November 2, 2017 for the first three LRIP units.

Contract Identification

Appropriation: Procurement
Contract Name: AMDR Low Rate initial Production (CLIN 0401)
Contractor: Raytheon Company
Contractor Location: 1001 Boston Post Rd E
Marlborough, MA 01752
Contract Number: N00024-14-C-5315/5
Contract Type: Fixed Price Incentive(Firm Target) (FPIF)
Award Date: April 19, 2018
Definitization Date: April 19, 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
136.5	151.7	1	136.5	151.7	1	144.4	144.7

Contract Variance		
Item	Cost Variance	Schedule Variance
Cumulative Variances To Date (1/27/2019)	-1.0	-10.4
Previous Cumulative Variances	--	--
Net Change	-1.0	-10.4

Cost and Schedule Variance Explanations

The unfavorable cumulative cost variance is due to additional engineering support required to resolve issues during the first time build of product line TRIMMs and pricing for TRIMM Material.

The unfavorable cumulative schedule variance is due to vendor delays with DREX on shipset 4.

Notes

This is the first time this contract is being reported.

Integrated Baseline Review was conducted on November 16, 2018 for this LRIP unit.

Contract Identification

Appropriation: Procurement
Contract Name: AMDR Integration and Production Support (I&PS)
Contractor: Raytheon Company
Contractor Location: 1001 Boston Post Rd E
Marlborough, MA 01752
Contract Number: N00024-19-C-5501/6
Contract Type: Cost Plus Fixed Fee (CPFF)
Award Date: December 08, 2018
Definitization Date: December 18, 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
100.5	N/A	0	100.5	N/A	0	100.5	100.5

Cost and Schedule Variance Explanations

Cost and Schedule Variance reporting is not required on this (CPFF) contract.

Notes

This is the first time this contract is being reported.

Cost and Schedule Variance reporting is not required for this CPFF contract. This contract includes both RDT&E and Procurement related Engineering Services.

Deliveries and Expenditures

Deliveries				
Delivered to Date	Planned to Date	Actual to Date	Total Quantity	Percent Delivered
Development	0	0	0	--
Production	0	0	22	0.00%
Total Program Quantity Delivered	0	0	22	0.00%

Expended and Appropriated (TY $M)			
Total Acquisition Cost	6074.3	Years Appropriated	14
Expended to Date	1681.9	Percent Years Appropriated	70.00%
Percent Expended	27.69%	Appropriated to Date	2957.4
Total Funding Years	20	Percent Appropriated	48.69%

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

Operating and Support Cost

Cost Estimate Details

Date of Estimate:	January 31, 2019
Source of Estimate:	POE
Quantity to Sustain:	22
Unit of Measure:	System
Service Life per Unit:	40.00 Years
Fiscal Years in Service:	FY 2021 - FY 2071

Each AMDR System includes four fully populated AMDR-S array faces and a Radar Suite Controller.

Sustainment Strategy

In order to meet Operational Availability (Ao) KPP and O&S Cost Key System Attribute requirements AMDR will implement a performance-based product support strategy involving Naval Surface Warfare Center (NSWC) Crane Division, NSWC Port Hueneme Division, and NSWC Dahlgren Division, Defense Logistics Agency, Naval Supply Systems Command, and Center for Surface Combat Systems Dahlgren.

The AMDR system employs a two level maintenance philosophy (organizational to depot) with onboard maintenance performed by the ship's crew. The ship's operational tempo is assumed to be 180 days on station. Maintenance (preventative and corrective) can occur anytime during the 180 days on station as long as the system is not degraded by the maintenance activity. Commercial Off The Shelf (COTS) processing equipment refresh and upgrades will be implemented using a 'refresh by attrition' approach combined with an eight year refresh cycle. The planned software sustainment strategy for AMDR includes post-delivery routine software maintenance and software updates every two years to address new threats and other emergent capability requirements.

Antecedent Information

The antecedent system is AN/SPY-1D(V). AN/SPY-1D(V) has fielded 32 systems, each with a planned service life of 35 years. The source of the cost estimate is the Naval Sea Systems Command Systems Engineering Directorate - Cost Engineering and Industrial Analysis Division AN/SPY-1D(V) FRP ICE dated November 14, 2011 with the following adjustment: incorporated same forward pricing rate recommendation (FPRR) escalation rate as AMDR and added hardware modification costs based on percentage allocation of Aegis weapon system MK-7 hardware modification cost. The AN/SPY-1D(V) Sustaining Support cost element does not include costs for Operating Equipment Replacement, whereas AMDR does.

Annual O&S Costs BY2013 $M		
Cost Element	**AMDR Average Annual Cost Per System**	**AN/SPY-1D(V) (Antecedent) Average Annual Cost Per System**
Unit-Level Manpower	--	--
Unit Operations	--	--
Maintenance	1.995	2.542
Sustaining Support	1.922	1.489
Continuing System Improvements	0.426	1.417
Indirect Support	--	--
Other	--	--
Total	4.343	5.448

For AMDR, Unit-Level Manpower, Unit Operations, and Indirect Support are not reported because these costs are considered Ship Level costs.

Item	Total O&S Cost $M			
	AMDR			AN/SPY-1D(V) (Antecedent)
	Current Production APB Objective/Threshold		Current Estimate	
Base Year	3821.4	4203.5	3821.0	6410.8
Then Year	7402.7	N/A	7227.6	N/A

Current Estimate includes System Operations and Maintenance, Navy (OMN) (TY $7,019.9M, BY 2013 $3,711.7M) and Fleet OMN (TY $207.7M, BY 2013 $109.3M).

Equation to Translate Annual Cost to Total Cost

Total System O&S [BY 2013 $3,821.0M] = unitized cost [BY 2013 $4.343M] * number of systems [22] * service life per system [40].

O&S Cost Variance		
Category	**BY 2013 $M**	**Change Explanations**
Prior SAR Total O&S Estimates - Dec 2017 SAR	3810.4	
Programmatic/Planning Factors	0.0	
Cost Estimating Methodology	0.0	
Cost Data Update	0.0	
Labor Rate	10.6	The change is associated with assuming a higher labor rate for contractor efforts.
Energy Rate	0.0	

Technical Input	0.0
Other	0.0
Total Changes	10.6
Current Estimate	3821.0

Disposal Estimate Details

Date of Estimate:	January 31, 2019
Source of Estimate:	POE
Disposal/Demilitarization Total Cost (BY 2013 $M):	23.4

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