Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Missile Defense Agency											Date: March 2019	
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*					R-1 Program Element (Number/Name) PE 0603884C *I Ballistic Missile Defense Sensors*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	1,418.571	290.289	385.375	283.487	-	283.487	296.098	263.681	276.092	351.607	Continuing	Continuing
MD11: *BMDS Radars*	1,328.092	275.144	366.335	263.491	-	263.491	281.044	249.504	260.982	309.225	Continuing	Continuing
MC11: *Cyber Operations*	5.101	3.894	6.079	8.212	-	8.212	1.555	1.586	1.617	24.618	Continuing	Continuing
MD41: *Homeland Defense Radar - Hawaii (HDR-H)*	-	2.078	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.078
MD40: *Program-Wide Support*	85.378	9.173	12.961	11.784	-	11.784	13.499	12.591	13.493	17.764	Continuing	Continuing
Program MDAP/MAIS Code: 362												

Note

Homeland Defense Radar - Hawaii (HDR-H) funding was appropriated/budgeted as follow:
FY 2017: PE 0603884C BMDS Sensors, Project MD41
FY 2018: PE 0604673C Pacific Discriminating Radar, Project MD41
FY 2019: PE 0604672C Homeland Defense Radar Hawaii, Project MD41

The decrease from FY 2019 to FY 2020 reflects completion of AN/TPY-2 development in FY 2019 to provide improved raid handling and enhanced Aegis Engage on Remote Capability.

A. Mission Description and Budget Item Justification

The Ballistic Missile Defense System (BMDS) network of layered Sensors provides essential situational awareness and fire control data for the command and control of BMDS weapon systems, such as Ground-Based Midcourse Defense (GMD), Aegis Ballistic Missile Defense (BMD), and Terminal High Altitude Area Defense (THAAD). The suite of remote ground-based sensors provides; early warning, midcourse and terminal missile defense threat data enabling layered detection and tracking of missile targets, providing fire-control quality position, velocity, and discrimination data through Ground-Based Midcourse Defense Fire Control (GFC), or Command and Control, Battle Management and Communications (C2BMC).

Overlapping coverage of geographically diverse sensors provides improved threat track data, reduces the impact of the loss of any one sensor, and reduces the potential impact of countermeasures. The extended coverage and accuracy provided by a network of layered sensors increases the defensive footprint and reduces the number of target engagements required, thereby conserving interceptor inventory and maintaining a high probability of successful engagement. Networked forward-based sensors enable C2BMC to pair the best sensor coverage with the best available weapon system to provide the most effective defense against missile threats.

This program element includes BMDS threat discrimination improvements, which will enhance BMDS effectiveness against the evolving adversary threat. The result will be a BMDS architecture more capable of discriminating and destroying reentry vehicles with a higher degree of confidence, improving Warfighter shot doctrine, and

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Missile Defense Agency	Date: March 2019
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603884C *I Ballistic Missile Defense Sensors*

more efficiently using interceptor inventory. BMDS threat discrimination improvements are funded from the Enabling (0603890C), Midcourse (0603882C), BMD Sensors (0603884C), C2BMC (0603896C), and Aegis BMD (0603892C) PEs.

The BMD Sensors Program contributes to regional missile defense through the development, delivery and deployment/redeployment of Army Navy/Transportable Radar Surveillance and Control (AN/TPY-2) radars for operations or tests. AN/TPY-2 radars can be configured to operate either as a THAAD Fire Unit Radar (terminal mode) or Forward-Based Radar. These radars are transportable, they add flexibility to respond to geographical changes in threats. Radars provide early warning tracking and discrimination data through all phases of missile flight. Through the BMDS C2BMC and coalition data links, the AN/TPY-2 provides fire control data to enable remote Standard Missile (SM)-3 engagements by Aegis BMD, and to cue deployed THAAD and U.S. and partner Patriot batteries.

The BMDS sensor network includes; the COBRA DANE Radar at Eareckson Air Station, Alaska, the Upgraded Early Warning Radars (UEWRs) at Beale Air Force Base, CA; Fylingdales Royal Air Force, United Kingdom, and Thule Air Base in Greenland for defense of the homeland. The Clear Ultra High Frequency Early Warning Radar (EWR), at Clear Air Force Station, AK, and the Cape Cod EWR, at Cape Cod Air Force Station, MA, are also being upgraded to include missile defense functionality against long-range threats in addition to their existing Missile Warning and Space Surveillance missions. Upgrade activities began in CY 2012 and are now projected to be completed in CY 2020 due to current UEWR operational configuration emergency maintenance required by AF Space Command that blocked access to the radar sites for operational testing. The addition of the Clear UEWR and Cape Cod UEWRs to the BMDS sensor architecture improves BMDS sensor coverage and provides new engagement options against long-range missile threats from Northeast Asia and Southwest Asia respectively.

In accordance to Section 1684 (e) (2) of the National Defense Authorization Act for fiscal year 2016, the Missile Defense Agency is required to submit with the President's Budget request for fiscal year 2020 a plan to carry out Section 1684(d) and an update on progress in meeting Section 1684 (b) and (c). A decision to deploy an additional radar in the Atlantic has not yet been made. Current planned radar deployments include the Long-Range Discrimination Radar in Alaska, the Homeland Defense Radar - Hawaii, and the Pacific Radar that begin operating in 2021, 2023, and 2026 respectively.

The SBX is currently deployed in the Pacific Ocean. Current operational plans do not require homeporting of the SBX to the Atlantic.

The MDA previously completed the studies required by Section 1684 (b) and (c) of the National Defense Authorization Act for fiscal year 2016 and submitted them to the Congressional Defense Committees.

Cyber Operations sustain the Risk Management Framework (RMF) and Controls Validation Testing (CVT) activities, analysis of validation results, risk assessments, reviews of Plans of Action and Milestones (POA&Ms), and alignment and integration to the Tier 2 Cybersecurity Service Provider (CSSP) for the Sensors mission system.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Missile Defense Agency	Date: March 2019
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603884C *I Ballistic Missile Defense Sensors*

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	278.145	220.876	250.238	-	250.238
Current President's Budget	290.289	385.375	283.487	-	283.487
Total Adjustments	12.144	164.499	33.249	-	33.249
• Congressional General Reductions	-2.000	0.000			
• Congressional Directed Reductions	-5.000	-8.801			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	46.000	178.300			
• Congressional Directed Transfers	-21.000	-5.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-5.856	0.000			
• Missile Defeat and Defense Enhancement	0.000	0.000	0.000	-	0.000
• Other Adjustment	0.000	0.000	33.249	-	33.249

Change Summary Explanation

Net increase in FY 2018 from PB19 to PB20 reflects improvements in discrimination capabilities and USFK JEONS.

Net increase in FY 2019 from PB19 to PB20 reflects enacted congressional increases (USFK JEON, cyber threats, improved discrimination capabilities, systems engineering enhancements, AN/TPY-2 radar improvements) and decreases (program operations unjustified request; and transfer of Pacific Radar from this Program Element to Pacific Radar PE 0604673C).

Increase in FY 2020 from PB19 to PB20 provides additional VV&A, M&S Enterprise improvements, and USFK JEONS integration requirements.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Missile Defense Agency			Date: March 2019
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / *Ballistic Missile Defense Sensors*	Project (Number/Name) MD11 / *BMDS Radars*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
MD11: *BMDS Radars*	1,328.092	275.144	366.335	263.491	-	263.491	281.044	249.504	260.982	309.225	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Decrease in FY 2020 reflects the completion of AN/TPY-2 development in FY 2019 providing new BMDS capabilities, to include additional raid handling and enhanced Aegis BMD Engage on Remote.

A. Mission Description and Budget Item Justification

The BMDS Radars project includes development of future AN/TPY-2, COBRA DANE, LRDR, Sea Based X-Band (SBX), and UEWR capabilities through system engineering; software development; and testing support.

Modeling and Simulation (M&S) efforts include enhanced sensor models, development of Radio Frequency scene generators, integration of digital simulations into the Ballistic Missile Defense System (BMDS) M&S architecture, and Verification, Validation, and Accreditation of radar models. United States Forces Korea (USFK) Joint Emerging Operational Needs Statement (JEONS) provides rapid deployment of software upgrades to optimize performance against increasing threats and improve regional integration. This project also funds participation and support for Ballistic Missile Defense System (BMDS) element ground and flight test campaigns and Warfighter games and exercises.

This project will continue development of discrimination advanced algorithms for the AN/TPY-2, COBRA DANE, Sea Based X-Band (SBX), and the UEWR radars to counter evolving threats. The discrimination improvement effort will develop and field integrated Element capabilities to improve BMDS ability to identify lethal and non-lethal objects. Sensors will continue development of discrimination improvement mid-term design and test support for SBX and far-term trade analysis and planning.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020
Title: Basic Development Program	25.004	25.502	28.742
Articles:	-	-	-
Description: The Basic Development Program includes development and testing of software maintenance updates to address software trouble reports identified on fielded SW versions and flight/ground test events. Software maintenance updates also includes annual cybersecurity certifications and accreditations, testing for vulnerabilities, and third party assessments of all sensors systems. Software improvement efforts also include optimization of increased processing capabilities. The Basic Development Program also provides analysis of software performance during flight and ground testing of Phased Adaptive Approach (PAA) Phases II and III to conduct Materiel Release Analysis for software delivery. The Materiel Release Closure Plan for the AN/TPY-2 ensures the Reliability, Availability, and Maintainability (RAM) Program promotes reliability growth in the suite of AN/TPY-2 radars via product improvements.			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD11 / *BMDS Radars*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020
Specific and/or unique accomplishments to each FY are as follows: ***FY 2019 Plans:*** - SEE ABOVE. ***FY 2020 Plans:*** - SEE ABOVE ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Increase from FY 2019 to FY 2020 provides additional software development.			
Title: BMDS Radars Modeling & Simulation (M&S)	20.212	23.815	60.812
Articles:	-	-	-
Description: BMDS Radars M&S efforts include enhanced sensor models, development and maintenance of Radio Frequency (RF) scene generators, integration of digital simulations into the Ballistic Missile Defense System (BMDS), M&S architecture, and Verification, Validation, and Certification (VV&C) of radar models. This effort includes support for technical and performance assessments using Open Systems Architecture Sensor Models (OSM), Open Systems Architecture Signal Injectors (OSI) and other models/tools, as well as development and sustainment of Digital and Hardware in the Loop (HWIL) representations of the tactical versions of AN/TPY-2, LRDR, SBX, UEWR, and COBRA DANE Upgrade (CDU). This effort includes support for tactical Requirements verification, including development and VV&C of models for testing electronic protection and objective debris mitigation algorithms. This project also supports war games, Warfighter exercises and training, and execution of element-level ground test campaigns to anchor M&S. Specific and/or unique accomplishments to each FY are as follows: ***FY 2019 Plans:*** - SEE ABOVE ***FY 2020 Plans:*** - Initiate development of additional capabilities in high fidelity digital models for AN/TPY-2 and SBX. - Initiate Validation of high fidelity digital models for AN/TPY-2 and SBX. - Initiate Validation of Multi-band Electronic Attack Digital Injection Capability (MEDIC). - Initiate development of integrated simulation capabilities in high fidelity radar models for Full Digital Product as part of Enterprise Digital Integrated System Simulation (EDISS)			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD11 / *BMDS Radars*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020
- Initiate development of integrated simulation capabilities in HWIL radar models for Ground Test Integrated System Simulation (GTISS) ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Increase from FY 2019 to FY 2020 provides additional VV&A and M&S Enterprise improvements to provide high fidelity simulation (Digital) and stimulation (HWIL) of advanced radar capabilities in support of future technical capability declarations (TCD).			
Title: Capability Development Program	136.611	223.777	103.973
Articles:	-	-	-
Description: The Capability Development Program provides engineering support to enable compliance with BMD System Specification threat capabilities and addresses advanced threats prevalent in 2017 and beyond. This task includes the redesign of select components to address obsolescence and improve reliability of the system. This task initiates electronic protection and objective debris mitigation development efforts to reduce or eliminate the effect of corporate clutter and electronic attack on sensors. This effort develops the Post Intercept Assessment (PIA) capability for the SBX and UEWRs. It develops, designs and tests sensor mid-term discrimination improvements for X-Band radars, to include SBX threat discrimination improvements. It also performs object classification performance updates to UEWR radars. This effort funds participation in far-term discrimination improvement threat model specifications and develops discrimination and countermeasure mitigation capability development. Additional software development activities include support to THAAD Launch on Remote (LoR) capability and X86 performance optimization to enhance processing speed. Specific and/or unique accomplishments to each FY are as follows: ***FY 2019 Plans:*** - SEE ABOVE ***FY 2020 Plans:*** - Initiate additional raid handling, - Initiate enhanced Aegis BMD Engage on Capability, - Initiate expanded active sensor bias and full sensor bias reporting. - Initiate threat updates and verification, core standards system engineering, required updates to models and simulation, and performance assessments. ***FY 2019 to FY 2020 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD11 / *BMDS Radars*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020
Decrease from FY 2019 to FY 2020 reflects completion of AN/TPY-2 development in FY 2019 to provide improved raid handling and enhanced Aegis BMD Engage on Remote Capability.			
Title: Sensors Directorate Operations	65.483	57.428	50.892
Articles:	-	-	-
Description: Program Operations provides strategic planning, program integration, contracting, acquisition, engineering, financial management, internal reviews and audits, and program assessments for the Sensors Program Office. Recurring activities include: - Provide technical and business management support activities to provide the Program Director with critical program status and decision quality data - Ensure Sensors program compliance with internal and external direction, policies, and regulations to deliver critical capability within a consistent and disciplined process - Conduct internal program reviews to measure program progress against the six Missile Defense Agency approved baselines - Continue a Mission Assurance and Manufacturing Engineering Program to include Quality, Configuration Management, Manufacturing, Engineering, and Safety in all phases of the system life cycle, throughout the supply chain, and at all levels of assembly emphasizing high yield rates which minimize test and rework costs - Provide Quality Safety and Mission Assurance (QSMA) operations to ensure compliance with Agency requirements for design, test, manufacturing, quality, safety and reliability to ensure high quality products are delivered to the Warfighter Specific and/or unique accomplishments to each FY are as follows: ***FY 2019 Plans:*** - SEE ABOVE ***FY 2020 Plans:*** -SEE ABOVE ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease from FY 2019 to FY 2020 reflects the transition of Sensors Test and SBX personnel to the Sensors Test PE, 0604879C, and SBX PE, 0603907C.			
Title: Upgrade Clear Early Warning Radar	2.034	6.613	3.172
Articles:	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD11 / *BMDS Radars*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020
Description: Upgrade of Clear Early Warning Radar and Cape Cod Early Warning Radar includes adaptation of hardware and software to UEWR infrastructure, support to BMDS communications and architecture work and installation at site. This project also includes preparation and removal of legacy equipment at each UEWR site. Specific and/or unique accomplishments to each FY are as follows: ***FY 2019 Plans:*** - Initiate operations and sustainment activities post operational acceptance to include SATCOM operators and System Administrators ***FY 2020 Plans:*** - Complete operations and sustainment activities post operational acceptance to include interim contractor logistics support at Clear Air Force Station (AFS) ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease from FY 2019 to FY 2020 reflects the completion of operations and sustainment activities post operational acceptance to include interim contractor logistics support at Clear Air Force Station (AFS).			
Title: United States Forces Korea (USFK) Joint Emerging Operational Needs Statement (JEONS)	25.800	29.200	15.900
Articles:	-	-	-
Description: Rapid deployment of software upgrades to optimize performance against increasing threats and improve regional integration. Phase 1 provides enhanced discrimination, increases search plan optimization, and updates Position, Navigation, and Timing and Regional Mission Data. Phase 2 will improve debris mitigation to increase raid performance against threats, improve debris tracks on radar resources, and provide search plan upgrades that increase search acquisition and support remote launcher capabilities. Phase 3 provides additional increased search plan capabilities, implementation of the DoD Regional Clock, remote launcher upgrades to integrate AN/TPY-2 with PATRIOT and THAAD systems, and improves proficiencies against advanced threats in complex environments. Specific and/or unique accomplishments to each FY are as follows: ***FY 2019 Plans:*** - Complete Phase 3 to utilize the DoD Regional Clock, expand defended areas and increase capabilities against threats, including improved remote launch capabilities			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD11 / *BMDS Radars*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020
- Initiate studies for an alternative radar mission profile and search plans to support regional engagement with THAAD, Aegis and Patriot ***FY 2020 Plans:*** - Initiate expanded THAAD/MSE integration (Part II) in support of the U.S. Forces Korea (USFK) Joint Emergent Operational Need Statement (JEONS), ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease from FY 2019 to FY 2020 reflects USFK JEON requirements.			
Accomplishments/Planned Programs Subtotals	275.144	366.335	263.491

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• 0208866C: *O&M*	491.179	472.473	522.529	-	522.529	502.337	552.596	573.723	657.706	0.000	3,772.543
• 0208866C: *PROCUREMENT*	3,052.841	2,572.400	1,493.793	-	1,493.793	1,670.987	1,834.709	1,971.280	1,822.396	0.000	14,418.406
• 0603882C: *Ballistic Missile Defense Midcourse Defense Segment*	1,153.263	803.359	1,156.506	-	1,156.506	829.451	766.237	834.533	776.671	Continuing	Continuing
• 0603890C: *BMD Enabling Programs*	533.993	620.831	571.507	-	571.507	603.672	541.667	574.553	553.969	Continuing	Continuing
• 0603896C: *Ballistic Missile Defense Command and Control, Battle Management & Communication*	449.985	507.817	564.206	-	564.206	534.988	502.581	525.742	535.636	Continuing	Continuing
• 0603898C: *Ballistic Missile Defense Joint Warfighter Support*	48.574	48.767	51.532	-	51.532	51.411	53.932	53.600	54.646	Continuing	Continuing
• 0603904C: *Missile Defense Integration and Operations Center (MDIOC)*	51.905	58.125	56.161	-	56.161	57.446	58.574	61.144	62.339	Continuing	Continuing
• 0603907C: *Sea Based X-Band Radar (SBX)*	173.988	136.715	128.156	-	128.156	119.452	132.826	127.504	139.909	Continuing	Continuing
• 0603914C: *Ballistic Missile Defense Test*	406.806	515.897	395.924	-	395.924	417.946	335.481	451.723	405.136	Continuing	Continuing

Exhibit R-2A, RDT&E Project Justification: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD11 / *BMDS Radars*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• 0604181C: *Hypersonic Defense*	63.032	130.944	157.425	-	157.425	142.391	116.931	119.780	122.078	0.000	852.581
• 0604673C: *Pacific Discriminating Radar*	59.564	15.926	6.711	-	6.711	59.800	53.444	279.349	398.573	0.000	873.367
• 0604873C: *Long Range Discrimination Radar (LRDR)*	370.516	166.543	136.423	-	136.423	122.877	99.920	88.203	64.569	Continuing	Continuing
• 0604879C: *Ballistic Missile Defense Sensor Test*	88.840	77.405	105.530	-	105.530	114.698	99.088	112.943	96.526	Continuing	Continuing
• 13999903: *Planning and Design, Defense Wide*	8.397	8.525	8.822	-	8.822	0.000	0.000	0.000	0.000	Continuing	Continuing

Remarks

D. Acquisition Strategy

The Radar Development Contract (RDC) awarded on Nov 1, 2017 supports the Sensors Directorate's X-Band Radars (XBR). Ballistic Missile Defense System (BMDS) capability and performance requirements, which underpin continuing XBR development requirements include, but are not limited to, the Army/Navy Transportable Radar Surveillance and Control (AN/TPY-2) radar and the Sea-Based X-Band (SBX) radar. These requirements stem directly from formal Warfighter requirements as developed in the United States Strategic Command (USSTRATCOM)-led Warfighter Involvement Process (see USSTRATCOM Special Instruction (SI) 538-3, Missile Defense Warfighter Involvement Process, June 25, 2008). Achievable requirements documented in the Prioritized Capabilities List (PCL) and Modification and Fielding Requirements List (MFRL) are documented in MDA's Achievable Capabilities List (ACL) and translated via the BMDS architecture and system specifications into flow-down requirements, characteristics, and capability needs for individual BMDS program specifications, and ultimately are approved through the systems engineering and baseline change management process for BMDS programs to execute. The RDC supports the XBRs for product improvement, including developmental upgrades of software and development of hardware and software to meet enhanced capabilities and risk reduction measures; warfighter support, including wargames and exercise support; engineering services, including engineering support for delivered and accepted radars to facilitate maintenance efforts which may include, but are not limited to, hardware obsolescence studies, hardware redesign, technology insertion and refurbishment; BMDS test subject matter expert (SME) support; modeling and simulation SME support; and cybersecurity. These support activities are for all AN/TPY-2 radars, in the Forward Based Mode (FBM) and Terminal Mode (TM), and the SBX Radar to include the Weather Air Search Radar (WxASR) located on the SBX platform.

The BMDS Communications System Complex-Transportable (BCSC-T) Program Plan addresses the design, development, acquisition, testing, integration, activation, and fielding of the BCSC-T. The overall executing agent is the Program Manager Defense Communications and Transmission Systems (PMDCATS). Lockheed Martin Mission Systems (C2BMC prime contractor) via an Other Transaction Agreement provides on-site support.

E. Performance Metrics

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD11 / *BMDS Radars*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Basic Development Program - Information Assurance AN/TPY-2	SS/CPAF	Raytheon : MA	18.953	3.722	Nov 2017	3.802	Nov 2018	17.699	Nov 2019	-		17.699	Continuing	Continuing	Continuing
Basic Development Program - Information Assurance SBX	SS/CPAF	Raytheon : MA	0.855	0.223	Oct 2017	0.225	Oct 2018	0.000		-		0.000	Continuing	Continuing	Continuing
Basic Development Program - Material Release Get Well Plan	SS/CPAF	Raytheon : MA	14.520	2.045	Dec 2017	2.082	Dec 2018	0.609	Dec 2019	-		0.609	Continuing	Continuing	Continuing
Basic Development Program - Prior year Capability Development no longer funded in the FYDP	Various	Various : Various	8.778	0.000		0.000		0.000		-		0.000	0.000	8.778	0.000
Basic Development Program - Sys Integration & Tech Assessments	SS/CPAF	Raytheon : MA/AL	20.186	3.273	Mar 2018	2.824	Mar 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Basic Development Program - X-Band Software Enhancements/ Development	SS/CPAF	Raytheon : AL	93.972	15.741	Jan 2018	16.569	Jan 2019	10.434	Feb 2020	-		10.434	Continuing	Continuing	Continuing
BMDS Radars Modeling & Simulation (M&S) - M&S Development	SS/CPFF	Raytheon : MA, CO	131.027	13.178	Nov 2017	16.656	Nov 2018	43.399	Jan 2020	-		43.399	Continuing	Continuing	Continuing
BMDS Radars Modeling & Simulation (M&S) - VV&A of Models	MIPR	AMRDEC : AL	48.281	5.037	Dec 2017	5.124	Dec 2018	14.946	Dec 2019	-		14.946	Continuing	Continuing	Continuing
BMDS Radars Modeling & Simulation (M&S) - Warfighter Exercises	SS/CPFF	Raytheon : MA	10.340	1.997	Feb 2018	2.035	Feb 2019	2.467	Mar 2020	-		2.467	Continuing	Continuing	Continuing
Capability Development Program - AN/TPY-2 Capability Development	SS/CPAF	Raytheon : MA	124.939	66.632	Oct 2017	37.813	Nov 2018	20.416	Nov 2019	-		20.416	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD11 / *BMDS Radars*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Capability Development Program - AN/TPY-2 GaN TTP	SS/CPAF	Raytheon : MA	14.720	10.200	Jan 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Capability Development Program - COBRA DANE Upgrades	TBD	TBD : TBD	16.000	5.000	Dec 2017	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Capability Development Program - Electronic Protection	SS/CPAF	Raytheon, GTRI : MA, GA	14.897	7.659	Oct 2017	8.911	Oct 2018	5.209	Oct 2019	-		5.209	Continuing	Continuing	Continuing
Capability Development Program - Enhanced Discrimination	C/CPAF	USAF, Raytheon : Hanscom AFB MA	99.818	24.900	Nov 2017	160.353	Jan 2019	60.360	Jan 2020	-		60.360	Continuing	Continuing	Continuing
Capability Development Program - Homeland Defense Radar - Hawaii (HDR-H) Studies and Analysis	MIPR	JHU/APL, NSWC, MDA : MD, AL, VA	2.451	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Capability Development Program - Homeland Defense Radar - Pacific (HDR-P) Study	MIPR	JHU/APL, NSWC, MDA : MD, VA, AL	0.000	5.000	Feb 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Capability Development Program - Integrated Electronic Security System (IESS) Site K	MIPR	US Corps of Engineers : Germany	0.000	6.820	Jan 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Capability Development Program - Post Intercept Assessment (PIA)	C/CPAF	Raytheon : MA	0.000	10.400	Jan 2018	6.700	Dec 2018	5.200	Dec 2019	-		5.200	Continuing	Continuing	Continuing
Capability Development Program - Prior year Capability Development no longer funded in the FYDP	Various	Various : Various	22.753	0.000		0.000		0.000		-		0.000	0.000	22.753	0.000

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD11 / *BMDS Radars*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Capability Development Program - SBX Capability Development	SS/CPAF	Raytheon : MA	0.000	0.000		7.000	Jan 2019	11.788	Mar 2020	-		11.788	Continuing	Continuing	Continuing
Capability Development Program - UEWR Capability Development	SS/CPAF	Raytheon : MA	0.000	0.000		3.000	Jun 2019	1.000	Jun 2020	-		1.000	Continuing	Continuing	Continuing
Sensors Directorate Operations - - Contractor Service Support	Various	Various : Various	205.153	19.027	Nov 2017	18.709	Nov 2018	18.267	Oct 2019	-		18.267	Continuing	Continuing	Continuing
Sensors Directorate Operations - - FFRDC/ UARC	SS/CPAF	CSS, APL, LL, OGA, GTRI, MITRE : AL,MA, VA, MD, GA	86.054	13.404	Nov 2017	7.613	Nov 2018	7.815	Nov 2019	-		7.815	Continuing	Continuing	Continuing
Sensors Directorate Operations - -- Civilians/ Travel	Various	MDA : AL, VA, MA	156.857	22.026	Oct 2017	21.970	Oct 2018	19.512	Oct 2019	-		19.512	Continuing	Continuing	Continuing
Sensors Directorate Operations - Army Hybrid Program Office	MIPR	SMDC : AL	5.968	1.865	Dec 2017	1.236	Dec 2018	1.258	Dec 2019	-		1.258	Continuing	Continuing	Continuing
Sensors Directorate Operations - Network and Infrastructure Services	C/CPAF	Northrop Grumman/ IJacobs Eng : AL, AK, CA, CO, HI, NM, VA	35.583	6.205	Feb 2018	5.700	Feb 2019	2.000	Jan 2020	-		2.000	Continuing	Continuing	Continuing
Sensors Directorate Operations - Other Govt Agencies	MIPR	SMDC/AL, Hanscom AFB : MA	32.393	2.956	Feb 2018	2.200	Feb 2019	2.040	Feb 2020	-		2.040	Continuing	Continuing	Continuing
Upgrade Clear Early Warning Radar - BCN Upgrades	MIPR	MDA C2BMC / DISA : MA, AK	18.633	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Upgrade Clear Early Warning Radar - Facilities Site Activation/Admin Comms	MIPR	MDA C2BMC : MA, AK	7.449	0.000		5.282	Dec 2018	0.000		-		0.000	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD11 / *BMDS Radars*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Upgrade Clear Early Warning Radar - GMD Fire Control Integration	SS/CPAF	Boeing/AK/AL, Raytheon : MA	5.910	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Upgrade Clear Early Warning Radar - Prior year Upgrade Clear Early Warning Radar no longer funded in the FYDP	Various	Various : Various	9.218	0.000		0.000		0.000		-		0.000	0.000	9.218	0.000
Upgrade Clear Early Warning Radar - Radar Upgrade -- Prime Contractor	C/CPAF	Raytheon : MA	122.384	2.034	Jan 2018	1.331	Jan 2019	3.172	Jan 2020	-		3.172	Continuing	Continuing	Continuing
United States Forces Korea (USFK) Joint Emerging Operational Needs Statement (JEONS) - Software Enhancements/ Development	C/CPAF	Raytheon : MA	0.000	25.800	Jan 2018	29.200	Jan 2019	15.900	Jan 2020	-		15.900	Continuing	Continuing	Continuing
		Subtotal	1,328.092	275.144		366.335		263.491		-		263.491	Continuing	Continuing	N/A

Remarks

Note: Clear Early Warning Upgrade Program includes upgrade of the Cape Cod EWR.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	-	-		-		-		-		-	-	-	N/A

Remarks

Operations and sustainment of Upgraded Early Warning Radar (UEWR), COBRA DANE (CD), and Army Navy/Transportable Radar Surveillance and Control (AN/TPY-2) Radars Contract Logistics Support (CLS) are Operations and Maintenance (O&M) Defense-Wide appropriations and are described in the Missile Defense Agency (MDA) O-Documents.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Missile Defense Agency			Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD11 / *BMDS Radars*	

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	-	-		-		-		-		-	-	-	N/A

Remarks

N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	-	-		-		-		-		-	-	-	N/A

Remarks

N/A

	Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	1,328.092	275.144		366.335		263.491		-		263.491	Continuing	Continuing	N/A

Remarks

Award Date reflects date of first obligation. Additional obligations may incrementally occur throughout the year.

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD11 / *BMDS Radars*

Significant Event Complete ▲ Significant Event Planned △ | Milestone Decision Complete ★ Milestone Decision Planned ☆ | Element Test Complete ◆ Element Test Planned ◇ | System Level Test Complete ● System Level Test Planned ○ | Complete Activity ✦ Planned Activity ✧

	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
SNG-C-D-2	◇																											
SNG-A-H-2	◇																											
SNG-U-D-2	◇																											
SNG-S-H-2	◇																											
SNG-C-H-3		◇																										
SNG-S-D-3			◇																									
FTI-03 (OTA, OT Intercept Flight Test)					△																							
FTG-11 (OT) (GM, OT Intercept Flight Test)						△																						
FTT-23 (TH, DT Intercept Flight Test)							△																					
FTX-23 (AEGIS 5.1, DT Target Only Flight Test)							△																					
(EX) EAGLE RESOLVE 20									△																			
(EX) AIR AND MISSILE DEFENSE EXERCISE 21											△																	
(EX) AIR AND MISSILE DEFENSE EXERCISE 22															△													
(EX) EAGLE RESOLVE 22																	△											
(EX) AIR AND MISSILE DEFENSE EXERCISE 23																			△									
SNG-U-H-4																					◇							
SNG-A-D-4																						◇						
SNG-C-D-3																						◇						
SNG-A-H-4																							◇					
(EX) AIR AND MISSILE DEFENSE EXERCISE 24																							△					
SNG-S-D-6																								✧	✧			
(EX) EAGLE RESOLVE 24																									△			
SNG-A-D-5																										✧	✧	
SNG-S-H-5																										✧	✧	

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD11 / *BMDS Radars*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
SNG-C-D-2	1	2018	1	2018
SNG-A-H-2	1	2018	1	2018
SNG-U-D-2	1	2018	1	2018
SNG-S-H-2	1	2018	1	2018
SNG-C-H-3	2	2018	2	2018
SNG-S-D-3	3	2018	3	2018
FTI-03 (OTA, OT Intercept Flight Test)	1	2019	1	2019
FTG-11 (OT) (GM, OT Intercept Flight Test)	2	2019	2	2019
FTT-23 (TH, DT Intercept Flight Test)	4	2019	4	2019
FTX-23 (AEGIS 5.1, DT Target Only Flight Test)	4	2019	4	2019
(EX) EAGLE RESOLVE 20	2	2020	2	2020
(EX) AIR AND MISSILE DEFENSE EXERCISE 21	4	2020	4	2020
(EX) AIR AND MISSILE DEFENSE EXERCISE 22	4	2021	4	2021
(EX) EAGLE RESOLVE 22	2	2022	2	2022
(EX) AIR AND MISSILE DEFENSE EXERCISE 23	4	2022	4	2022
SNG-U-H-4	2	2023	2	2023
SNG-A-D-4	3	2023	3	2023
SNG-C-D-3	3	2023	3	2023
SNG-A-H-4	4	2023	4	2023
(EX) AIR AND MISSILE DEFENSE EXERCISE 24	4	2023	4	2023
SNG-S-D-6	1	2024	2	2024
(EX) EAGLE RESOLVE 24	2	2024	2	2024

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD11 / *BMDS Radars*

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
SNG-A-D-5	3	2024	4	2024
SNG-S-H-5	3	2024	4	2024

Exhibit R-2A, RDT&E Project Justification: PB 2020 Missile Defense Agency			Date: March 2019
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / *Ballistic Missile Defense Sensors*	Project (Number/Name) MC11 / *Cyber Operations*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
MC11: *Cyber Operations*	5.101	3.894	6.079	8.212	-	8.212	1.555	1.586	1.617	24.618	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Increase from FY 2019 to FY 2020 provides developmental efforts for DoD directed cybersecurity improvements including DoD required cybersecurity tools, policies and procedures for improved network defense against cyber threats to enhance BMDS cybersecurity posture as well as to begin full Sensors system integration with an automated BMDS Cybersecurity Service Provider (CSSP).

A. Mission Description and Budget Item Justification

Sustain the Department of Defense Instruction (DoDI) 8510.01 Risk Management Framework (RMF) for DoD Information Technology (IT) requirement for the MDA Sensors Directorate and conduct Security Control Assessments (SCA) activities, analysis of validation results, risk assessments and reviews of proposed Program Manager/Information System Security Manager (PM/ISSM) Plans of Action and Milestones for MDA Sensors mission systems. It also includes support for external cybersecurity assessments and penetration testing of the Sensors mission systems, both in laboratory Element Cybersecurity Experiments and in ground test activities, in accordance with the Director, Operational Test and Evaluation (DOT&E) directive and the Integrated Master Test Plan (IMTP). It maintains the Assessment and Authorization (A&A) data repository, capturing the RMF documentation (artifacts, validation results, Cybersecurity Risk Assessment results, cybersecurity scorecard, and Authorizing Official (AO) authorization decisions) and POA&M for all MDA information systems. This project supports the alignment, development, and implementation of an integrated Tier 2 Cyber Security Service Provider (CSSP) capability on the Sensors mission systems IAW the DoD Cybersecurity Discipline Implementation Plan and DoDI 8530.01 Cybersecurity Activities Support to DoD Information Network Operations.

Provides the monitoring, prioritization, and tracking of Cybersecurity mitigation detailed in Information Technology security POA&Ms. The activities include preparation of A&A documentation and accreditation recommendations to the MDA Senior Information Security Officer (SISO)/Security Control Assessor (SCA) and Authorizing Official (AO). Independent Verification and Validation (IV&V) team actions ensure the availability, integrity, authentication, confidentiality and non-repudiation of the MDA mission; test; and administrative systems. Activities in the Project are necessary to comply with the Federal Information Security Management Act (FISMA).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020
Title: Network / System Assessment and Authorization (A&A)	3.894	6.079	8.212
Articles:	-	-	-
Description: Cyber Operations funds Sensors Directorate Information System Security Manager (ISSM) civilian salaries and cybersecurity engineering and architecture planning for program information technology systems. This project plans and tests the cybersecurity controls for the BMDS and maintains Sensors Risk Management Framework (RMF) authorizations for Sensors-managed information systems, conducts Controls Validation Testing (CVT)/ Security Controls Assessment (SCA) of sensors mission and support systems and provides and maintains Plans of Action and Milestones to mitigate cybersecurity deficiencies.			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MC11 / *Cyber Operations*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020
Cyber Operations conducts annual cybersecurity program reviews on the Sensors enclaves to assess compliance in implementing and maintaining controls. Specific and/or unique accomplishments to each FY are as follows: ***FY 2019 Plans:*** - SEE ABOVE. ***FY 2020 Plans:*** -SEE ABOVE ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Increase from FY 2019 to FY 2020 provides developmental efforts for DoD directed cybersecurity improvements including DoD required cybersecurity tools, policies and procedures for improved network defense against cyber threats to enhance BMDS cybersecurity posture as well as to begin full Sensors system integration with an automated BMDS Cybersecurity Service Provider (CSSP).			
Accomplishments/Planned Programs Subtotals	3.894	6.079	8.212

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• 0603896C: *Ballistic Missile Defense Command and Control, Battle Management & Communication*	449.985	507.817	564.206	-	564.206	534.988	502.581	525.742	535.636	Continuing	Continuing
• 0603898C: *Ballistic Missile Defense Joint Warfighter Support*	48.574	48.767	51.532	-	51.532	51.411	53.932	53.600	54.646	Continuing	Continuing
• 0603904C: *Missile Defense Integration and Operations Center (MDIOC)*	51.905	58.125	56.161	-	56.161	57.446	58.574	61.144	62.339	Continuing	Continuing
• 0603907C: *Sea Based X-Band Radar (SBX)*	173.988	136.715	128.156	-	128.156	119.452	132.826	127.504	139.909	Continuing	Continuing
• 0604873C: *Long Range Discrimination Radar (LRDR)*	370.516	166.543	136.423	-	136.423	122.877	99.920	88.203	64.569	Continuing	Continuing

Exhibit R-2A, RDT&E Project Justification: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MC11 / *Cyber Operations*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• 0604879C: *Ballistic Missile Defense Sensor Test*	88.840	77.405	105.530	-	105.530	114.698	99.088	112.943	96.526	Continuing	Continuing
• 0901598C: *Management HQ - MDA*	29.947	28.626	27.065	-	27.065	27.446	28.164	28.698	29.271	Continuing	Continuing
• 13999903: *Planning and Design, Defense Wide*	8.397	8.525	8.822	-	8.822	0.000	0.000	0.000	0.000	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Missile Defense Agency			Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MC11 / *Cyber Operations*	

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Network / System Assessment and Authorization (A&A) - CND/IA Advisory and Assistance Services (Booz Allen)	C/CPFF	Booz Allen Hamilton : AL, CO, VA	2.692	0.538	Nov 2017	0.509	Nov 2018	0.509	Nov 2019	-		0.509	Continuing	Continuing	Continuing
Network / System Assessment and Authorization (A&A) - CND/IA Advisory and Assistance Services (Torch Technologies)	C/CPFF	Torch Technologies : AL, CO, VA	1.654	0.353	Jan 2018	0.385	Jan 2019	0.719	Nov 2019	-		0.719	Continuing	Continuing	Continuing
Network / System Assessment and Authorization (A&A) - Civilian Salaries	Various	MDA : AL, CO, VA	0.755	0.176	Oct 2017	0.185	Oct 2018	0.297	Oct 2019	-		0.297	Continuing	Continuing	Continuing
Network / System Assessment and Authorization (A&A) - Cybersecurity Supply Chain Compliance	SS/CPAF	Raytheon : MA	0.000	2.827	Mar 2018	5.000	Jan 2019	6.687	Mar 2020	-		6.687	Continuing	Continuing	Continuing
		Subtotal	5.101	3.894		6.079		8.212		-		8.212	Continuing	Continuing	N/A

Remarks

N/A

	Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	5.101	3.894		6.079		8.212		-		8.212	Continuing	Continuing	N/A

Remarks

Award Date reflects date of first obligation. Additional obligations may incrementally occur throughout the year.

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MC11 / *Cyber Operations*

Significant Event Complete ▲ Significant Event Planned △ Milestone Decision Complete ★ Milestone Decision Planned ☆ Element Test Complete ◆ Element Test Planned ◇ System Level Test Complete ● System Level Test Planned ○ Complete Activity ✦ Planned Activity ✧

	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
BMDS Cyber Security Policy Development	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧				
Transition to Cyber Security Risk Management Framework (CRMF)	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧
Information Assurance Certification and Accreditation (C&A) Package Preparation / Submission	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧
Cyber Security Program Policy / Risk Management	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧
Cyber Security Mitigation Monitoring and Tracking	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧
Integrated Cyber Security Service Provider									✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧			

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MC11 / *Cyber Operations*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
BMDS Cyber Security Policy Development	1	2018	4	2023
Transition to Cyber Security Risk Management Framework (CRMF)	1	2018	4	2024
Information Assurance Certification and Accreditation (C&A) Package Preparation / Submission	1	2018	4	2024
Cyber Security Program Policy / Risk Management	1	2018	4	2024
Cyber Security Mitigation Monitoring and Tracking	1	2018	4	2024
Integrated Cyber Security Service Provider	1	2020	1	2024

Exhibit R-2A, RDT&E Project Justification: PB 2020 Missile Defense Agency			Date: March 2019
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / *Ballistic Missile Defense Sensors*	Project (Number/Name) MD41 / *Homeland Defense Radar - Hawaii (HDR-H)*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
MD41: *Homeland Defense Radar - Hawaii (HDR-H)*	-	2.078	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.078
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

HDRH funding was appropriated/budgeted as follow:
FY 2017: PE 0603884C BMDS Sensors, Project MD41 FY 2018: PE 0604673C Pacific Discriminating Radar, Project MD41 FY 2019: PE 0604672C Homeland Defense Radar Hawaii, Project MD41

A. Mission Description and Budget Item Justification

The Homeland Defense Radar-Hawaii (HDR-H) is a persistent discrimination radar that will provide additional capability to the Ballistic Missile Defense System (BMDS) to support the defense of Hawaii. HDR-H's primary mission is to provide autonomous acquisition and persistent precision tracking and discrimination to optimize the defensive capability of the BMDS and counter evolving threats. The HDR-H radar will be integrated into the BMDS through the C2BMC system and will feature a scalable and open system architecture to mitigate evolving threats. HDR-H's inherent capability will support additional mission areas, including but not limited to, Space Situational Awareness (SSA). The HDR-H radar is comprised of an equipment shelter housing a singled-faced array, a Mission Control Facility (MCF) which supports radar operations, a Radar Antenna Base, a Thermal Control System, and supporting facilities and infrastructure. The radar prime contractor will be responsible for building and fielding the radar equipment with associated Radar Antenna Base and Thermal Control, and the HDR-H Equipment Shelter (HES). Siting surveys will be conducted and EIS will be completed to determine the final recommended site. The HDR-H radar will be made operational in Hawaii by not later than September 30, 2023.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020
Title: MD41 Homeland Defense Radar - Hawaii (HDR-H)"	2.078	0.000	0.000
Articles:	-	-	-
Description: The HDR-H program includes requirements development activities associated with systems engineering, hardware and software development, discrimination improvements, design reviews, testing, and Models and Simulation (M&S) efforts for radar development. Efforts include site activation and preparation of site infrastructure for construction activities. The program will develop and integrate C2BMC systems for HDR-H functionality.			
FY 2019 Plans: N/A			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD41 / *Homeland Defense Radar - Hawaii (HDR-H)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020
N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** HDRH funding was appropriated/budgeted as follow: FY 2017: PE 0603884C BMDS Sensors, Project MD41 FY 2018: PE 0604673C Pacific Discriminating Radar, Project MD41 FY 2019: PE 0604672C Homeland Defense Radar Hawaii, Project MD41			
Accomplishments/Planned Programs Subtotals	2.078	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD41 / *Homeland Defense Radar - Hawaii (HDR-H)*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MD41 Homeland Defense Radar - Hawaii (HDR-H)" - Homeland Defense Radar - Hawaii (HDR-H) - Site Activation & Studies	C/CPFF	Lockheed Martin : AL	0.000	2.078	Nov 2017	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	0.000	2.078		0.000		0.000		-		0.000	Continuing	Continuing	N/A

Remarks

N/A

	Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	2.078		0.000		0.000		-		0.000	Continuing	Continuing	N/A

Remarks

Award Date reflects date of first obligation. Additional obligations may incrementally occur throughout the year.

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD41 / *Homeland Defense Radar - Hawaii (HDR-H)*

Significant Event Complete ▲ Milestone Decision Complete ★ Element Test Complete ◆ System Level Test Complete ● Complete Activity ✦
Significant Event Planned △ Milestone Decision Planned ☆ Element Test Planned ◇ System Level Test Planned ○ Planned Activity ✧

	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
Development	✧																											

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD41 / *Homeland Defense Radar - Hawaii (HDR-H)*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Development	1	2018	1	2018

Exhibit R-2A, RDT&E Project Justification: PB 2020 Missile Defense Agency			Date: March 2019
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / *Ballistic Missile Defense Sensors*	Project (Number/Name) MD40 / *Program-Wide Support*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
MD40: *Program-Wide Support*	85.378	9.173	12.961	11.784	-	11.784	13.499	12.591	13.493	17.764	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Program Wide Support (PWS) is allocated on a pro-rata basis across multiple Agency PE's each fiscal year based on the total Agency budget, and therefore fluctuates per PE by fiscal year.

A. Mission Description and Budget Item Justification

PWS contains non-headquarters management costs in support of MDA functions and activities across the entire BMDS. It Includes Government Civilians and Contract Support Services. This provides integrity and oversight of the BMDS as well as supports MDA in the development and evaluation of technologies that will respond to the changing threat. Additionally, PWS includes personnel to support global deployments performing deployment site preparation and activation, and provides facility capabilities for MDA Executing Agent locations. Other MDA wide costs include: physical and technical security; civilian drug testing; audit readiness; the Science, Technology, Engineering, and Mathematics (STEM) program; legal services and settlements; travel and agency training; office, equipment, vehicle, and warehouse leases; utilities and base operations; data and unified communications support; supplies and maintenance; materiel and readiness and central property management of equipment; Facilities Sustainment, Restoration and Modernization (SRM) program, (formerly Real Property Maintenance) to keep the Department's inventory of facilities in good working order; and similar operating expenses. PWS is allocated on a pro-rata basis across most Agency PEs and therefore fluctuates per PE by fiscal year based on the total Agency budget in that fiscal year.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020
Title: Program Wide Support	9.173	12.961	11.784
Articles:	-	-	-
Description: PWS contains non-headquarters management costs in support of MDA functions and activities across the entire BMDS. It Includes Government Civilians and Contract Support Services. This provides integrity and oversight of the BMDS as well as supports MDA in the development and evaluation of technologies that will respond to the changing threat. Additionally, PWS includes personnel to support global deployments performing deployment site preparation and activation, and provides facility capabilities for MDA Executing Agent locations. Other MDA wide costs include: physical and technical security; civilian drug testing; audit readiness; the Science, Technology, Engineering, and Mathematics (STEM) program; legal services and settlements; travel and agency training; office, equipment, vehicle, and warehouse leases; utilities and base operations; data and unified communications support; supplies and maintenance; materiel and readiness and central property management of equipment; Facilities Sustainment, Restoration and Modernization (SRM) program, (formerly Real Property Maintenance) to keep the Department's inventory of facilities in good working order; and similar operating expenses. PWS is allocated on a pro-rata basis across most Agency PEs and therefore fluctuates per PE by fiscal year based on the total Agency budget in that fiscal year.			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD40 / *Program-Wide Support*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020
FY 2019 Plans: - SEE ABOVE. ***FY 2020 Plans:*** - SEE ABOVE. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** N/A			
Accomplishments/Planned Programs Subtotals	9.173	12.961	11.784

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD40 / *Program-Wide Support*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Wide Support - Agency Operations Management	C/CPAF	Various : Multi: AL, CA, CO, VA	8.214	0.134	Jul 2018	0.075	Jul 2019	0.177	Jul 2020	-		0.177	Continuing	Continuing	Continuing
Program Wide Support - Agency Operations User Services	MIPR	Various : Multi: AL, CO, NM, VA, Various	8.251	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Program Wide Support - Agency Operations and Support Other Agency Services (MIPRs)	MIPR	Various : Multi:AL,VA	11.077	0.000		0.000		2.234	Jul 2020	-		2.234	Continuing	Continuing	Continuing
Program Wide Support - Agency Operations and Support Other Agency Services (Reqn)	Reqn	Department of Labor : Washington, DC	0.170	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Program Wide Support - Agency Operations and Support Services	C/CPFF	Various : Multi: AL, CO, CA, VA	51.160	8.665	Aug 2018	12.886	Mar 2019	9.373	Aug 2020	-		9.373	Continuing	Continuing	Continuing
Program Wide Support - Agency Operations and Support civilian Salaries, Travel, Training	Allot	MDA : Multi:AK, AL,CA, CO, VA	4.189	0.374	Nov 2017	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Program Wide Support - Agency Operations and Support, International, and Materiel and Readiness	C/CPAF	JRDC : JRDC	0.587	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Program Wide Support - Agency Operations, Sustainment and GPC	Allot	Various : Multi: AL, CO, CA, VA	1.730	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	85.378	9.173		12.961		11.784		-		11.784	Continuing	Continuing	N/A

Remarks

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Missile Defense Agency			Date: March 2019
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / *Ballistic Missile Defense Sensors*	Project (Number/Name) MD40 / *Program-Wide Support*	

	Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	85.378	9.173		12.961		11.784		-		11.784	Continuing	Continuing	N/A

Remarks

Award Date reflects date of first obligation. Additional obligations may incrementally occur throughout the year.

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD40 / *Program-Wide Support*

Significant Event Complete ▲ | Milestone Decision Complete ★ | Element Test Complete ◆ | System Level Test Complete ● | Complete Activity ✦
Significant Event Planned △ | Milestone Decision Planned ☆ | Element Test Planned ◇ | System Level Test Planned ○ | Planned Activity ✧

	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
MD40 Program-Wide Support	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Missile Defense Agency		Date: March 2019
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0603884C / *Ballistic Missile Defense Sensors*	**Project (Number/Name)** MD40 / *Program-Wide Support*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
MD40 Program-Wide Support	1	2018	4	2024