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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Missile Defense Agency **Date:** February 2020

Appropriation/Budget Activity 0400: <i>Research, Development, Test & Evaluation, Defense-Wide / BA 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	1,581.299	382.759	352.288	281.957	-	281.957	576.699	656.539	574.703	593.592	Continuing	Continuing
MD11: <i>BMDs Radars</i>	1,477.753	360.338	311.998	269.199	-	269.199	552.234	633.753	555.360	571.096	Continuing	Continuing
MC11: <i>Cyber Operations</i>	8.995	6.053	28.506	1.558	-	1.558	1.580	1.614	1.191	5.390	Continuing	Continuing
MD40: <i>Program-Wide Support</i>	94.551	16.368	11.784	11.200	-	11.200	22.885	21.172	18.152	17.106	Continuing	Continuing

Program MDAP/MAIS Code: 362

Note

Homeland Defense Radar - Hawaii (HDR-H) funding was appropriated/budgeted as follows:

FY 2017: PE 0603884C BMDs Sensors, Project MD41

FY 2018: PE 0604673C Pacific Discriminating Radar, Project MD41

FY 2019/outyears: PE 0604672C Homeland Defense Radar Hawaii, Project MD41

Decrease from FY 2020 to FY 2021 reflects FY 2020 Congressional plus up for AN/TPY-2 High Altitude Electromagnetic Pulse (HEMP) Hardening and the completion of USINDOPACOM Joint Emerging Operational Needs Statement (JEONS) requirements.

The FY 2021 funding request was reduced by \$12.3 million during DWR to reduce Discrimination efforts.

The FY 2021 funding request was reduced by \$1.917 million during DWR to postpone HDR-Hawaii.

A. Mission Description and Budget Item Justification

The Missile Defense System (MDS) network of layered Sensors provides essential situational awareness and fire control data for the command and control of MDS 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. This data enables 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.

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This program element includes MDS threat discrimination improvements, which will enhance MDS effectiveness against the evolving adversary threat. The result will be a MDS architecture more capable of discriminating and destroying reentry vehicles with a higher degree of confidence, improving Warfighter shot doctrine, and more efficiently using interceptor inventory. MDS threat discrimination improvements are funded from the Enabling (0603890C), Midcourse (0603882C), BMD Sensors (0603884C), C2BMC (0603896C), and Aegis BMD (0603892C) Program Elements.

The BMD Sensors Program contributes to regional and homeland 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 and 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 MDS 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 MDS 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 MDS sensor architecture improves MDS sensor coverage and provides new engagement options against long-range missile threats from Northeast Asia and Southwest Asia respectively.

This program element also supports planned radar deployments including the Long Range Discrimination Radar (LRDR) in Alaska.

The Sea Based X-Band Radar (SBX) is currently deployed in the Pacific Ocean.

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.

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B. Program Change Summary (\$ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	385.375	283.487	296.098	-	296.098
Current President's Budget	382.759	352.288	281.957	-	281.957
Total Adjustments	-2.616	68.801	-14.141	-	-14.141
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	68.801			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-4.964	0.000			
• Missile Defeat and Defense Enhancement	0.000	0.000	0.000	-	0.000
• Other Adjustment	2.348	0.000	-14.141	-	-14.141

Change Summary Explanation

Increase in FY 2020 reflects Congressional plus ups for Cyber Security requirements and High altitude Electromagnetic Pulse (HEMP) hardening efforts, as well as a reduction to modeling and simulations.

Decrease in FY 2021 reflects a reduction in discrimination efforts.

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Missile Defense Agency **Date:** February 2020

Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MD11 / <i>BMDS Radars</i>
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
MD11: <i>BMDS Radars</i>	1,477.753	360.338	311.998	269.199	-	269.199	552.234	633.753	555.360	571.096	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Decrease from FY 2020 to FY 2021 reflects FY 2020 Congressional plus up for AN/TPY-2 High Altitude Electromagnetic Pulse (HEMP) Hardening and the completion of USINDOPACOM Joint Emerging Operational Needs Statement (JEONS) requirements.

A. Mission Description and Budget Item Justification

The MDS 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 Missile Defense System (MDS) M&S architecture, and Verification, Validation, and Accreditation of radar models. United States Indo-Pacific Command (USINDOPACOM) 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 MDS element ground and flight test campaigns and Warfighter games and exercises.

This project provides development of discrimination advanced algorithms for MDS radars to counter evolving threats. The discrimination improvement effort will develop and field integrated Element capabilities to improve MDS ability to identify lethal and non-lethal objects. Sensors will continue development of discrimination improvement mid-term design and test support for MDS radars and far term trade analysis and planning.

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2019	FY 2020	FY 2021
Title: Basic Development Program	27.194	28.742	26.031
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 to support Materiel Release for software deliveries. 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.			

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		FY 2019	FY 2020	FY 2021
Specific and/or unique accomplishments to each FY are as follows: FY 2020 Plans: - SEE ABOVE. FY 2021 Plans: - SEE ABOVE. FY 2020 to FY 2021 Increase/Decrease Statement: N/A				
Title: BMDS Radars Modeling & Simulation (M&S)		21.892	40.319	57.279
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 Missile Defense System (MDS), 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 various simulations and models to include 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, as well as the development of M&S frameworks and truth models required to anchor M&S.		Articles: -	-	-
Specific and/or unique accomplishments to each FY are as follows: 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 SBX - Initiate Validation of Multi-band Electronic Attack Digital Injection Capability (MEDIC) - Initiate End-to-end Digital Integrated System-level Simulation (EDISS) requirements development - Initiate Ground Test Integrated System Simulation (GTISS)requirements development FY 2021 Plans: - Continue development of EDISS (End-to-end Digital Integrated System-level Simulation), called Early Digital Product (EDP) - Continue EDISS requirements development				

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		FY 2019	FY 2020	FY 2021
<ul style="list-style-type: none"> - Initiate EDISS software development and conduct spiral In-Progress Reviews - Initiate EDISS M&S Integration, Test, and Verification, Increment Acceptance Reviews - Initiate Software Development of EDISS Full Digital Product (FDP), Increments 1 and 2 - Initiate systems engineering for FDP Inc 1, initiate systems engineering for FDP Inc 2, including System Requirements Review and System Functional Review - Initiate software development for FDP Inc 1, including Spiral In-Progress Reviews - Initiate integration and testing for FDP Inc 1 - Initiate Phase 1 of GTISS (Ground Test Integrated System-level Simulation) improvements to the MDA Ground Test Architecture: <ul style="list-style-type: none"> - Continue GTISS Phase 1 requirements development - Initiate GTISS Phase 1 software development - Initiate GTISS Phase 1 M&S Integration, Test, and Verification - Initiate Engineering and Development of GTISS Phase 2 - Initiate GTISS Phase 2 software development, including in-progress technical reviews - Initiate Integration and Test GTISS Phase 2 M&S - Initiate GTISS Phase 3 Functional Analysis and System Design - Initiate GTISS Phase 3 requirements analysis and functional analysis, develop system design - Initiate GTISS Phase 3 Systems Engineering Technical Reviews - Continue development and validation of Multi-band Electronic Attack Digital Injection Capability (MEDIC) - 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 - Continue validation of high fidelity digital models for SBX <p>FY 2020 to FY 2021 Increase/Decrease Statement: Increase from FY 2020 to FY 2021 reflects an increase for the incremental capability development of high-fidelity models for integration with both End-to-End Digital Integrated System-level Simulation (EDISS) and the Ground Test Integrated System-level Simulation (GTISS) programs. Activities include delivery and integration support for the Early Digital Product (EDP), software development for Full Digital Product (FDP) Increment 1, development and integration for GTISS Phase 1, development and technical reviews for GTISS Phase 2, and functional analysis and system design for GTISS Phase 3.</p>				
Title: Capability Development Program		218.200	103.973	135.434
		Articles:	-	-
Description: The Capability Development Program provides engineering support to enable compliance with BMD System Specification threat capabilities and addresses advanced threats. This task includes the redesign of select components to address				

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		FY 2019	FY 2020	FY 2021
<p>obsolescence and improve reliability of the system. This task continues 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 SBX and UEWRS. It develops, designs, and tests sensor mid-term discrimination improvements for X-Band radars, to include SBX threat discrimination improvements. 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 Patriot launch on THAAD capability, X86 performance optimization to enhance processing speed, and developmental information system enhancements.</p> <p>Specific and/or unique accomplishments to each FY are as follows:</p> <p>FY 2020 Plans:</p> <ul style="list-style-type: none"> - 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 <p>FY 2021 Plans:</p> <ul style="list-style-type: none"> - Initiate development of sensor mid-term discrimination improvements for X-Band radars, to include SBX threat discrimination improvements - Initiate development of sensor electronic protection for SBX - Initiate additional development of sensor electronic protection for AN/TPY-2 and LRDR and objective debris mitigation development efforts to reduce or eliminate the effect of corporate clutter and electronic attack on sensors - Continue expanded active sensor bias and full sensor bias reporting - Continue threat updates and verification, core standards system engineering, required updates to models and simulation, and performance assessments <p>FY 2020 to FY 2021 Increase/Decrease Statement:</p> <p>Increase from FY 2020 to FY 2021 initiates electronic protection efforts for SBX, provides additional electronic protection capabilities for AN/TPY-2 and LRDR, and the development of sensor mid-term discrimination improvements for X-band radars to include SBX threat discrimination improvements. It also reflects the transfer of weapon system specific cyber development efforts from Budget Project MC11, Cyber Operations, Network/System Assessment and Authorizations (A&A) to Budget Project MD11, MDS Radars, Capability Development.</p>				
Title: Sensors Directorate Operations		57.428	50.892	49.566
Articles:		-	-	-

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		FY 2019	FY 2020	FY 2021
<p>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.</p> <p>Recurring activities include:</p> <ul style="list-style-type: none"> - Provide technical and business management support activities to provide 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 <p>Specific and/or unique accomplishments to each FY are as follows:</p> <p>FY 2020 Plans: - SEE ABOVE.</p> <p>FY 2021 Plans: - SEE ABOVE.</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: N/A</p>				
<p>Title: Upgrade Clear Early Warning Radar</p> <p align="right">Articles:</p> <p>Description: Upgrade of Clear Early Warning Radar and Cape Cod Early Warning Radar includes adaptation of hardware and software to UEWR infrastructure, support to MDS communications and architecture work and installation at site. This project also includes preparation and removal of legacy equipment at each UEWR site.</p> <p>Specific and/or unique accomplishments to each FY are as follows:</p> <p>FY 2020 Plans:</p>		6.424 -	3.172 -	0.889 -

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		FY 2019	FY 2020	FY 2021
<p>-Continue operations and sustainment activities post operational acceptance to include interim contractor logistics support at Clear Air Force Station (AFS)</p> <p>FY 2021 Plans: -Complete operations and sustainment activities post operational acceptance to include interim contractor logistics support at Clear Air Force Station (AFS)</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: Decrease from FY 2020 to FY 2021 reflects the completion of remaining interim contractor logistics support at Clear Air Force Station (AFS)</p>				
<p>Title: USINDOPACOM Joint Emerging Operational Needs Statement (JEONS)</p> <p align="right">Articles:</p> <p>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.</p> <p>Specific and/or unique accomplishments to each FY are as follows:</p> <p>FY 2020 Plans: - Initiate expanded THAAD/MSE integration (Part II) in support of the USINDOPACOM Joint Emerging Operational Needs Statement (JEONS).</p> <p>FY 2021 Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: Decrease from FY 2020 to FY 2021 reflects completion of USINDOPACOM Joint Emerging Operational Needs Statement (JEONS) requirements</p>		29.200	15.900	0.000
		-	-	-
<p>Title: High Altitude Electromagnetic Pulse (HEMP) Hardening</p> <p align="right">Articles:</p>		0.000	69.000	0.000
		-	-	-

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021
<p>Description: This effort develops, designs, and tests High-Altitude Electromagnetic Pulse (HEMP) upgrade capabilities for Army Navy/Transportable Radar Surveillance and Control (AN/TPY-2) Forward Based Mode (FBM) radar sites.</p> <p>FY 2020 Plans:</p> <ul style="list-style-type: none"> - Conduct design efforts, prototype development, and developmental testing for FBM site equipment HEMP upgrades and commercial power interface at USINDOPACOM FBM sites - Conduct site survey and planning efforts for five FBM sites - Conduct Hardened Transportable Terminal modifications and shelter design - Acquire two systems for commercial power interface for USINDOPACOM FBM sites - Acquire systems for HEMP upgrades at FBM sites - Purchase HEMP hardened communications power generation equipment for FBM sites - Modify one USINDOPACOM FBM site to enable emplacement of Army generators <p>FY 2021 Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: Decrease from FY 2020 to FY 2021 reflects FY 2020 Congressional plus up for AN/TPY-2 High Altitude Electromagnetic Pulse (HEMP) Hardening.</p>			
Accomplishments/Planned Programs Subtotals	360.338	311.998	269.199

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• 0208866C MD11: <i>BMDS Radars Program O&M</i>	166.849	227.192	176.868	-	176.868	207.938	223.274	288.336	287.631	Continuing	Continuing
• 0208866C MD11: <i>BMDS Sensors Procurement</i>	13.585	10.046	0.000	-	0.000	5.593	22.145	17.065	17.009	Continuing	Continuing
• 0603882C: <i>Ballistic Missile Defense Midcourse Defense Segment</i>	790.316	1,303.716	1,004.305	-	1,004.305	776.125	726.566	767.592	1,068.536	Continuing	Continuing
• 0603890C: <i>BMD Enabling Programs</i>	614.855	634.449	599.380	-	599.380	552.815	544.582	560.863	582.675	Continuing	Continuing

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C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• 0603896C: <i>Ballistic Missile Defense Command and Control, Battle Management & Communication</i>	500.965	549.756	593.353	-	593.353	593.330	546.471	581.376	543.971	Continuing	Continuing
• 0603898C: <i>Ballistic Missile Defense Joint Warfighter Support</i>	48.401	51.532	49.560	-	49.560	51.735	51.059	53.133	54.023	Continuing	Continuing
• 0603904C: <i>Missile Defense Integration and Operations Center (MDIOC)</i>	51.689	56.161	55.356	-	55.356	55.721	57.457	59.798	61.334	Continuing	Continuing
• 0603907C: <i>Sea Based X-Band Radar (SBX)</i>	125.900	128.156	118.318	-	118.318	135.931	131.510	145.582	169.980	Continuing	Continuing
• 0603914C: <i>Ballistic Missile Defense Test</i>	510.292	399.738	378.302	-	378.302	385.910	396.524	394.949	417.261	Continuing	Continuing
• 0604181C: <i>Hypersonic Defense</i>	132.612	390.204	206.832	-	206.832	107.521	111.084	115.487	118.333	Continuing	Continuing
• 0604672C: <i>Homeland Defense Radar-Hawaii</i>	70.735	188.480	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	259.215
• 0604673C: <i>Pacific Discriminating Radar</i>	14.453	6.711	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	21.164
• 0604873C: <i>Long Range Discrimination Radar (LRDR)</i>	172.705	136.423	137.256	-	137.256	118.787	90.299	60.251	41.726	Continuing	Continuing
• 0604879C: <i>Ballistic Missile Defense Sensor Test</i>	71.905	105.530	76.456	-	76.456	99.138	131.191	122.983	124.398	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). Missile Defense System (MDS) 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 MDS architecture and system specifications into flow-down requirements, characteristics, and capability needs for individual MDS program specifications, and ultimately are approved through the systems engineering and

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<p>baseline change management process for MDS 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; MDS 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.</p>		

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Missile Defense Agency												Date: February 2020			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)						Project (Number/Name)					
0400 / 4				PE 0603884C / Ballistic Missile Defense Sensors						MD11 / BMDS Radars					
Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Basic Development Program - Material Release Get Well Plan - AMCOM	MIPR	AMCOM : AL	0.000	0.283	Oct 2018	0.285	Nov 2019	0.290	Nov 2020	-		0.290	Continuing	Continuing	Continuing
Basic Development Program - Basic Development - SBX	SS/CPAF	Raytheon : MA	0.000	0.000		2.000	Nov 2019	2.000	Nov 2020	-		2.000	Continuing	Continuing	Continuing
Basic Development Program - Information Assurance AN/TPY-2	SS/CPAF	Raytheon : MA	22.675	3.862	Nov 2018	4.230	Nov 2019	3.131	Nov 2020	-		3.131	Continuing	Continuing	Continuing
Basic Development Program - Information Assurance SBX	SS/CPAF	Raytheon : MA	1.078	0.225	Oct 2018	0.000		0.000		-		0.000	0.000	1.303	0.000
Basic Development Program - Material Release Get Well Plan - ATEC	MIPR	ATEC : AL	0.000	0.715	Nov 2018	0.820	Nov 2019	0.697	Nov 2020	-		0.697	Continuing	Continuing	Continuing
Basic Development Program - Material Release Get Well Plan - CCDC	SS/CPAF	CCDC AVMC : AL	16.565	1.084	Nov 2018	1.250	Dec 2019	1.125	Nov 2020	-		1.125	0.000	20.024	0.000
Basic Development Program - Sys Integration & Tech Assessments	MIPR	CCDC AVMC : AL	23.459	2.824	Nov 2018	3.132	Nov 2019	2.100	Nov 2020	-		2.100	0.000	31.515	0.000
Basic Development Program - X-Band Software Enhancements/ Development	SS/CPAF	Raytheon : AL	109.713	18.201	Nov 2018	17.025	Feb 2020	16.688	Nov 2020	-		16.688	Continuing	Continuing	Continuing
BMDS Radars Modeling & Simulation (M&S) - M&S Development	SS/CPFF	Raytheon : MA, CO	144.205	13.952	Nov 2018	23.906	Jan 2020	41.871	Jan 2021	-		41.871	Continuing	Continuing	Continuing
BMDS Radars Modeling & Simulation (M&S) - M&S Development-LM	SS/CPIF	Lockheed Martin : NJ	0.000	0.000		0.000		2.600	Nov 2020	-		2.600	Continuing	Continuing	Continuing

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Missile Defense Agency **Date:** February 2020

Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MD11 / <i>BMDS Radars</i>
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Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
BMDS Radars Modeling & Simulation (M&S) - VV&A of Models	MIPR	CCDC AVMC : AL	53.318	5.905	Dec 2018	13.946	Dec 2019	10.300	Dec 2020	-		10.300	Continuing	Continuing	Continuing
BMDS Radars Modeling & Simulation (M&S) - Warfighter Exercises	SS/CPFF	Raytheon : MA	12.337	2.035	Feb 2019	2.467	Mar 2020	2.508	Feb 2021	-		2.508	Continuing	Continuing	Continuing
Capability Development Program - Electronic Protection - GTRI	SS/CPFF	GTRI : GA	0.000	0.521	Nov 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Capability Development Program - Electronic Protection - PRIME	C/CPAF	Raytheon : MA	0.000	18.315	Nov 2018	0.000		29.354	Nov 2020	-		29.354	Continuing	Continuing	Continuing
Capability Development Program - Enhanced Discrimination - CCDC	MIPR	CCDC AVMC : AL	0.000	8.214	Nov 2018	0.000		6.200	Nov 2020	-		6.200	Continuing	Continuing	Continuing
Capability Development Program - Enhanced Discrimination - MITRE	FFRDC	MITRE : AL	0.000	3.187	Nov 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Capability Development Program - AN/TPY-2 Capability Development - CCDC	MIPR	CCDC AVMC : AL	0.000	10.390	Nov 2018	0.000		8.850	Nov 2020	-		8.850	Continuing	Continuing	Continuing
Capability Development Program - AN/TPY-2 Capability Development - JHU	FFRDC	John Hopkins University : MD	0.000	4.408	Nov 2018	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Capability Development Program - AN/TPY-2 Capability Development - PRIME	SS/CPAF	Raytheon : MA	191.571	14.071	Nov 2018	20.416	Nov 2019	21.279	Nov 2020	-		21.279	Continuing	Continuing	Continuing
Capability Development Program - Electronic Protection - CCDC	MIPR	CCDC AVMC : AL	22.556	2.948	Nov 2018	5.209	Oct 2019	4.500	Nov 2020	-		4.500	Continuing	Continuing	Continuing

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Missile Defense Agency												Date: February 2020			
Appropriation/Budget Activity						R-1 Program Element (Number/Name)				Project (Number/Name)					
0400 / 4						PE 0603884C / Ballistic Missile Defense Sensors				MD11 / BMDS Radars					
Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Capability Development Program - Enhanced Discrimination	C/CPAF	Raytheon : MA	124.718	141.524	Jan 2019	60.360	Jan 2020	42.515	Jan 2021	-		42.515	Continuing	Continuing	Continuing
Capability Development Program - Enhanced Discrimination - LM	SS/CPAF	Lockheed Martin : NJ	0.000	5.922	Jan 2019	0.000		6.670	Dec 2020	-		6.670	Continuing	Continuing	Continuing
Capability Development Program - Network and Infrastructure Services	C/CPAF	Jacobs Engineering : AL, MA	0.000	0.000		0.000		6.290	Nov 2020	-		6.290	Continuing	Continuing	Continuing
Capability Development Program - Post Intercept Assessment (PIA)	C/CPAF	Raytheon : MA	10.400	0.000		5.200	Dec 2019	0.000		-		0.000	0.000	15.600	0.000
Capability Development Program - SBX Capability Development - includes Post Intercept Assessment (PIA)	SS/CPAF	Raytheon : MA	0.000	8.700	Jan 2019	11.788	Mar 2020	4.776	Jan 2021	-		4.776	Continuing	Continuing	Continuing
Capability Development Program - UEUR Capability Development - includes Post Intercept Assessment (PIA)	SS/CPAF	Raytheon : MA	0.000	0.000		1.000	Jun 2020	5.000	Jun 2021	-		5.000	Continuing	Continuing	Continuing
Sensors Directorate Operations - Army Hybrid Program Office	MIPR	SMDC : AL	7.833	1.086	Dec 2018	1.258	Dec 2019	2.035	Dec 2020	-		2.035	Continuing	Continuing	Continuing
Sensors Directorate Operations - Civilians/ Travel	Various	MDA : AL, VA, MA	178.883	24.723	Oct 2018	19.512	Oct 2019	19.201	Oct 2020	-		19.201	Continuing	Continuing	Continuing
Sensors Directorate Operations - Contractor Service Support	Various	Various : Various	224.180	18.330	Nov 2018	18.267	Oct 2019	18.850	Oct 2020	-		18.850	Continuing	Continuing	Continuing
Sensors Directorate Operations - FFRDC/ UARC	SS/CPAF	CSS, APL, LL, OGA, GTRI, MITRE : AL, MA, VA, MD, GA	99.458	4.753	Nov 2018	7.815	Nov 2019	7.815	Nov 2020	-		7.815	Continuing	Continuing	Continuing

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Missile Defense Agency												Date: February 2020			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)						Project (Number/Name)					
0400 / 4				PE 0603884C / Ballistic Missile Defense Sensors						MD11 / BMDS Radars					
Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Sensors Directorate Operations - Network and Infrastructure Services	C/CPAF	Jacobs Engineering : AL, AK, CA, CO, HI, NM, VA	41.788	5.822	Feb 2019	2.000	Jan 2020	0.292	Jan 2021	-		0.292	Continuing	Continuing	Continuing
Sensors Directorate Operations - Other Govt Agencies	MIPR	Various : Various	35.349	2.714	Feb 2019	2.040	Feb 2020	1.373	Feb 2021	-		1.373	Continuing	Continuing	Continuing
Upgrade Clear Early Warning Radar - Facilities Site Activation/Admin Comms	MIPR	Various : AL, MA, AK	7.449	0.390	Dec 2018	0.000		0.000		-		0.000	0.000	7.839	0.000
Upgrade Clear Early Warning Radar - Radar Upgrade -- Prime Contractor	C/CPAF	Raytheon : MA	124.418	6.034	Jan 2019	3.172	Jan 2020	0.889	Jan 2021	-		0.889	Continuing	Continuing	Continuing
USINDOPACOM Joint Emerging Operational Needs Statement (JEONS) - Software Enhancements/ Development	C/CPAF	Raytheon : MA	25.800	29.200	Jan 2019	15.900	Jan 2020	0.000		-		0.000	0.000	70.900	0.000
High Altitude Electromagnetic Pulse (HEMP) Hardening - FBM Site Modifications	MIPR	Various : Various	0.000	0.000		5.800	Mar 2020	0.000		-		0.000	Continuing	Continuing	Continuing
High Altitude Electromagnetic Pulse (HEMP) Hardening - Hardened Transportable Terminal (HTT) Shelter and Modifications	MIPR	US Army : Various	0.000	0.000		7.000	Mar 2020	0.000		-		0.000	Continuing	Continuing	Continuing
High Altitude Electromagnetic Pulse (HEMP) Hardening - Power Distribution Centers (PDC) and Commercial Power	C/TBD	Various : Various	0.000	0.000		39.600	Mar 2020	0.000		-		0.000	Continuing	Continuing	Continuing

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Missile Defense Agency **Date:** February 2020

Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MD11 / <i>BMDS Radars</i>
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Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
High Altitude Electromagnetic Pulse (HEMP) Hardening - Power Distribution System (PDS) Development and Integration	SS/CPAF	Raytheon : MA	0.000	0.000		16.600	Mar 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Subtotal			1,477.753	360.338		311.998		269.199		-		269.199	Continuing	Continuing	N/A

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

Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
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.

Test and Evaluation (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Subtotal			-	-		-		-		-		-	-	-	N/A

Remarks
N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Missile Defense Agency **Date:** February 2020

Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MD11 / <i>BMDS Radars</i>
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Management Services (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Subtotal			-	-		-		-		-		-	-	-	N/A

Remarks
N/A

	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	1,477.753	360.338	311.998	269.199	-	269.199	Continuing	Continuing	N/A

Remarks
Award Dates reflect date of first obligation. Additional obligations may incrementally occur throughout the year.

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Missile Defense Agency **Date:** February 2020

Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MD11 / <i>BMDS Radars</i>
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	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 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025					
FTI-03 (OTA, OT Intercept Flight Test)	▲											
FTG-11 (OT) (GM, OT Intercept Flight Test)	▲											
FTT-23 (TH, DT Intercept Flight Test)			▲									
(EX) EAGLE RESOLVE 20				△								
(EX) AIR AND MISSILE DEFENSE EXERCISE 21					△							
TH CTV-01 (LTPO, DT Interceptor Only Flight Test)						△						
SNG-S-D-4							◇					
FTT-21 (TH, DT Intercept Flight Test)								△				
SNG-S-H-4									◇			
SNG-A-D-3										◇		
SNG-S-D-5											◇	
SNG-U-D-4												◇
SNG-C-D-2												◇
(EX) EAGLE RESOLVE 22										△		
SNG-U-H-3											◇	
FTT-25 (TH Intercept Flight Test)												△
(EX) AIR AND MISSILE DEFENSE EXERCISE 22												◇
(EX) AIR AND MISSILE DEFENSE EXERCISE 23												△
FTX-40 (AEGIS 5.1, DT Tracking Exercise Flight Test)												△
SNG-A-H-5												◇
SNG-A-D-4												◇
SNG-U-H-4												◇
SNG-C-D-3												◇
FTX-23 (AEGIS 5.1, DT Target Only Flight Test)												△

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Missile Defense Agency **Date:** February 2020

Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MD11 / <i>BMDS Radars</i>
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	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 2019		FY 2020		FY 2021		FY 2022		FY 2023		FY 2024		FY 2025	
FTT-24 (TH, DT Intercept Flight Test)														
SNG-A-H-4														
(EX) AIR AND MISSILE DEFENSE EXERCISE 24														
FTX-28 E1-E3 (TH, DT Target Only Flight Test)														
FTM-43 (AEGIS 5.1, DT/OT Intercept Flight Test)														
SNG-S-D-6														
(EX) EAGLE RESOLVE 24														
FTT-22 (TH Intercept Flight Test)														
SNG-S-H-5														
FTO-04 (GM, OT Intercept Flight Test)														
SNG-A-D-6														
SNG-A-H-6														
FTM-39 (AEGIS 5.1, OT Intercept Flight Test)														

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Missile Defense Agency		Date: February 2020
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MD11 / <i>BMDS Radars</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
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
(EX) EAGLE RESOLVE 20	2	2020	2	2020
(EX) AIR AND MISSILE DEFENSE EXERCISE 21	4	2020	4	2020
TH CTV-01 (LTPO, DT Interceptor Only Flight Test)	1	2021	1	2021
SNG-S-D-4	1	2021	1	2021
FTT-21 (TH, DT Intercept Flight Test)	2	2021	2	2021
SNG-S-H-4	4	2021	4	2021
SNG-A-D-3	1	2022	1	2022
SNG-S-D-5	1	2022	1	2022
SNG-U-D-4	1	2022	1	2022
SNG-C-D-2	1	2022	1	2022
(EX) EAGLE RESOLVE 22	2	2022	2	2022
SNG-U-H-3	2	2022	2	2022
FTT-25 (TH Intercept Flight Test)	3	2022	3	2022
(EX) AIR AND MISSILE DEFENSE EXERCISE 22	3	2022	4	2022
(EX) AIR AND MISSILE DEFENSE EXERCISE 23	4	2022	4	2022
FTX-40 (AEGIS 5.1, DT Tracking Exercise Flight Test)	4	2022	4	2022
SNG-A-H-5	4	2022	4	2022
SNG-A-D-4	1	2023	1	2023
SNG-U-H-4	1	2023	1	2023

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Missile Defense Agency **Date:** February 2020

Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MD11 / <i>BMDS Radars</i>
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Events	Start		End	
	Quarter	Year	Quarter	Year
SNG-C-D-3	1	2023	1	2023
FTX-23 (AEGIS 5.1, DT Target Only Flight Test)	1	2023	1	2023
FTT-24 (TH, DT Intercept Flight Test)	3	2023	3	2023
SNG-A-H-4	4	2023	4	2023
(EX) AIR AND MISSILE DEFENSE EXERCISE 24	4	2023	4	2023
FTX-28 E1-E3 (TH, DT Target Only Flight Test)	4	2023	4	2023
FTM-43 (AEGIS 5.1, DT/OT Intercept Flight Test)	4	2023	4	2023
SNG-S-D-6	1	2024	2	2024
(EX) EAGLE RESOLVE 24	2	2024	2	2024
FTT-22 (TH Intercept Flight Test)	3	2024	3	2024
SNG-S-H-5	3	2024	4	2024
FTO-04 (GM, OT Intercept Flight Test)	1	2025	1	2025
SNG-A-D-6	3	2025	3	2025
SNG-A-H-6	3	2025	3	2025
FTM-39 (AEGIS 5.1, OT Intercept Flight Test)	4	2025	4	2025

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Missile Defense Agency **Date:** February 2020

Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MC11 / <i>Cyber Operations</i>
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
MC11: <i>Cyber Operations</i>	8.995	6.053	28.506	1.558	-	1.558	1.580	1.614	1.191	5.390	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Decrease from FY 2020 to FY 2021 reflects the FY 2020 Congressional plus up of \$20.3 million in FY 2020 for critical AN/TPY-2 Cybersecurity requirements and the transfer of weapon system specific cyber development efforts from Budget Project MC11, Cyber Operations, Network/System Assessment and Authorizations (A&A) to Budget Project MD11, BMDS Radars, Capability Development.

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 (POA&M) 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. These activities are necessary to comply with the Federal Information Security Management Act (FISMA).

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2019	FY 2020	FY 2021
Title: Network / System Certification and Accreditation (C&A)	6.053	28.506	1.558
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 Missile Defense System (MDS) 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 (POA&M)			

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Missile Defense Agency		Date: February 2020
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MC11 / <i>Cyber Operations</i>

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021
<p>to mitigate cybersecurity deficiencies. Cyber Operations conducts annual cybersecurity program reviews on the Sensors enclaves to assess compliance in implementing and maintaining controls. This effort 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.</p> <p>Specific and/or unique accomplishments to each FY are as follows:</p> <p>FY 2020 Plans:</p> <ul style="list-style-type: none"> - Continue critical AN/TPY-2 Cyber Mission Systems Development & Engineering - Continue Cyber Mission Support Systems Development & Engineering - Improve Risk Management Framework (RMF) - Continue Computer Network Defense (CND) operations sustainment <p>FY 2021 Plans:</p> <p>-SEE ABOVE.</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement:</p> <p>Decrease from FY 2020 to FY 2021 reflects the FY 2020 Congressional add of \$20.3 million in FY 2020 for critical AN/TPY-2 Cybersecurity requirements and the transfer of weapon system specific cyber development efforts from Budget Project MC11, Cyber Operations, Network/System Assessment and Authorizations (A&A) to Budget Project MD11, BMDS Radars, Capability Development.</p>			
Accomplishments/Planned Programs Subtotals	6.053	28.506	1.558

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• 0603896C: <i>Ballistic Missile Defense Command and Control, Battle Management & Communication</i>	500.965	549.756	593.353	-	593.353	593.330	546.471	581.376	543.971	Continuing	Continuing
• 0603898C: <i>Ballistic Missile Defense Joint Warfighter Support</i>	48.401	51.532	49.560	-	49.560	51.735	51.059	53.133	54.023	Continuing	Continuing

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Missile Defense Agency **Date:** February 2020

Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MC11 / <i>Cyber Operations</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2019</u>	<u>FY 2020</u>	<u>FY 2021</u> <u>Base</u>	<u>FY 2021</u> <u>OCO</u>	<u>FY 2021</u> <u>Total</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• 0603904C: <i>Missile Defense Integration and Operations Center (MDIOC)</i>	51.689	56.161	55.356	-	55.356	55.721	57.457	59.798	61.334	Continuing	Continuing
• 0603907C: <i>Sea Based X-Band Radar (SBX)</i>	125.900	128.156	118.318	-	118.318	135.931	131.510	145.582	169.980	Continuing	Continuing
• 0604672C: <i>Homeland Defense Radar-Hawaii</i>	70.735	188.480	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	259.215
• 0604673C: <i>Pacific Discriminating Radar</i>	14.453	6.711	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	21.164
• 0604873C: <i>Long Range Discrimination Radar (LRDR)</i>	172.705	136.423	137.256	-	137.256	118.787	90.299	60.251	41.726	Continuing	Continuing
• 0604879C: <i>Ballistic Missile Defense Sensor Test</i>	71.905	105.530	76.456	-	76.456	99.138	131.191	122.983	124.398	Continuing	Continuing
• 0901598C: <i>Management HQ - MDA</i>	28.626	27.065	26.902	-	26.902	26.708	26.364	26.495	27.036	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Missile Defense Agency												Date: February 2020			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
0400 / 4				PE 0603884C / Ballistic Missile Defense Sensors				MC11 / Cyber Operations							
Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Network / System Certification and Accreditation (C&A) - AN/TPY 2 CSSP Development and Implementation	SS/CPAF	Raytheon : MA	0.000	0.000		6.334	Feb 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Network / System Certification and Accreditation (C&A) - AN/TPY 2 Cybersecurity Compliance	SS/CPAF	Raytheon : MA	0.000	0.000		7.082	Jan 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Network / System Certification and Accreditation (C&A) - CND/IA Advisory and Assistance Services (Booz Allen) - Consolidated in Contract Support Services	C/CPFF	Booz Allen Hamilton : AL, CO, VA	3.230	1.904	Nov 2018	0.000		0.000		-		0.000	0.000	5.134	0.000
Network / System Certification and Accreditation (C&A) - CND/IA Advisory and Assistance Services (Torch Technologies) - Consolidated in Contract Support Services	C/CPFF	Torch Technologies : AL, CO, VA	2.007	0.634	Jan 2019	0.000		0.000		-		0.000	0.000	2.641	0.000
Network / System Certification and Accreditation (C&A) - Civilian Salaries/Travel	Various	MDA : AL, CO, VA	0.931	0.324	Oct 2018	0.297	Oct 2019	0.333	Oct 2020	-		0.333	Continuing	Continuing	Continuing
Network / System Certification and Accreditation (C&A) - Contract Support Services	Various	MDA : Various	0.000	0.000		3.559	Oct 2019	1.225	Oct 2020	-		1.225	Continuing	Continuing	Continuing
Network / System Certification and Accreditation (C&A) -	SS/CPAF	Raytheon : MA	2.827	3.191	Jan 2019	6.687	Mar 2020	0.000		-		0.000	Continuing	Continuing	Continuing

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Missile Defense Agency **Date:** February 2020

Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MC11 / <i>Cyber Operations</i>
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Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Cybersecurity Supply Chain Compliance															
Network / System Certification and Accreditation (C&A) - LRDR Cybersecurity Compliance	SS/FPIF	Lockheed Martin : NJ	0.000	0.000		3.221	Mar 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Network / System Certification and Accreditation (C&A) - SBX Cybersecurity Compliance	MIPR	Military Sealift Command : VA	0.000	0.000		1.326	Feb 2020	0.000		-		0.000	Continuing	Continuing	Continuing
Subtotal			8.995	6.053		28.506		1.558		-		1.558	Continuing	Continuing	N/A

Remarks
N/A

	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	8.995	6.053	28.506	1.558	-	1.558	Continuing	Continuing	N/A

Remarks
Award Dates reflect date of first obligation. Additional obligations may incrementally occur throughout the year.

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Missile Defense Agency **Date:** February 2020

Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MC11 / <i>Cyber Operations</i>
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	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 2019			FY 2020			FY 2021			FY 2022			FY 2023			FY 2024			FY 2025			
Transition to Cyber Security Risk Management Framework (RMF)	◆																					
Risk Management Framework (RMF) Assessment and Authorization (A&A) package preparation and submission	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇
Cyber Security Program Policy / Risk Management	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇
Cyber Security Mitigation Monitoring and Tracking	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇
BMDS Cyber Security Policy Development	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇
Integrated Cyber Security Service Provider					◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Missile Defense Agency		Date: February 2020
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MC11 / <i>Cyber Operations</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
Transition to Cyber Security Risk Management Framework (RMF)	1	2019	1	2019
Risk Management Framework (RMF) Assessment and Authorization (A&A) package preparation and submission	1	2019	4	2025
Cyber Security Program Policy / Risk Management	1	2019	4	2025
Cyber Security Mitigation Monitoring and Tracking	1	2019	4	2025
BMDS Cyber Security Policy Development	1	2019	4	2025
Integrated Cyber Security Service Provider	1	2020	4	2025

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Missile Defense Agency										Date: February 2020		
Appropriation/Budget Activity 0400 / 4					R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>				Project (Number/Name) MD40 / <i>Program-Wide Support</i>			
COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
MD40: <i>Program-Wide Support</i>	94.551	16.368	11.784	11.200	-	11.200	22.885	21.172	18.152	17.106	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Program Wide Support (PWS) is allocated on a pro-rata basis across multiple Agency program elements (PEs) 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 MDS. These functions include Government Civilians and Contract Support Services. This effort provides integrity and oversight of the MDS 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 worldwide. 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 across multiple geographic locations; commercial and ancillary facility services; management of all facility aspects regardless of lifecycle stage; supplies and maintenance; compliance with statutory environmental requirements; data and unified communications support; materiel and readiness and central property management of equipment; Facilities Sustainment, Restoration and Modernization (FSRM) 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 2019	FY 2020	FY 2021
Title: Program Wide Support	16.368	11.784	11.200
Articles:	-	-	-
Description: PWS contains non-headquarters management costs in support of MDA functions and activities across the entire MDS. These functions include Government Civilians and Contract Support Services. This effort provides integrity and oversight of the MDS 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 worldwide. 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 across multiple geographic locations; commercial and ancillary facility services; management of all facility aspects regardless of lifecycle stage; supplies and maintenance; compliance with statutory environmental requirements; data and unified communications support; materiel and readiness and central property management of equipment; Facilities Sustainment,			

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Missile Defense Agency		Date: February 2020		
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MD40 / <i>Program-Wide Support</i>		
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		FY 2019	FY 2020	FY 2021
Restoration and Modernization (FSRM) 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.				
FY 2020 Plans: - SEE ABOVE.				
FY 2021 Plans: - SEE ABOVE.				
FY 2020 to FY 2021 Increase/Decrease Statement: N/A				
Accomplishments/Planned Programs Subtotals		16.368	11.784	11.200
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Missile Defense Agency **Date:** February 2020

Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MD40 / <i>Program-Wide Support</i>
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Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Program Wide Support - Agency Facilities and Maintenance	MIPR	Various Multi: AL, CO, CA, VA	0.000	0.000		0.000		11.200	Nov 2020	-		11.200	Continuing	Continuing	Continuing
Program Wide Support - Agency Operations Management	C/CPAF	Various: Multi: AL, CA, CO, VA	8.348	0.075	Jul 2019	0.177	Jul 2020	0.000		-		0.000	0.000	8.600	0.000
Program Wide Support - Agency Operations and Support Other Agency Services	MIPR	Various: Multi:AL,VA	11.247	0.000		2.234	Jul 2020	0.000		-		0.000	0.000	13.481	0.000
Program Wide Support - Agency Operations and Support Services	C/CPFF	Various: Multi: AL, CO, CA, VA	59.825	16.293	Mar 2019	9.373	Aug 2020	0.000		-		0.000	0.000	85.491	0.000
Program Wide Support - Prior year no longer funded in the FYDP	Various	Various: Various	15.131	0.000		0.000		0.000		-		0.000	0.000	15.131	0.000
Subtotal			94.551	16.368		11.784		11.200		-		11.200	Continuing	Continuing	N/A

Remarks
N/A

	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	94.551	16.368	11.784	11.200	-	11.200	Continuing	Continuing	N/A

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

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Missile Defense Agency		Date: February 2020
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0603884C / <i>Ballistic Missile Defense Sensors</i>	Project (Number/Name) MD40 / <i>Program-Wide Support</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
MD40 Program-Wide Support	1	2019	4	2025