Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Missile Defense Agency											Date: May 2021	
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*					R-1 Program Element (Number/Name) PE 0604181C / *Hypersonic Defense*							
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
Total Program Element	195.644	386.528	272.632	247.931	-	247.931	-	-	-	-	-	-
MD29: *Hypersonic Defense*	190.254	379.830	262.549	239.151	-	239.151	-	-	-	-	-	-
MD40: *Program Wide Support*	5.390	6.698	10.083	8.780	-	8.780	-	-	-	-	-	-
Program MDAP/MAIS Code: 362												

Note

FY 2021 Defense Appropriation included Congressional Plus Up (CPU) for Glide Phase Defeat Weapon System, Disruptive Technology for Future Architecture and Engineering Enablers. Decrease from FY 2021 to FY 2022 reflects the Congressional Plus Up in FY 2021.

A. Mission Description and Budget Item Justification

Potential adversaries are developing hypersonic missile capabilities that can travel at exceptional speeds with unpredictable flight paths that challenge existing defensive systems. These are challenging realities of the emerging missile threat environment that U.S. missile defense policy, strategy, and capabilities must address. These adversaries continue to expand the capability and capacity of their offensive hypersonic missile inventories, and both strategic and regional hypersonic missile capabilities. Research on hypersonic weapon technology and development of hypersonic weapons is proliferating to other countries.

In accordance with Public Law 114-328, the Director of the Missile Defense Agency shall serve as the executive agent for the Department of Defense for the development of a capability by the United States to counter hypersonic boost-glide vehicle capabilities and conventional prompt strike capabilities that may be employed against the United States, the allies of the United States, and the deployed forces of the United States. In carrying out as the executive agent, the Director shall develop architectures for a hypersonic defense capability, from detecting threats to intercepting such threats, that involves systems of the military departments and the Defense Agencies; and includes both kinetic and non-kinetic options for such interception; and establish a program of record to develop a hypersonic defense capability. MDA's Hypersonic Missile Defense (HMD) strategy includes leveraging existing systems, delivering an initial layered defense capability, and increasing defense capabilities in the future. Activities enabling this strategy are the following:

- Missile Defense System (MDS) architecture changes needed to address hypersonic threats include: persistent tracking of an unpredictable threat, improved communications, fire control strategy changes, and inclusion of new kinetic interceptor(s) with very high agility in a harsh aerothermal environment and/or non-kinetic solutions needed to negate hypersonic threats
- Maturing critical technologies and mitigating key technical risks including testing in relevant environments prior to selecting a final concept
- Partnering with the Services and other agencies to leverage work on common technologies, test infrastructure, weapon development, testing, and war-gaming
- Partnering with Allies where possible
- Demonstrating hypersonic defense capability and performance through system testing

This Hypersonic Defense (HD) Program Element (PE) includes executing the systems engineering activities, upgrading existing systems, investing in new technologies, developing new defensive capabilities and collecting hypersonic vehicle data in partner flight tests.

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Missile Defense Agency	Date: May 2021
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604181C / *Hypersonic Defense*

This PE supports Pacific Deterrence Initiatives (PDI) by pursuing a glide phase interceptor capability to counter the peer threat in a regional denied environment.

Funding provides limited hypersonic missile defense content:
- Execute Systems Engineering for HD (architecture analysis, technology prioritization, requirements development, planning, analysis and capability development)
- Modify existing MDS Sensors and Command, Control, Battle Management, and Communications (C2BMC) for track and warning of hypersonic threats
- Develop Hypersonic Defense Weapon Systems and mature technology to enable a broad set of solutions including kinetic and non-kinetic means
- Develop advanced sensor and Command and Control (C2) technology to include ground, airborne, and space based technologies to inform the HD development strategy

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	390.204	206.832	107.521	-	107.521
Current President's Budget	386.528	272.632	247.931	-	247.931
Total Adjustments	-3.676	65.800	140.410	-	140.410
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	65.800			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-3.865	0.000			
• Missile Defeat and Defense Enhancement	0.000	0.000	0.000	-	0.000
• Other Adjustment	0.189	0.000	140.410	-	140.410

Change Summary Explanation

FY 2020 does not include the enacted rescission of $25.1 million for MDA hypersonic defense partner tests and $12.5 million for delays in the Glide Phase Defeat Weapon System.

FY 2021 Defense Appropriation included Congressional Plus Up (CPU) for Glide Phase Defeat Weapon System, Disruptive Technology for Future Architecture and Engineering Enablers.

Increase in FY 2022 provides acceleration of Aegis Glide Phase Intercept (GPI) capability and other hypersonic missile defense capabilities.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Missile Defense Agency			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604181C / *Hypersonic Defense*	Project (Number/Name) MD29 / *Hypersonic Defense*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
MD29: *Hypersonic Defense*	190.254	379.830	262.549	239.151	-	239.151	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Decrease from FY 2021 to FY 2022 reflects the Congressional Plus Up in FY 2021.

A. Mission Description and Budget Item Justification

Potential adversaries are developing hypersonic missile capabilities that can travel at exceptional speeds with unpredictable flight paths that challenge existing defensive systems. These are challenging realities of the emerging missile threat environment that U.S. missile defense policy, strategy, and capabilities must address. These adversaries continue to expand the capability and capacity of their offensive hypersonic missile inventories, both strategic and regional hypersonic missile capabilities. Research on hypersonic weapon technology and development of hypersonic weapons is proliferating to other countries.

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- Maturing critical technologies and mitigating key technical risks including testing in relevant environments prior to selecting a final concept
- Partnering with the Services and other agencies to leverage work on common technologies, test infrastructure, weapon development, testing, and war-gaming
- Partnering with Allies where possible
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This Hypersonic Defense (HD) Program Element (PE) includes executing the systems engineering activities, upgrading existing systems, investing in new technologies, developing new defensive capabilities and collecting hypersonic vehicle data in partner flight tests.

This PE supports Pacific Deterrence Initiatives (PDI) by pursuing a glide phase interceptor capability to counter the peer threat in a regional denied environment.

Funding provides limited hypersonic missile defense content:
- Execute Systems Engineering for HD (architecture analysis, technology prioritization, requirements development, planning, analysis and capability development)

Exhibit R-2A, RDT&E Project Justification: PB 2022 Missile Defense Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604181C / *Hypersonic Defense*	**Project (Number/Name)** MD29 / *Hypersonic Defense*

- Modify existing MDS Sensors and Command, Control, Battle Management, and Communications (C2BMC) for track and warning of hypersonic threats
- Develop Hypersonic Defense Weapon Systems and mature technology to enable a broad set of solutions including kinetic and non-kinetic means
- Develop advanced sensor and C2 technology to include ground, airborne, and space based technologies to inform the HD development strategy

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022
Title: Hypersonic Defense	0.000	0.000	0.000
Articles:	-	-	-
Description: N/A ***FY 2021 Plans:*** N/A ***FY 2022 Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** N/A			
Title: Disruptive Technologies for Future Architecture	38.523	54.052	16.565
Articles:	-	-	-
Description: Provides identification, development of new technology and capabilities needed across the kill chain in support of Hypersonic Missile Defense architecture alternatives, and the ability to address advanced threats. Specific and/or unique accomplishments to each FY are as follows: ***FY 2021 Plans:*** - Provide development of Weapon and Sensor System Component Technologies: -- Initial Digital Focal Plane Array deliveries under the Hypersonic Threat and Sensor Technologies -- Advanced technology efforts to increase Digital Focal Plane Arrays dynamic range for improved sensitivity across a broader range of threats -- Develop low-cost/light weight Focal Plane Array sensor supporting electronics and cooling. -- Develop propulsion technology to increase maneuverability and energy management -- Develop advanced concepts to counter the evolving threats -- Perform advanced long term seeker windows and on-demand propulsion for axial/lateral divert activities ***FY 2022 Plans:*** - Continue to develop supporting low-cost/light weight Focal Plane Array sensor electronics for increased throughput and cryocoolers in an open architecture applicable to multiple sensor systems - Continue development of advanced technology concepts to counter the evolving threats			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Missile Defense Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604181C / *Hypersonic Defense*	**Project (Number/Name)** MD29 / *Hypersonic Defense*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022
- Continue to develop propulsion technology to increase maneuverability and energy management for future endo-atmospheric hypersonic interceptor kill vehicles and rocket motors to include testing and demonstrations in relevant environments ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Decrease from FY 2021 to FY 2022 reflects the FY 2021 Congressional Plus Up for advanced long term seeker windows and on-demand propulsion for axial/lateral divert activities.			
Title: Engineering Enablers	76.434	59.901	65.173
Articles:	-	-	-
Description: Provides systems engineering activities required to evolve the MDS to address hypersonic threats, to include architecture analysis, capability roadmap development, and requirements development. Recurring activities include: - Conduct foundational Systems Engineering activities required to develop Hypersonic Defense, including concept definition, requirements and interfaces, system design, integration, test planning, and use of digital engineering tools and practices -- Provide key products for development and maintenance of the technical baseline -- Assess current MDS capabilities against hypersonic threats and analyze future HD solutions to counter the evolving threat -- Develop and integrate modeling and simulation tools to validate HD requirements and assess HD performance -- Support HD reviews to coordinate the technical and program baselines to ensure development of a successful capability -- Continue to mature modeling and simulation architecture - Perform engineering analysis, develop requirements, and define interfaces for sensor-to-weapon fire control using C2BMC to lay the path for connectivity, battle management, and sensor tasking to a weapon system such as Aegis Specific and/or unique accomplishments to each FY are as follows: ***FY 2021 Plans:*** - Develop modeling and simulation for glide phase weapon lethality and conduct lethality testing - Perform Kinetic Kill Lethality Testing, M&S anchored in aero and aero optical test data and mid and long term hypersonic defense architecture analysis ***FY 2022 Plans:*** - Provide Truth and Threat Modeling to stimulate and enable integrated M&S federations (Ground Test and All-Digital in-line Truth Models and Threat Modeling) - Develop hypersonic threat models and update existing threat models based on real-world data to support analysis ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Increase from FY 2021 to FY 2022 provides systems engineering activities to accelerate the development of hypersonic missile defense capabilities and evolve to multi-domain missile defense that includes ballistic and hypersonic missile defense.			
Title: Leverage and Upgrade Existing Systems	94.653	21.212	21.559

Exhibit R-2A, RDT&E Project Justification: PB 2022 Missile Defense Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604181C / *Hypersonic Defense*	**Project (Number/Name)** MD29 / *Hypersonic Defense*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022
Articles:	-	-	-
Description: Analyze existing systems capability to defend against hypersonic threats and upgrade existing systems to support hypersonic missile defense activities. Specific and/or unique accomplishments to each FY are as follows: ***FY 2021 Plans:*** - Complete JEON response for real time detection warning, tracking, and reporting of Hypersonic Glide Vehicles (HGV) via C2BMC for MDS situational awareness - Evaluate and support internal synchronization, technology insertion, and program requirements generation and validation - Continue to upgrade C2BMC and sensor cueing to provide C2BMC reporting of HGV tracks to MDS weapon systems ***FY 2022 Plans:*** - Upgrade C2BMC to support Aegis Glide Phase Intercept (GPI) capability - Continue C2BMC algorithm development and prototyping for advanced threat battle management to support weapon system engagement - Complete AN/TPY-2 test integration and track reporting threats with C2BMC using CX software version 5 (CX5), which will contribute to end-to-end missile defense system performance ***FY 2021 to FY 2022 Increase/Decrease Statement:*** N/A			
Title: Glide Phase Defeat Weapon System	66.141	127.384	135.854
Articles:	-	-	-
Description: This effort develops an operational defensive capability to engage and defeat regional hypersonic threats during the glide phase of flight using the proven Aegis Weapon System. This will provide an additional layer of hypersonic defense from an Aegis ship which also augments Sea-Based Terminal capability by extending the battlespace of early terminal. The operational defensive capability includes the development of a GPI missile that reduces the operational seam currently used by hypersonic threats to fly between air defense and ballistic missile defense systems. The effort also includes updates to the Aegis Weapon System and C2BMC for planning, tracking and conducting launch on remote engagements against hypersonic threats within the MDS as well as conducting studies and advancing hypersonic capability to legacy Aegis Weapon Systems. Specific and/or unique accomplishments to each FY are as follows: ***FY 2021 Plans:*** GPI Missile - Conduct GPI missile technical risk reduction activities and concept development/definition - Award multiple contractor efforts through preliminary design focusing on maturation of high risk areas to determine the executability of each concept's unique design characteristics			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Missile Defense Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604181C / *Hypersonic Defense*	**Project (Number/Name)** MD29 / *Hypersonic Defense*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022
- Conduct initial technical reviews of GPI missile designs - Establish GPI draft requirements baseline and commence drafting Top-Level Specifications and Interface Control Documents - Conduct studies to explore and advance concepts in missile technology Aegis Weapon System - Continue analysis based on initial modeling to identify system design gaps and integration challenges needed to incorporate Glide Phase Weapon Control changes in the Aegis Weapon System - Continue Aegis Weapon System analysis to determine software design modifications - Award Aegis Weapon System Prime development contract - Continue modeling changes needed to incorporate GPI capability into the MDS - Establish Aegis Weapon System draft requirements baseline and commence drafting Element Specification and Interface Control Documents - Conduct reviews and activities for improving defense against hypersonic threats with the Aegis platform - Conduct studies to explore and advance concepts in weapon system technology			
FY 2022 Plans: GPI Missile - Continue GPI design analysis activities and requirements definition - Conduct Technology Readiness Level Assessments of contractor designs - Conduct GPI Missile System Requirement Reviews (SRR) for multiple vendor designs which ensures the system under review can proceed into initial systems development - Initiate preparations for multiple GPI missile Preliminary Design Reviews (PDR) which establishes the allocated baseline for the GPI capability to include Mk 41 Vertical Launch System integration and Aegis Launch on Remote engagement capability - Conduct studies to explore and advance concepts in missile technology - Design and procure material for Software Evaluation Station (SWES), Computer In The Loop (CIL) and Hardware In The Loop (HIL) Aegis Weapon System - Conduct Aegis Weapon System trade studies and concepts supporting Level A-Specification development - Continue modeling changes needed to incorporate Aegis Weapon System upgrades and Interceptor development - Initiate preparations for Aegis Weapon System (AWS) development Preliminary Design Reviews (PDR) which establishes the allocated baseline work associated with the GPI Interceptor to include Mission Planning capabilities -- Launch On Remote Engagement Capability -- C2 logic required for hypersonic vehicle glide phase engagements -- C2BMC algorithm development and prototyping for advanced threat battle management to support weapon system engagement			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Missile Defense Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604181C / *Hypersonic Defense*	**Project (Number/Name)** MD29 / *Hypersonic Defense*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022
-- Hypersonic glide phase engagement sequences -- Integration of AWS with new Hypersonic Glide Phase Interceptor -- Interoperability of AWS Regional Glide Phase capability with the MDS - Conduct reviews and activities for improving defense against hypersonic threats with the Aegis platform - Conduct studies to explore and advance concepts in weapon system technology ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Increase from FY 2021 to FY 2022 provides for additional requirements definition, assessments and studies in preparation for the missile and weapon system PDR.			
Title: Partnered Flight Test Participation	104.079	0.000	0.000
Articles:	-	-	-
Description: MDA's participation in Partner Flight Test events is critical for data collection across a diverse hypersonic threat set from multiple types of launch platforms. Participation in these test events supports the development and fielding of MDA's Hypersonic Defense capabilities to protect the United States, its allies, and deployed forces in all phases of flight. ***FY 2021 Plans:*** N/A ***FY 2022 Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** N/A			
Accomplishments/Planned Programs Subtotals	379.830	262.549	239.151

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• 0603176C: *Advanced Concepts and Performance Assessment*	45.852	49.410	15.800	-	15.800	-	-	-	-	-	-
• 0603180C: *Advanced Research*	27.166	35.024	21.466	-	21.466	-	-	-	-	-	-
• 0603884C: *Ballistic Missile Defense Sensors*	348.356	265.803	224.750	-	224.750	-	-	-	-	-	-
• 0603890C: *BMD Enabling Programs*	630.196	616.455	595.301	-	595.301	-	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Missile Defense Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604181C / *Hypersonic Defense*	**Project (Number/Name)** MD29 / *Hypersonic Defense*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• 0603892C: *AEGIS BMD*	722.582	877.336	732.512	-	732.512	-	-	-	-	-	-
• 0603896C: *Ballistic Missile Defense Command and Control, Battle Management & Communication*	550.513	645.741	603.448	-	603.448	-	-	-	-	-	-
• 0603915C: *Ballistic Missile Defense Targets*	545.764	536.133	553.334	-	553.334	-	-	-	-	-	-
• 1206895C: *Ballistic Missile Defense System Space Programs*	139.887	162.068	292.811	-	292.811	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

To optimize Missile Defense System performance, MDA leverages the nation's engineering centers of excellence at government agencies, Military Services, Federally Funded Research and Development Centers (FFRDCs), University Affiliated Research Centers (UARCs), and industry. The executing agents use varying contracting strategies in a flexible manner to maximize their contribution to the Missile Defense System. MDA acquires products and services by competitive means to the extent that is possible, practical and uses the Advanced Technology Broad Area Announcement process to award concept definition contracts.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Missile Defense Agency			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604181C / *Hypersonic Defense*	Project (Number/Name) MD29 / *Hypersonic Defense*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Hypersonic Defense - Component Technology for Sensors and Weapons	MIPR	Various : AL	20.500	0.000		0.000		0.000		-		0.000	0.000	20.500	0.000
Hypersonic Defense - MDS C2BMC Upgrades	C/Various	Various : AL	33.645	0.000		0.000		0.000		-		0.000	0.000	33.645	0.000
Hypersonic Defense - MDS Sensor Upgrades - AN/TPY-2	SS/CPFF	Raytheon : MA	16.474	0.000		0.000		0.000		-		0.000	0.000	16.474	0.000
Hypersonic Defense - MDS Sensor Upgrades - LRDR	C/FFP	Lockheed Martin : NJ	12.007	0.000		0.000		0.000		-		0.000	0.000	12.007	0.000
Hypersonic Defense - Sensor Technology - Advanced Threat Tracking and Analysis / Low Latency Processing	MIPR	Various : AL, CA	13.016	0.000		0.000		0.000		-		0.000	0.000	13.016	0.000
Hypersonic Defense - Sensor Technology - Sensor Concept and Development	MIPR	Various : AL	21.522	0.000		0.000		0.000		-		0.000	0.000	21.522	0.000
Hypersonic Defense - Systems Engineering	Allot	MDA : AL, VA	5.444	0.000		0.000		0.000		-		0.000	0.000	5.444	0.000
Hypersonic Defense - Systems Engineering -- CSS	C/CPFF	TEAMS : AL, VA	6.688	0.000		0.000		0.000		-		0.000	0.000	6.688	0.000
Hypersonic Defense - Systems Engineering -- FFRDC/UARC	MIPR	Various : VA, AL	7.257	0.000		0.000		0.000		-		0.000	0.000	7.257	0.000
Hypersonic Defense - Systems Engineering -- Industry	C/CPAF	Boeing : AL	3.539	0.000		0.000		0.000		-		0.000	0.000	3.539	0.000
Hypersonic Defense - Technology Development Program Operations	Allot	MDA : AL, VA	11.861	0.000		0.000		0.000		-		0.000	0.000	11.861	0.000

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Missile Defense Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604181C / *Hypersonic Defense*	**Project (Number/Name)** MD29 / *Hypersonic Defense*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Hypersonic Defense - Weapon Concept Definition & Risk Reduction	C/Various	Various : AL	38.301	0.000		0.000		0.000		-		0.000	0.000	38.301	0.000
Disruptive Technologies for Future Architecture - Hypersonic Defense - Component Technology for Sensors and Weapons	MIPR	Various : AL	0.000	16.104	Nov 2019	46.260	Dec 2020	11.794	Dec 2021	-		11.794	Continuing	Continuing	Continuing
Disruptive Technologies for Future Architecture - Hypersonic Defense - Sensor Technology - Advanced Threat Tracking and Analysis / Low Latency Processing	MIPR	Various : AL, CA	0.000	7.351	Nov 2019	0.000		0.000		-		0.000	0.000	7.351	0.000
Disruptive Technologies for Future Architecture - Hypersonic Defense - Sensor Technology / Sensor Concept and Development	MIPR	Various : AL	0.000	15.068	Nov 2019	7.792	Dec 2020	4.771	Dec 2021	-		4.771	Continuing	Continuing	Continuing
Engineering Enablers - Hypersonic Defense - Systems Engineering	Various	MDA : AL, VA	0.000	12.620	Nov 2019	19.360	Nov 2020	21.155	Nov 2021	-		21.155	Continuing	Continuing	Continuing
Engineering Enablers - Hypersonic Defense - Systems Engineering - Lethality and Analysis	Various	Various : TN, AL, NM, CA, TX	0.000	8.325	Feb 2020	8.407	Nov 2020	8.575	Nov 2021	-		8.575	Continuing	Continuing	Continuing
Engineering Enablers - Hypersonic Defense - Systems Engineering - M&S	C/CPAF	Northrop Grumman : AL	0.000	6.680	Feb 2020	5.423	Jan 2021	9.153	Dec 2021	-		9.153	0.000	21.256	0.000
Engineering Enablers - Hypersonic Defense -	Various	Various : AL	0.000	12.834	Feb 2020	2.009	Feb 2021	2.050	Dec 2021	-		2.050	0.000	16.893	0.000

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Missile Defense Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604181C / *Hypersonic Defense*	Project (Number/Name) MD29 / *Hypersonic Defense*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering - Threat Engineering															
Engineering Enablers - Hypersonic Defense - Systems Engineering -- CSS	C/CPFF	TEAMS : AL, VA	0.000	7.473	Nov 2019	3.462	Nov 2020	3.531	Nov 2021	-		3.531	Continuing	Continuing	Continuing
Engineering Enablers - Hypersonic Defense - Systems Engineering -- FFRDC/UARC	MIPR	Various : AL, VA	0.000	28.502	Nov 2019	21.240	Jan 2021	20.709	Dec 2021	-		20.709	Continuing	Continuing	Continuing
Leverage and Upgrade Existing Systems - Hypersonic Defense - C2BMC GPI	C/CPAF	SciTec : Newark, NJ	0.000	0.000		0.000		1.832	Nov 2021	-		1.832	Continuing	Continuing	Continuing
Leverage and Upgrade Existing Systems - Hypersonic Defense - C2BMC GPI (PRIME)	C/CPIF	Lockheed Martin : AL	0.000	0.000		0.000		7.926	Nov 2021	-		7.926	Continuing	Continuing	Continuing
Leverage and Upgrade Existing Systems - Hypersonic Defense - C2BMC GPI Prototype/ Development	C/CPAF	Northrop Grumman : CO	0.000	0.000		0.000		2.850	Nov 2021	-		2.850	Continuing	Continuing	Continuing
Leverage and Upgrade Existing Systems - Hypersonic Defense - MDS C2BMC	Various	Various : Various	0.000	28.092	Nov 2019	3.583	Jan 2021	1.121	Nov 2021	-		1.121	Continuing	Continuing	Continuing
Leverage and Upgrade Existing Systems - Hypersonic Defense - MDS C2BMC Upgrades (Prime)	C/CPIF	Lockheed Martin : AL	0.000	8.398	Jan 2020	9.777	Nov 2020	2.840	Nov 2021	-		2.840	Continuing	Continuing	Continuing
Leverage and Upgrade Existing Systems - Hypersonic Defense -	C/CPAF	Northrop Grumman : CO	0.000	23.181	Jan 2020	7.852	Nov 2020	4.000	Nov 2021	-		4.000	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Missile Defense Agency			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604181C / *Hypersonic Defense*	Project (Number/Name) MD29 / *Hypersonic Defense*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MDS C2BMC Upgrades for HD															
Leverage and Upgrade Existing Systems - Hypersonic Defense - MDS Sensor Upgrades	C/FFP	Lockheed Martin : NJ	0.000	4.189	Nov 2019	0.000		0.000		-		0.000	0.000	4.189	0.000
Leverage and Upgrade Existing Systems - Hypersonic Defense - MDS Sensor Upgrades - AN/TPY-2	SS/CPFF	Raytheon : MA	0.000	30.793	Nov 2019	0.000		0.990	Nov 2021	-		0.990	0.000	31.783	0.000
Glide Phase Defeat Weapon System - Hypersonic Defense - D	Allot	MDA : AL, VA	0.000	3.866	Nov 2019	4.230	Nov 2020	0.000		-		0.000	0.000	8.096	0.000
Glide Phase Defeat Weapon System - Hypersonic Defense - Engineering Support	MIPR	NSWCD : VA	0.000	0.000		8.908	Nov 2020	13.525	Nov 2021	-		13.525	Continuing	Continuing	Continuing
Glide Phase Defeat Weapon System - Hypersonic Defense - Interface Change Proposals	MIPR	NIWC PAC : CA	0.000	0.000		2.111	Nov 2020	3.560	Nov 2021	-		3.560	Continuing	Continuing	Continuing
Glide Phase Defeat Weapon System - Hypersonic Defense - Special Studies	C/CPAF	APL : MD	0.000	0.000		6.049	Nov 2020	4.271	Nov 2021	-		4.271	Continuing	Continuing	Continuing
Glide Phase Defeat Weapon System - Hypersonic Defense - Systems Engineering	MIPR	MIT/LL : MA	0.000	0.000		5.000	Nov 2020	14.237	Nov 2021	-		14.237	Continuing	Continuing	Continuing
Glide Phase Defeat Weapon System - Hypersonic Defense - Systems Engineering Support	MIPR	MITRE : VA	0.000	0.000		0.000		1.424	Nov 2021	-		1.424	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Missile Defense Agency			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604181C / *Hypersonic Defense*	Project (Number/Name) MD29 / *Hypersonic Defense*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Glide Phase Defeat Weapon System - Hypersonic Defense - Weapon Concept Definition and Risk Reduction	C/Various	Various : VA	0.000	62.275	Feb 2020	0.000		0.000		-		0.000	0.000	62.275	0.000
Glide Phase Defeat Weapon System - Hypersonic Defense - Weapon System Modification	C/CPIF	Lockheed Martin : NJ	0.000	0.000		101.086	Nov 2020	98.837	Nov 2021	-		98.837	Continuing	Continuing	Continuing
		Subtotal	190.254	275.751		262.549		239.151		-		239.151	Continuing	Continuing	N/A

Remarks

FY 2020 does not include the enacted rescission of $12.5 million for delays in the Glide Phase Defeat Weapon System

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Partnered Flight Test Participation - Partner Flight Test Participation	MIPR	Space and Missile Defense Command/ US Maritime Administration/ Pacific Missile Range Facility/ Ronald Reagan Test Site/ L3/JHU/APL/ MDIOC/ Lockheed Martin/AMRDEC/ NSWC/NAWC : AL/ CA/CO/DC/HI/TN/TX	0.000	104.079	Jan 2020	0.000		0.000		-		0.000	0.000	104.079	0.000
		Subtotal	0.000	104.079		0.000		0.000		-		0.000	0.000	104.079	N/A

Remarks

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Missile Defense Agency			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604181C / *Hypersonic Defense*	Project (Number/Name) MD29 / *Hypersonic Defense*	

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	190.254	379.830		262.549		239.151		-		239.151	Continuing	Continuing	N/A

Remarks

Award Dates reflect date of first obligation. Additional obligations may incrementally occur throughout the year.
FY 2020 does not reflect the enacted rescission of $25.1 million for MDA hypersonic defense partner tests.

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Missile Defense Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604181C / *Hypersonic Defense*	**Project (Number/Name)** MD29 / *Hypersonic Defense*

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 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025				FY 2026			
AN/TPY-2 Capability Development	✦	✦	✦	✦																								
LRDR Capability Development	✦	✦	✦	✦																								
Weapon Systems Concept Definition & Risk Reduction (Phases 1 and 2)	✦	✦	✦	✦																								
Hypersonic Defense Sensor and Weapons Component Technology Performance Testing	✧	✧	✧	✧	✧	✧	✧	✧																				
Hypersonic Threat Sensor Technology Development	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧																
C2BMC Capability Development	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧																
Hypersonic Defense Sensor & Weapons Component Technology Capability Development	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧																
Weapons Technology Risk Reduction Contract(s) Award			✧	✧	✧	✧	✧	✧	✧	✧	✧	✧																
Missile System Requirement Review												✧																
Weapons System Requirement Review												✧																

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Missile Defense Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604181C / *Hypersonic Defense*	**Project (Number/Name)** MD29 / *Hypersonic Defense*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
AN/TPY-2 Capability Development	1	2020	4	2020
LRDR Capability Development	1	2020	4	2020
Weapon Systems Concept Definition & Risk Reduction (Phases 1 and 2)	1	2020	4	2020
Hypersonic Defense Sensor and Weapons Component Technology Performance Testing	1	2020	4	2021
Hypersonic Threat Sensor Technology Development	1	2020	4	2022
C2BMC Capability Development	1	2020	4	2022
Hypersonic Defense Sensor & Weapons Component Technology Capability Development	1	2020	4	2022
Weapons Technology Risk Reduction Contract(s) Award	3	2020	4	2022
Missile System Requirement Review	4	2022	4	2022
Weapons System Requirement Review	4	2022	4	2022

Note

Based on the OUSD(C) FY 2022 President's Budget Submission Guidance, fiscal years covered in the justification material will include FY 2020 through FY 2022. Planned entries in the R4 may continue past FY 2022, out-years will be addressed in future budget submissions.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Missile Defense Agency			Date: May 2021
Appropriation/Budget Activity 0400 / 4	R-1 Program Element (Number/Name) PE 0604181C / *Hypersonic Defense*	Project (Number/Name) MD40 / *Program Wide Support*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
MD40: *Program Wide Support*	5.390	6.698	10.083	8.780	-	8.780	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Program Wide Support (PWS) is allocated on a pro-rata basis across multiple Agency 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 2020	FY 2021	FY 2022
Title: Program Wide Support	6.698	10.083	8.780
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, Restoration and Modernization (FSRM) program, (formerly Real Property Maintenance) to keep the Department's inventory of			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Missile Defense Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604181C / *Hypersonic Defense*	**Project (Number/Name)** MD40 / *Program Wide Support*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022
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 2021 Plans:*** - SEE ABOVE. ***FY 2022 Plans:*** - SEE ABOVE. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Decrease from FY 2021 to FY 2022 reflects the PWS allocation on a pro-rata basis across multiple Agency PEs each fiscal year based on the total Agency budget, and therefore fluctuates per PE by fiscal year.			
Accomplishments/Planned Programs Subtotals	6.698	10.083	8.780

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Missile Defense Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604181C / *Hypersonic Defense*	**Project (Number/Name)** MD40 / *Program Wide Support*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Wide Support - Agency Facilities and Maintenance	MIPR	Various : AL, CO, CA, VA	0.000	0.000		0.000		6.485	Nov 2021	-		6.485	Continuing	Continuing	Continuing
Program Wide Support - Agency Facilities and Maintenance SRM	MIPR	Various : Multi: AK, AL, CA, CO, HI, VA	0.000	0.000		4.370	Dec 2020	1.084	Dec 2021	-		1.084	Continuing	Continuing	Continuing
Program Wide Support - Agency Operations Management	Various	Various : Multi, AL, CA, CO, VA	0.082	0.100	Aug 2020	1.979	Nov 2020	0.000		-		0.000	0.000	2.161	0.000
Program Wide Support - Agency Operations and Support Other Agency Services	MIPR	Various : Multi: AK/ AL/CA/CO/HI/MD/ VA/NJ/NY/OCONUS	0.000	0.000		0.265	Nov 2020	0.000		-		0.000	0.000	0.265	0.000
Program Wide Support - Agency Operations and Support Services	C/Various	Various : Multi: AK, AL, CA, CO, HI, VA	5.308	0.000		0.000		1.211	Nov 2021	-		1.211	Continuing	Continuing	Continuing
Program Wide Support - Agency Operations, Sustainment and GPC	C/FFP	Various : Multi: AK, AL, CA, HI, NY, NM, VA	0.000	0.000		3.469	Nov 2020	0.000		-		0.000	0.000	3.469	0.000
Program Wide Support - Facilities Maintenance	MIPR	Various : Multi: AK, AL, CA, CO, HI, VA	0.000	6.598	Nov 2019	0.000		0.000		-		0.000	0.000	6.598	0.000
		Subtotal	5.390	6.698		10.083		8.780		-		8.780	Continuing	Continuing	N/A

Remarks

N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	5.390	6.698		10.083		8.780		-		8.780	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 2022 Missile Defense Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604181C / *Hypersonic Defense*	**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 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025				FY 2026			
MD40 Program-Wide Support	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧																

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Missile Defense Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 4	**R-1 Program Element (Number/Name)** PE 0604181C / *Hypersonic Defense*	**Project (Number/Name)** MD40 / *Program Wide Support*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
MD40 Program-Wide Support	1	2020	4	2022

Note

Based on the OUSD(C) FY 2022 President's Budget Submission Guidance, fiscal years covered in the justification material will include FY 2020 through FY 2022. Planned entries in the R4 may continue past FY 2022, out-years will be addressed in future budget submissions.