Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Missile Defense Agency											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	0.000	0.000	75.300	-	75.300	116.300	152.300	137.200	113.000	0	594.100
MD29: *Hypersonic Defense*	-	0.000	0.000	75.300	-	75.300	116.300	152.300	137.200	113.000	0	594.100
Program MDAP/MAIS Code: 362												

Note

In accordance with FY 2017 NDAA direction for MDA to establish a program of record for Hypersonic Defense, this is a new PE in FY 2018. This is a continuation of efforts funded beginning in FY 2016, to include efforts in PE 0603890C budget project MD24, to assess architecture alternatives and provide recommendations for future BMDS configurations to keep pace with evolving advanced threats.

A. Mission Description and Budget Item Justification

This program element supports a focused program that includes executing the systems engineering process, full kill chain technology identification and maturation, providing analysis and assessment of target of opportunity events, and executing near term sensor and command and control capability upgrades to address defense from hypersonic threats, which pose a significant threat.

The Hypersonic Defense effort will develop and deliver a set of material solutions to address and defeat hypersonic threats informed by a set of near term technology demonstrations. Based on Department of Defense FY 2017 efforts to counter hypersonic threats, MDA will assess architecture alternatives and provide recommendations for future BMDS configurations to keep pace with evolving threats. An integrated set of enhancements provides incremental capability measured by progress and knowledge points in the following areas:

- Establishment of systems engineering needs, requirements, and architecture trade studies to identify alternative material solutions
- Modification of existing BMDS sensors and C2BMC element for hypersonic threats
- Definition of weapon concepts and investments in key technology to enable a broad set of solutions including kinetic and non-kinetic means both right and left of launch
- Execution of a series of sensor technology demonstrations, to include ground, airborne and space-based technology, to inform the development strategy

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Missile Defense Agency	Date: May 2017
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*

B. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	75.300	-	75.300
Total Adjustments	0.000	0.000	75.300	-	75.300
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustment	0.000	0.000	75.300	-	75.300

Change Summary Explanation

The increase in FY2018 from PB17 to PB18 supports emerging Department of Defense priorities:

-- Establishment of a program or record for Hypersonic Defense, per FY 2017 NDAA direction ($75.300 million)

Exhibit R-2A, RDT&E Project Justification: FY 2018 Missile Defense Agency			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
MD29: *Hypersonic Defense*	-	0.000	0.000	75.300	-	75.300	116.300	152.300	137.200	113.000	0	594.100
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In accordance with FY 2017 NDAA direction for MDA to establish a program of record for Hypersonic Defense, MD29 is a new budget project in FY 2018. This is a continuation of efforts funded beginning in FY 2016, to include efforts in PE 0603890C budget project MD24, to assess architecture alternatives and provide recommendations for future BMDS configurations to keep pace with evolving advanced threats.

A. Mission Description and Budget Item Justification

The Hypersonic Defense effort will develop and deliver a set of material solutions to address and defeat hypersonic threats informed by a set of near term technology demonstrations.

MDA will conduct systems engineering activities required to initiate development of BMDS capabilities to address advanced threats. Efforts will include architecture analysis activities such as a Defense Against Hypersonic Threats Analysis of Alternatives (AoA), jointly conducted with the Office of the Secretary of Defense, Cost Assessment and Program Evaluation, and Services with participation from the Combatant Commands.

MDA will leverage existing sensors and ground infrastructure/Command and Control to quickly demonstrate and deploy a three-phase limited contingency capability to provide real-time warning over the majority of the hypersonic threat profile. The initial limited contingency capability will be fully integrated into the C2BMC program of record. MDA plans to leverage the lessons learned and analysis from this capability development for the design and development of additional sensors for potential advanced threat applications.

To address the weapon technology required to defeat the hypersonic threat, MDA will focus on the development of weapon concepts through competitive development efforts with industry. The concepts and identified technology component risk reduction will formulate the trade space across cost, risk, and performance to inform the requirements development process. The Agency will also extend analysis tools to provide inputs to concept design and requirements development.

MDA will begin sensor demonstrations against hypersonic threats. The demonstrations build on ground, air, and space sensor technology to demonstrate capabilities to detect and track hypersonic threats. This initial demonstration will employ tracking capability in all three phases of flight: boost phase using overhead persistent infrared, mid-phase using airborne or space, and terminal phase using ground, airborne, or space tracking. MDA will also conduct pre and post demonstration performance assessment to analyze data collects. MDA plans to leverage the lessons learned and analysis from this demonstration for the design and development of a space sensor for potential hypersonic threat applications.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018
Title: Hypersonic Defense	0.000	0.000	75.300
Articles:	-	-	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Missile Defense Agency		Date: May 2017
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 2016	FY 2017	FY 2018
Description: This effort includes the systems engineering, technology development, and near term component capability development activities required to evolve the BMDS to address hypersonic threats, to include architecture analysis, capability roadmap development, and requirements development. It also includes an assessment of existing and new capabilities, identification, development, and demonstration of new technology and capabilities needed across the kill chain in support of architecture alternatives, and their ability to address advanced threats. ***FY 2016 Accomplishments:*** N/A ***FY 2017 Plans:*** N/A ***FY 2018 Plans:*** Systems Engineering: - Complete and deliver the Defense Against Hypersonic Threats Analysis of Alternatives (AoA) report - Conduct integrated architecture and performance analysis of end-to-end hypersonic threat capabilities based on the outcome of the AoA - Complete analysis and assessments of target of opportunity events - Draft capability roadmap - Complete requirements and initial system integration activities for near term capabilities - Draft initial requirements document Sensors Technology & Demonstration: - Identify and demonstrate sensor technology through: -- Dual airborne passive observation with stereo MDA configured MQ-9 Reapers -- Ground electro-optical/infrared and advanced sensor observations with a Multi-Spectral Targeting System (MTS)-C -- Pre and post mission performance analysis - Award technology demonstration contract - Purchase long lead component hardware required to build and test a sensor for future space applications - Conduct preliminary design of a space payload for future space applications Weapon Concept Definition: - Initiate development of innovative weapon concepts to address the hypersonic threat set - Deliver multiple initial concepts and identify technology risk reduction efforts			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Missile Defense Agency		Date: May 2017
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 2016	FY 2017	FY 2018
Near Term Capability Development - Initiate design and development activities for prototype updates to various BMD sensor algorithms - Conduct design and development activities for C2BMC/BOA changes to provide limited tracking/display of the advanced threat.			
Accomplishments/Planned Programs Subtotals	0.000	0.000	75.300

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
• 0603176C: *Advanced Concepts and Performance Assessment*	11.853	17.880	12.996	-	12.996	13.741	15.048	15.319	16.361	Continuing	Continuing
• 0603884C: *Ballistic Missile Defense Sensors*	233.020	230.077	247.345	-	247.345	247.643	362.850	401.267	497.503	Continuing	Continuing
• 0603890C: *BMD Enabling Programs*	406.326	408.594	449.442	-	449.442	466.760	540.409	629.864	501.915	Continuing	Continuing
• 0603896C: *Ballistic Missile Defense Command and Control, Battle Management & Communication*	425.996	456.267	430.115	-	430.115	461.275	501.956	496.411	514.139	Continuing	Continuing

Remarks

D. Acquisition Strategy

To optimize BMDS 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 BMDS. MDA acquires products and services by competitive means to the extent that is possible and practical.

E. Performance Metrics

N/A

Exhibit R-3, RDT&E Project Cost Analysis: FY 2018 Missile Defense Agency		Date: May 2017
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 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Hypersonic Defense - BMDS C2BMC/BOA Upgrades	C/Various	Various : AL	0.000	0.000		0.000		14.000	Nov 2017	-		14.000	Continuing	Continuing	Continuing
Hypersonic Defense - BMDS Sensor Upgrades	SS/CPFF	Raytheon : MA	0.000	0.000		0.000		4.100	Nov 2017	-		4.100	Continuing	Continuing	Continuing
Hypersonic Defense - Performance Assessment for Sensors and Weapons	MIPR	Various : AL	0.000	0.000		0.000		6.500	Nov 2017	-		6.500	Continuing	Continuing	Continuing
Hypersonic Defense - Sensor Technology	Allot	MDA : AL, NM	0.000	0.000		0.000		2.700	Oct 2017	-		2.700	Continuing	Continuing	Continuing
Hypersonic Defense - Sensor Technology - EO/ IR Tracking Demonstration	C/CPFF	Various : AL, CA	0.000	0.000		0.000		3.277	Nov 2017	-		3.277	Continuing	Continuing	Continuing
Hypersonic Defense - Sensor Technology - OGA	MIPR	Various : AL	0.000	0.000		0.000		1.900	Nov 2017	-		1.900	Continuing	Continuing	Continuing
Hypersonic Defense - Sensor Technology - Space Sensor Concept and Development	C/CPIF	Various : AL	0.000	0.000		0.000		20.823	Nov 2017	-		20.823	Continuing	Continuing	Continuing
Hypersonic Defense - Systems Engineering	Allot	MDA : AL, VA	0.000	0.000		0.000		0.500	Oct 2017	-		0.500	Continuing	Continuing	Continuing
Hypersonic Defense - Systems Engineering - CSS	C/CPFF	TEAMS : AL, VA	0.000	0.000		0.000		2.000	Nov 2017	-		2.000	Continuing	Continuing	Continuing
Hypersonic Defense - Systems Engineering - FFRDC/UARC	MIPR	Various : VA, AL	0.000	0.000		0.000		2.000	Nov 2017	-		2.000	Continuing	Continuing	Continuing
Hypersonic Defense - Systems Engineering - Industry	C/CPAF	Boeing : AL	0.000	0.000		0.000		2.500	Nov 2017	-		2.500	Continuing	Continuing	Continuing
Hypersonic Defense - Weapon Concept Definition	C/CPFF	Various : AL	0.000	0.000		0.000		15.000	Apr 2018	-		15.000	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		75.300		-		75.300	-	-	-

Exhibit R-3, RDT&E Project Cost Analysis: FY 2018 Missile Defense Agency			Date: May 2017
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 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Remarks N/A															
Project Cost Totals			0.000	0.000		0.000		75.300		-		75.300	-	-	-

Remarks
N/A

Exhibit R-4, RDT&E Schedule Profile: FY 2018 Missile Defense Agency		Date: May 2017
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 2016				FY 2017				FY 2018				FY 2019				FY 2020				FY 2021				FY 2022			
Technology Development									✧	✧	✧	✧																
Concept Risk Reduction													✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧				
Proof of Concept																									✧	✧	✧	✧
Tracking Demonstration									△																			
Concept Definition Contract Award											△																	
AoA Completion											△																	
Prototype Space Component Design Review												△																

Exhibit R-4A, RDT&E Schedule Details: FY 2018 Missile Defense Agency		Date: May 2017
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**
Technology Development	1	2018	4	2018
Concept Risk Reduction	1	2019	4	2021
Proof of Concept	1	2022	4	2022
Tracking Demonstration	1	2018	1	2018
Concept Definition Contract Award	3	2018	3	2018
AoA Completion	3	2018	3	2018
Prototype Space Component Design Review	4	2018	4	2018