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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force **Date:** February 2020

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 5: System Development & Demonstration (SDD)</i>	R-1 Program Element (Number/Name) PE 0604329F / <i>Small Diameter Bomb (SDB) - EMD</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	1,135.693	75.345	45.241	17.280	0.000	17.280	27.386	27.877	28.375	28.898	0.000	1,386.095
655191: <i>SDB Increment II</i>	1,135.693	75.345	45.241	17.280	0.000	17.280	27.386	27.877	28.375	28.898	0.000	1,386.095
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-	-	-

Program MDAP/MAIS Code: 439

A. Mission Description and Budget Item Justification

GBU-53/B Small Diameter Bomb Increment II (SDB II) StormBreaker is a joint interest United States Air Force (USAF) and Department of Navy (DoN) Acquisition Category (ACAT) IC program, with the USAF as the lead service. SDB II addresses the following warfighter requirements: attack moving and stationary targets, adverse weather operations, multiple ordnance carriage, precision munitions capability, reduced munitions footprint, increased weapons effectiveness, minimized potential for collateral damage, reduced susceptibility of munitions to countermeasures, and provides a network-enabled weapon capability via Link-16 and Ultra High Frequency (UHF) weapon data link. SDB II is a key component of the Air Force Global Strike Task Force Concept of Operations (CONOPs). The threshold aircraft for the USAF is the F-15E, and the threshold aircraft for the DoN are the F-35B and F-35C. Objective aircraft include the F-22, F-16, F-35A, B-2, A-10, MQ-9, B-1, B-52, AC-130 and the F/A-18E/F. SDB II is compatible with the Bomb Rack Unit-61 (BRU-61) miniature munitions carriage, Type II carriage systems, the CNU-660/E carriage system, the Common Munitions Built In Test (BIT)/Reprogramming Equipment (CMBRE), and the Joint Mission Planning System (JMPS). SDB II will develop and field a single weapon storage container (USAF) and a dual weapon storage container (DoN).

SDB II completed a competitive Risk Reduction in October 2009 and entered Milestone B Engineering and Manufacturing Development (EMD) in August 2010. A Fixed Price Incentive Firm EMD contract with five options for annual Low Rate Initial Production (LRIP) lots (FY15-FY19) was awarded in August 2010. SDB II received Milestone C approval to enter LRIP in June 2015 and completed an Acquisition Program Baseline update. Contract options for LRIP Lots 1-5 have been exercised. Initial Operational Test and Evaluation (IOT&E) started June 2018 and completed December 2019. Initial Operational Capability (IOC) for the F-15E is scheduled for FY 2020. IOC on the DoN's F-35B and F-35C is scheduled for FY 2022; and is based on the F-35 B/C hardware and software modification schedule. DoN's first production lot (Lot 4/FY19) supports F/A-18E/F IOC.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver SDB II weapon system capability. The use of such program funds would be in addition to the civilian pay expenses budgeted in program element 0605831F.

This program is in Budget Activity 5, System Development and Demonstration (SDD) because it has passed Milestone B approval and is conducting engineering and manufacturing development tasks aimed at meeting validated requirements prior to full rate production.

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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	78.091	31.241	17.311	0.000	17.311
Current President's Budget	75.345	45.241	17.280	0.000	17.280
Total Adjustments	-2.746	14.000	-0.031	0.000	-0.031
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	14.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-2.746	0.000			
• Other Adjustments	0.000	0.000	-0.031	0.000	-0.031

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 655191: *SDB Increment II*

Congressional Add: *Precision Navigation*

Congressional Add: *SDB II Tech Refresh*

Congressional Add Subtotals for Project: 655191

Congressional Add Totals for all Projects

	FY 2019	FY 2020
	5.000	4.000
	-	10.000
Congressional Add Subtotals for Project: 655191	5.000	14.000
Congressional Add Totals for all Projects	5.000	14.000

Change Summary Explanation

FY19 funding was reduced by \$2.746M for Small Business Innovation Research (SBIR)

FY20 Congressional Adds (\$4M for Precise Navigation; \$10M for Seeker cost reduction initiative)

C. Accomplishments/Planned Programs (\$ in Millions)	FY 2019	FY 2020	FY 2021
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Title: SDB II Development and Engineering Changes

Description: Development activities to deliver capabilities in the SDB II Capability Development Document (CDD). Design, develop, integrate, model, test, and qualify engineering changes to SDB II baseline hardware and software to meet emerging threats and to maintain compatibility with external systems. Activities include, but are not limited to, DoD-mandated data link cryptographic modernization, program protection, exportability features, cyber security, advanced guidance, navigation and control, enhanced lethality, precise/advance navigation, and address obsolescence issues and affordability opportunities. Conduct trade studies and concept development for technology refresh redesigns as based on obsolescence forecasts.

	30.320	19.802	5.940
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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
<p><i>FY 2020 Plans:</i> Complete cryptographic modernization design reviews, test asset builds, and continue weapon data link integration and qualification. Conduct activities for production readiness. Continue collaboration with National Security Agency (NSA) on data link key management. Continue updates for mission planning and Operational Flight Program (OFP) software. Continue development, qualification, and begin testing of engineering changes associated with program protection, exportability, cyber security, enhanced lethality, survivability, threat defeat, software-based capability enhancements, obsolescence, and affordability. Continue integration of SDB II with Command and Control Infrastructure, including Air Operations Center (AOC) integration and Joint Terminal Attack Controller (JTAC) kits. Continue technical order updates to support ongoing OFP development efforts. Continue BRU-61 OFP updates and integration. Lease temporary work space/seating for development and test management personnel, as required to support mission needs.</p> <p><i>FY 2021 Plans:</i> Continue cryptographic modernization weapon data link integration and ground qualification. Conduct activities for production readiness. Continue collaboration with NSA on data link key management. Continue updates for mission planning and OFP software. Conduct all-up-round (AUR) testing.</p> <p>Continue development, qualification, and testing of engineering changes associated with program protection, exportability, cyber security, enhanced lethality, survivability, threat defeat, software-based capability enhancements, obsolescence, and affordability. Continue integration of SDB II with Command and Control Infrastructure, including AOC integration and JTAC kits. Continue technical order updates to support ongoing OFP development efforts. Continue BRU-61 OFP updates and integration. Conduct trade studies and concept development for technology refresh redesigns as required based on obsolescence forecasts.</p> <p><i>FY 2020 to FY 2021 Increase/Decrease Statement:</i> Funding decreased due to majority of data link cryptographic modernization integration, test and qualification hardware having been purchased in FY19 and FY20.</p>				
<p><i>Title:</i> SDB II Integration and Qualification Testing on F-15E</p> <p><i>Description:</i> F-15E Aircraft Integration incorporates tests and targets, Modeling and Simulation (M&S), target lethality, data link, and mission planning. Develop F-15E OFP upgrades to provide the capability to program the weapon with mission planned targets, weapon data link control, and exclusion zone information prior to launch of the weapon. It also allows the aircrew to make in-flight targeting and weapon data link programming if/when required based on employment scenarios.</p> <p>Funding decreased from FY19 following reorganization of major thrust areas.</p> <p><i>FY 2020 Plans:</i></p>		14.114	0.000	0.000

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
N/A				
FY 2021 Plans: N/A				
FY 2020 to FY 2021 Increase/Decrease Statement: N/A				
Title: SDB II M-Code Description: Activities include, but are not limited to, design, development, test and qualification of engineering changes to the SDB II system required for M-Code, and enhanced anti-jam capability. M-Code provides an enhanced anti-jam capability and secures access to military GPS signals. M-Code will provide the ability to operate in increasing adversarial anti-access/area-denial (A2/AD) jamming environments with increased accuracy, better signal acquisition, and enhanced security fetures. FY 2020 Plans: Continue activities to provide SDB II with M-Code capabilities for improved anti-jam and secure access to military GPS signals. Complete component and system-level design reviews and continue development, test, and qualification activities for M-Code receiver and associated component integration. Build component and system-level developmental test assets. Update mission planning and threshold aircraft operational flight program (OFF) software to ensure aircraft to weapon integration and transmission of the appropriate M-Code initialization data and crypto keys. Implement engineering change proposals required by GPS Directorate to comply with signal-in-space interface control documents, key management distribution and security requirements. FY 2021 Plans: Continue activities to provide SDB II with M-Code capabilities for improved anti-jam and secure access to military GPS signals. Continue development, test, and qualification activities for M-Code receiver and associated component integration. Build component and system-level developmental test assets and conduct ground and flight testing. Update mission planning and threshold aircraft OFF software to ensure aircraft-to-weapon integration and transmission of the appropriate M-Code initialization data and crypto keys. Implement engineering change proposals required by GPS Directorate to comply with signal-in-space interface control documents, key management distribution and security requirements. FY 2020 to FY 2021 Increase/Decrease Statement: Funding decrease was minimal from FY 2020 to FY 2021, and reflects similar planned activities.		25.911	11.439	11.340
Accomplishments/Planned Programs Subtotals		70.345	31.241	17.280
		FY 2019	FY 2020	
Congressional Add: Precision Navigation		5.000	4.000	

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	FY 2019	FY 2020
FY 2019 Accomplishments: Activities include designing, implementing, and down selecting seeker based navigation algorithms suitable for operation in GPS denied environments. This effort includes designing/ evaluating multiple solutions on existing and planned weapon hardware. The effort is planned in a two phased approach: Phase 1 will design and down select solution while Phase 2 includes flight tests and final qualification.		
FY 2020 Plans: Activities include continuation of work to design, test, implement, and down select seeker based algorithms suitable for operation in a GPS denied environments.		
Congressional Add: SDB II Tech Refresh	-	10.000
FY 2020 Plans: SDB II Tech Refresh thrust will be a multi-year initiative to increase system affordability, protect our ability to produce and operate, and increase weapon value for the warfighter. This thrust includes, but may not be limited to, reducing the cost of the seeker and other components, subsystems, and assemblies within the weapon and associated system-of-systems; mitigating or responding to Diminishing Manufacturing Sources and Material Shortages (DMSMS); solidifying and/or increasing competition within the supplier industrial base; maximizing operational weapon effectiveness and value through capability enhancements and countering emerging threats; and improving supportability, handling, mission planning and human machine interface.		
Conduct Analysis of Alternatives to evaluate best value Engineering Change Proposals (ECPs) to and/or redesign of the seeker and/or other components and subsystems within the weapon; evaluate supplier and assembly cost reduction; develop a technology roadmap for system affordability, producibility and operational improvements; analyze system requirements and conduct a Systems Requirements Review; mature key technologies and reduce risk for preferred alternatives; and develop and test software enhancements to provide near and/or longer term performance enhancements to maximize warfighter value for fielded or future weapons. Work may also extend beyond the weapon into the SDB II system-of-systems to improve operational effectiveness, operator reliability, aircraft integration, mission planning and human machine interface.		
Congressional Adds Subtotals	5.000	14.000

D. 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
• MPAF 02 Line Item SDB002: <i>Small Diameter Bomb II</i>	100.861	212.434	273.436	-	273.436	308.116	321.869	279.530	223.550	489.974	2,209.770
• RDTE 05 PE 0604329N: <i>Small Diameter Bomb II</i>	57.397	46.129	55.473	-	55.473	59.351	50.642	46.091	47.013	0.000	362.096

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D. 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>
• WPN Line Item 223800: <i>Small Diameter Bomb II</i>	88.772	118.466	79.054	-	79.054	80.918	82.945	84.684	86.456	301.856	923.151

Remarks

DoN RDT&E funds include F-35B and F-35C Integration and Support Cost.

E. Acquisition Strategy

The SDB II Engineering and Manufacturing Development (EMD) contract was awarded using competitive procedures. At the completion of the 42-month Risk Reduction phase in October 2009, one contractor was selected in April 2010 and awarded the EMD contract in August 2010. The EMD contract is a Fixed-Price Incentive Firm (FPIF) contract with priced production options for the first five production lots. SDB II production Lots 1-3 are FPIF. Production Lots 4-5 are firm fixed price. The Government is buying the SDB II based on the contractor System Performance Specification (SPS) which has been approved by the Government. The contractor is accountable for system performance as defined in the SPS and a system warranty as defined in the EMD contract and follow-on production contracts. Accordingly, the contractor is accountable to the Government for the design of the weapon system, as well as the planning and execution of the Development Test and Evaluation (DT&E) program to verify system performance. The Government formally arranges and funds the use of Government flight test support for DT&E and OT&E.

In September 2017, the Government awarded a sole source indefinite delivery indefinite quantity (IDIQ) contract to Raytheon Missile Systems to design, develop, integrate, model, test, and qualify engineering changes to SDB II baseline hardware and software to meet emerging threats and to maintain compatibility with external systems. Activities include, but are not limited to M-Code GPS, data link cryptographic modernization, program protection, exportability features, cyber security, advanced guidance, navigation and control, enhanced lethality, and address obsolescence issues and affordability opportunities. These SDB II design changes are scheduled to begin cut-in production in FY 2022 (Lot 8) as technology is available.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Air Force **Date:** February 2020

Appropriation/Budget Activity 3600 / 5	R-1 Program Element (Number/Name) PE 0604329F / <i>Small Diameter Bomb (SDB)</i> - EMD	Project (Number/Name) 655191 / <i>SDB Increment II</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			
Risk Reduction Contract 1	C/CPFF	Boeing : St. Louis, MO	151.922	-		-		-		-		-	0.000	151.922	-
Risk Reduction Contract 2	C/CPFF	Raytheon : Tucson, AZ	150.800	-		-		-		-		-	0.000	150.800	-
EMD Contract	C/FPIF	Raytheon : Tucson, AZ	460.169	-		-		-		-		-	0.000	460.169	-
Engineering Changes & Technical Support	SS/ Various	Raytheon : Tucson, AZ	107.408	46.130	Dec 2018	29.769	Dec 2019	3.100	Dec 2020	-		3.100	21.262	207.669	136.520
M-Code Integration	SS/ Various	Raytheon : Tucson, AZ	23.801	25.911	Jan 2019	11.439	Mar 2020	11.340	Mar 2021	-		11.340	43.393	115.884	109.437
IMPACT High Pressure Air Compressor System	SS/FFP	Boeing : St. Charles, MO	3.175	-		-		-		-		-	0.000	3.175	-
F-15E Integration and Test Support	SS/ Various	Boeing : St. Louis, MO	50.433	1.683	Jun 2019	1.500	Jun 2020	1.000	Jun 2021	-		1.000	0.724	55.340	49.762
BRU-61/A Integration and Test Support	SS/ Various	Boeing : St. Louis, MO	8.529	-		-		-		-		-	0.000	8.529	-
Mission Planning	Various	Various : Various	5.732	-		-		-		-		-	0.000	5.732	5.832
Data Link Integration & Support	Various	Various : Various	3.004	-		-		-		-		-	0.000	3.004	-
System Performance & Lethality	Various	Various : Various	38.950	-		-		-		-		-	0.000	38.950	39.334
Other Product Development	Various	Various : Various	11.796	-		-		0.280	Mar 2021	-		0.280	36.791	48.867	69.594
Subtotal			1,015.719	73.724		42.708		15.720		-		15.720	102.170	1,250.041	N/A

Remarks
 Engineering Changes: upgrades to SDB II baseline hardware/software to meet emerging threats and to maintain compatibility with external systems. Activities include, but are not limited to, data link cryptographic modernization, program protection, exportability, cyber security, advanced guidance, navigation and control, enhanced lethality, and address obsolescence issues and affordability opportunities.
 Other Product Development: upgrades to baseline hardware/software to support F-35 Integration

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Air Force **Date:** February 2020

Appropriation/Budget Activity 3600 / 5	R-1 Program Element (Number/Name) PE 0604329F / <i>Small Diameter Bomb (SDB)</i> - EMD	Project (Number/Name) 655191 / <i>SDB Increment II</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			
Support	C/CPAF	Not specified. : TBD	0.000	-		-		-		-		-	0.000	0.000	-
Other Government Costs	Various	Various : Various	5.855	0.521	Apr 2019	0.543	Apr 2020	0.565	Apr 2021	-		0.565	0.736	8.220	8.201
Subtotal			5.855	0.521		0.543		0.565		-		0.565	0.736	8.220	N/A

Remarks
Other Gov't Costs: Command & Control Infrastructure Integration subject matter expert (SME) support

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			
Test and Evaluation	C/CPAF	Not specified. : TBD	0.000	-		-		-		-		-	0.000	0.000	-
DT&E	PO	96th Test Wing : Eglin AFB, FL	34.410	-		1.000	Dec 2019	0.000		-		0.000	0.000	35.410	33.725
DT&E: UTTR, WSMR	Various	Various : Various	10.304	-		-		-		-		-	0.000	10.304	-
Targets	Various	Various : Various	25.648	-		-		-		-		-	0.000	25.648	-
Other Test Support	Various	Various : Various	9.263	-		-		-		-		-	0.000	9.263	11.896
Subtotal			79.625	-		1.000		0.000		-		0.000	0.000	80.625	N/A

Remarks
UTTR: Utah Test and Training Range
WSMR: White Sands Missile Range

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			
Management Services	C/CPAF	Not specified. : TBD	0.000	-		-		-		-		-	0.000	0.000	-
Engineering Professional Administrative Support Services	Various	Various : Eglin AFB, FL	23.258	0.750	Jun 2019	0.750	Jun 2020	0.750	Jun 2021	-		0.750	1.500	27.008	25.508

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Air Force **Date:** February 2020

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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			
Program Management Administration (PMA)	Various	Various : Eglin AFB, FL	11.236	0.350	Oct 2018	0.240	Oct 2019	0.245	Oct 2020	-		0.245	0.264	12.335	11.536
Subtotal			34.494	1.100		0.990		0.995		-		0.995	1.764	39.343	N/A

Remarks
 EPASS: Engineering, Professional & Administrative Support Services
 PMA: Other government costs (travel, Government Purchase Card (GPC), equipment supplies, and IT support)

	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	1,135.693	75.345	45.241	17.280	-	17.280	104.670	1,378.229	N/A

Remarks
 Engineering Changes: upgrades to SDB II baseline hardware/software to meet emerging threats, maintain compatibility with external systems and improve system performance. Activities include, but are not limited to, data link cryptographic modernization, program protection, exportability, cyber security, advanced guidance, navigation and control, enhanced lethality, and address obsolescence issues and affordability opportunities.

 Other Product Development: upgrades to baseline hardware/software to support F-35 Integration

 FINANCIAL PERFORMANCE: SDB II is evaluated against traditional Research and Development (R&D) program expenditure benchmarks. However, the SDB II LRIP contract is a FPIF contract with progress payments. A percent of incurred costs are withheld until the end of the contract, when they are liquidated. Mandatory funding obligations and progress payment withholds will cause the program to lag traditional expenditure benchmarks, painting an inaccurate portrait of overall program health.

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Air Force		Date: February 2020
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	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<i>SDB Increment II</i>																												
IOT&E on F-15E																												
F-15E Required Assets Available (RAA)																												
M-Code Integration & Testing																												
Data Link Crypto Mod Integration & Testing																												
Integration & Testing on Threshold F-35B/C																												
Precision Navigation																												
SDB II Tech Refresh																												

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Air Force		Date: February 2020
Appropriation/Budget Activity 3600 / 5	R-1 Program Element (Number/Name) PE 0604329F / <i>Small Diameter Bomb (SDB)</i> - EMD	Project (Number/Name) 655191 / <i>SDB Increment II</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>SDB Increment II</i>				
IOT&E on F-15E	1	2019	1	2020
F-15E Required Assets Available (RAA)	4	2019	4	2020
M-Code Integration & Testing	1	2019	2	2023
Data Link Crypto Mod Integration & Testing	1	2019	4	2021
Integration & Testing on Threshold F-35B/C	1	2019	4	2022
Precision Navigation	4	2019	3	2022
SDB II Tech Refresh	4	2020	3	2022