Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Air Force											Date: February 2018	
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*					R-1 Program Element (Number/Name) PE 0207138F / *F-22A Squadrons*							
COST ($ in Millions)	**Prior Years**	**FY 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	364.691	610.942	603.553	0.000	603.553	496.298	659.563	473.243	481.862	Continuing	Continuing
674785: *F-22*	0.000	178.267	413.149	406.617	0.000	406.617	420.138	481.526	473.243	481.862	Continuing	Continuing
674788: *F-22 Tactical Mandates*	0.000	186.424	197.793	196.936	0.000	196.936	76.160	178.037	0.000	0.000	0.000	835.350

Note

This program, BA 7, PE 0207138F, project 674785, Sensor Enhancements, is a new start.

A. Mission Description and Budget Item Justification

The F-22 Raptor provides air superiority to the Joint Force; access in the highly contested operational environment; as well as homeland and cruise missile defense for the next 40+ years. The F-22 is a multi-mission fighter aircraft that combines stealth, supercruise, maneuverability and integrated avionics to make it the world's most capable combat aircraft. The Engineering and Manufacturing Development (EMD) phase of F-22 acquisition is complete. The program is now continuing pre-planned, incremental modernization development that enhances both F-22 Air Superiority and Global Strike capabilities. The F-22 modernization program upgrades the air vehicle, engine, and training systems to improve F-22 weapons, communications, electronic warfare (EW), and Intelligence Surveillance Reconnaissance (ISR) capabilities.

The F-22 Raptor's Operational Flight Program (OFP) is conducted using AGILE system development environments. Program Office executing Agile environment to evolve modernization activities into a single development stream in order to prototype a new acquisition construct. The AGILE environment allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a schedule cadence for capabilities as they mature.

Funds may be used to resolve emerging safety of flight and diminishing manufacturing sources issues, accommodate technology insertion and fulfill Federal Aviation Administration or other mandates necessary to ensure continued aircrew safety and mission effectiveness. This program element may include necessary civilian pay expenses required to manage, execute, and deliver F-22 weapon system capability. The use of such program funds would be in addition to the civilian pay expenses budgeted in program elements 0605826F, 0605827F, 0605828F, 0605829F, 0605830F, 0605831F, 0605832F, and 0605898F.

This program is in Budget Activity 7, Operational System Development because this budget activity includes development efforts to upgrade systems that have been fielded or have received approval for full rate production and anticipate production funding in the current or subsequent fiscal year.

Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Air Force	Date: February 2018
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0207138F / *F-22A Squadrons*

B. Program Change Summary ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	387.564	610.942	514.005	0.000	514.005
Current President's Budget	364.691	610.942	603.553	0.000	603.553
Total Adjustments	-22.873	0.000	89.548	0.000	89.548
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	-11.100	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	-11.773	0.000			
• Other Adjustments	0.000	0.000	89.548	0.000	89.548

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2017	FY 2018
Project: 674785: *F-22*		
Congressional Add: *F-22 Software*	12.000	0.000
Congressional Add Subtotals for Project: 674785	12.000	0.000
Congressional Add Totals for all Projects	12.000	0.000

Change Summary Explanation

FY17 Changes: -$11.1M total Congressional reduction (-$8.1M movement to M-code; -$15M for Small projects unjustified growth and +$12M for F-22 Software) and -$11.773M SBIR/STTR Transfer

FY19 programmatic increase of $94M along with inflation adjustments.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Air Force											Date: February 2018	
Appropriation/Budget Activity 3600 / 7					R-1 Program Element (Number/Name) PE 0207138F / *F-22A Squadrons*				Project (Number/Name) 674785 / *F-22*			
COST ($ in Millions)	**Prior Years**	**FY 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**	**Cost To Complete**	**Total Cost**
674785: *F-22*	0.000	178.267	413.149	406.617	0.000	406.617	420.138	481.526	473.243	481.862	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

This program, BA 7, PE 0207138F, project 674785, Sensor Enhancements, is a new start.

F-22 development and production are complete. The remaining program consists of F-22 Operational Flight Program (OFP) updates, capability enhancements, and mandates necessary to sustain F-22 weapon system survivability, lethality and availability. The "Continuing" Cost to Complete and Total Cost reflect these initiatives.

A. Mission Description and Budget Item Justification

The F-22 Raptor represents the USAF's priority placed on providing the Joint Force with air dominance, operational access, and homeland & cruise missile defense for the next 40+ years. The F-22 is a multi-mission fighter aircraft that combines stealth, supercruise, advanced maneuverability and integrated avionics to make it the world's most capable combat aircraft. While F-22 Engineering and Manufacturing Development (EMD) and aircraft production completed May 2012, funding for F-22 modernization is "continuing" beyond the FYDP.

The F-22 Raptor's Operational Flight Program (OFP) is conducted using AGILE system development environments. The AGILE environment allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a schedule cadence for capabilities as they mature.

This program funds all non-MDAP development efforts for the F-22. The program is now continuing the pre-planned and evolutionary modernization effort through incremental development phases that enhance the F-22 anti-access/area denial, Air Superiority and Global Strike capabilities. The development program modernizes and upgrades the air vehicle, engine, avionics, and training systems to improve/enhance F-22 weapons, communications, EW, and ISR capabilities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Increment 3.2A	0.104	0.000	0.000
Description: The F-22 Increment 3.2A Modernization Program is software development to improve Electronic Protection, Combat Identification and Link 16 interoperability.			
FY 2018 Plans: N/A			
FY 2019 Plans: N/A			
FY 2018 to FY 2019 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0207138F / *F-22A Squadrons*	**Project (Number/Name)** 674785 / *F-22*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
N/A			
Title: Update 6 Interoperability ***Description:*** Update 6 (U6) Interoperability, is an Operational Flight Program (OFP) update providing cryptographic updates required by the National Security Agency (NSA) to Intra-Flight Data Link (IFDL), Link-16, and Tactical Secure Voice (TSV) to maintain interoperability with Link-16 and secure voice networks. The U6 Interoperability program builds upon the development work already accomplished in the KOV-20 Cryptographic Modernization Program and integrates that development into a single OFP for fleet release. In addition, U6 Interoperability will correct other software deficiencies previously identified during operations. The F-22 Update 6 Program is conducted using AGILE system development environments. The AGILE environment allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs using a schedule cadence as they mature. ***FY 2018 Plans:*** U6 Interoperability will continue to code and system test iterative software drops as well as begin formal integrated flight testing for IFDL/Link 16 interoperability, TSV modernization and software enhancements. ***FY 2019 Plans:*** U6 Interoperability will complete system test and formal integrated flight test followed by completion of a Sufficiency of Test Review. U6 Interoperability will then complete a Fielding Decision Review and begin fleet release. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $40.42M decrease from FY18 to FY19. See above for details.	24.920	48.530	8.110
Title: Operational Software Development ***Description:*** Operational Software Development (OSD) major thrust was formally known as Software Support. OSD has been utilizing the AGILE systems development process to develop, test, and field new capabilities and capability enhancements. OSD includes Pilot Training Systems (PTS) and IMIS software development; Integrated Maintenance Data System (IMDS), Reliability and Maintainability Information System (REMIS) interface development, and Raptor AGILE Software Release (RASR). RASR product line includes the Operational Flight Program (OFP) build in which mature software capabilities from multiple product lines are compiled for integration; Certification Support, to include but not be limited to, airworthiness, JSIG compliance, TCTO validation and verification. This product line also allows for the fielding of the OFPs and the governance which determined capability prioritization. The AGILE process continues to allow for a more rapid delivery of capability to the war fighter ***FY 2018 Plans:*** F-22 will begin to develop a path to cloud-based computing to leverage commercially-based Agile software and hardware development practices. Also, the F-22 enterprise will partner with commercial Agile hardware and software companies to increase the speed and quality of product delivery to the	0.000	3.400	7.717

Exhibit R-2A, RDT&E Project Justification: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0207138F / *F-22A Squadrons*	**Project (Number/Name)** 674785 / *F-22*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
warfighter. ***FY 2019 Plans:*** F-22 will continue to develop a path to cloud-based computing to leverage commercially-based Agile software and hardware development practices. Also, the F-22 enterprise will partner with commercial Agile hardware and software companies to increase the speed and quality of product delivery to the warfighter. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $4.317M increase from FY18 to FY19. See above for details.			
Title: Advanced Technology Development (ATD) ***Description:*** Technology maturation, risk reduction, studies, and demonstrations of classified F-22 development efforts. The F-22 ATD Program is conducted using AGILE system development environments. The AGILE environment allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs using a schedule cadence as they mature. ***FY 2018 Plans:*** Continue technology maturation and risk reduction projects in support of various classified F-22 development efforts. Provide continued technology maturation and acquisition planning in support of the F-22 Sensor Enhancements Program. ***FY 2019 Plans:*** Continue technology maturation and risk reduction projects in support of various classified F-22 development efforts. Provide continued technology maturation and acquisition planning in support of the F-22 Sensor Enhancements Program. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $20.38M decrease from FY18 to FY19. See above for details.	19.750	126.400	106.020
Title: Sensor Enhancements ***Description:*** Improved sensor capabilities to maintain air dominance and preserve first shot, first kill capability. ***FY 2019 Plans:*** Commence proposal preparation activities for EMD and start PDR preparation contract to support 2020 MS B. Initiate integration studies to utilize results from related ATD efforts as part of assessing overall program technological readiness. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $91.05M increase from FY18 to FY19. See above for details.	-	-	91.050
Title: System Engineering/Program Management Support	4.080	9.470	6.830

Exhibit R-2A, RDT&E Project Justification: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0207138F / *F-22A Squadrons*	**Project (Number/Name)** 674785 / *F-22*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Description: Provides F-22 program-wide planning and execution including the following: Strategic Analysis and Support, Cost Estimating Data, and Systems Engineering Process Management. ***FY 2018 Plans:*** Provide F-22 program-wide planning and execution including the following: Strategic Analysis and Support, Cost Estimating Data, and Systems Engineering Process Management. ***FY 2019 Plans:*** Provide F-22 program-wide planning and execution including the following: Strategic Analysis and Support, Cost Estimating Data, and Systems Engineering Process Management. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $2.64M decrease from FY18 to FY19. See above for details.			
Title: Reliability and Maintainability Program (RAMP) ***Description:*** The RAMP Program provides for solution identification and integration of modifications to improve reliability, availability and maintainability (RAM) for the F-22 combined test fleet, located at Edwards AFB. The associated RAMP effort (O&M funded) develops candidate initiatives which are down-selected for implementation and integration based on their development maturity and impact on the F-22 life cycle costs. The RAMP program includes modifications to address corrosion, reduce maintenance hours, increase safety, and provide urgent response requirements to the F-22 fleet. ***FY 2018 Plans:*** Continue retrofit modifications on the combined test fleet aircraft in order to improve system/component reliability, and maintainability and reduce F-22 weapon system life cycle costs. In FY 2018, the F-22 program will add an additional operational test aircraft to the combined test fleet, by bringing an aircraft out of flyable storage. ***FY 2019 Plans:*** Continue retrofit modifications on the combined test fleet aircraft in order to improve system/component reliability, maintainability and reduce F-22 weapon system life cycle costs. Beginning in FY 2019, the retrofit modification program will support four (4) operational test aircraft, with the addition of previously stored aircraft being brought into the combined test fleet. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $1.5M decrease from FY18 to FY19. See above for details.	0.430	2.500	1.000
Title: F-22 Small Projects ***Description:*** Provides F-22 technology studies and demonstrations to include, but not be limited to, Low Observable (LO) Signature Management, Threat Modeling Support, Developmental Test (DT) Weapon Assets, Pilot Training (PT), Dynamic	14.310	30.380	15.000

Exhibit R-2A, RDT&E Project Justification: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0207138F / *F-22A Squadrons*	**Project (Number/Name)** 674785 / *F-22*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Synthetic Aperture Radar (SAR), Flight Test Engine Refurbishment, Support Equipment Development, Government Furnished Equipment (GFE), and Electronic Warfare (EW) system enhancements to counter evolving threats. F-22 Small Projects are conducted using AGILE system development environments. The AGILE environment allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs using a schedule cadence as they mature. ***FY 2018 Plans:*** Continue F-22 technology studies and demonstrations for DT Weapon Assets, Threat Modeling Support, Test Support, Test Aircraft Modifications, CRIIS Network development, PT, Dynamic SAR, Flutter Excitation System (FES), GFE, and continue acquisition planning for EW enhancements. ***FY 2019 Plans:*** Continue F-22 technology studies and demonstrations for DT Weapon Assets, Threat Modeling Support, Test Support, Test Aircraft Modifications, CRIIS Network development, PT, Dynamic SAR, FES, GFE, and continue acquisition planning for EW enhancements. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $15.38M decrease from FY18 to FY19. See above for details.			
Title: Combined Test Force (CTF)	49.870	54.600	57.930
Description: The F-22 CTF, located at Edwards Air Force Base, conducts full-up weapons system testing to assess the effect of the F-22 combined characteristics of stealth, speed, maneuverability, and integrated avionics upon mission accomplishment. The CTF uses operationally significant ground and flight test scenarios to identify system performance deficiencies early before they are more difficult and costly to resolve. F-22 flight testing is conducted using the AGILE system development environment. The AGILE environment allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs using a schedule cadence as they mature. ***FY 2018 Plans:*** Continue flight testing at AFTC, and required technology refresh. Significant programs scheduled for flight test at AFTC include: Update 6, refueling certifications, Seek Eagle and missile tests, ATD, 3.2B, and FES. Also will continue flight test planning using Agile methods for the following programs: F-22 Tactical Mandates, TACLink 16, Update 6, ATD, 3.2B, and CRIIS. In FY 2018, the F-22 program added a fourth aircraft to the developmental test fleet by bringing an aircraft out of flyable storage. ***FY 2019 Plans:*** Significant programs scheduled for flight test at AFTC include: F-22 Tactical Mandates, TACLink 16, Sensor Enhancements, refueling certifications, Special Projects, ATD, and CRIIS. Also will continue flight test planning using Agile methods for the			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0207138F / *F-22A Squadrons*	**Project (Number/Name)** 674785 / *F-22*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
following programs: F-22 Tactical Mandates, TACLink 16, Sensor Enhancements, Special Projects, Helmet Mounted Display, EGI-M, ATD, and CRIIS. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $3.33M increase from FY18 to FY19. See above for details.			
Title: Laboratory Test and Operations (LTO) ***Description:*** The LTO is a continuous activity that plans and conducts development, integration, test, and verification of F-22 OFPs with F-22 hardware. LTO provides maintenance, staffing, and operation of 18 development labs including five unique major System Integration Laboratories (SILs): the Agile Integration Lab (AIL); the Raptor Integration Lab (RaIL); the Air Combat Simulation (ACS) Lab; Vehicle Integration Facility (VIF); and the Vehicle System Simulator (VSS). Through the ACS, LTO provides the combat air forces with advanced mission-level test and training capability via a fully representative virtual simulation. F-22 LTO is conducted using the AGILE system development environment. The AGILE environment allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs using a schedule cadence as they mature. ***FY 2018 Plans:*** Maintaining lab availability in support of F-22 programs. Updating critical systems to include tech refresh, as required to support new aircraft configurations and capabilities. Adding a RADAR to the VSS. Accomplish OFP verification and risk reduction. Support pilot training for Air Combat Command exercises and war gaming; Air Force Operation Test & Evaluation Center test planning; and test event rehearsals. Support periodic AFWC operational mission data updates. The significant programs that execute in lab tests are Increment 3.2B, F-22 TACLink 16, F-22 Tactical Mandates, Update 6, ATD and AFWC mission data loads. ***FY 2019 Plans:*** Maintain lab availability in support of F-22 programs. Update critical systems to include technology refresh and laboratory improvements required to support new aircraft configurations and capabilities. Accomplish OFP verification and risk reduction. Support pilot training for Air Combat Command exercises and war gaming; Air Force Operation Test & Evaluation Center test planning; and test event rehearsals. Support periodic AFWC operational mission data updates. Will continue Lab test planning using Agile methods for the following programs: F-22 Tactical Mandates, TACLink 16, Update 6, Sensor Enhancements and ATD. The significant programs planned for lab test are F-22 TACLink 16, F-22 Tactical Mandates, Update 6, ATD and AFWC mission data loads. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $46.53M decrease from FY18 to FY19. See above for details.	51.720	129.859	83.330
Title: Pilot Systems ***Description:*** This major thrust was formally known as Helmet Mounted Display and Cueing System (HMDCS). The Pilot Systems product line will select, integrate, test, and field mature hardware to support the F-22 Raptor's pilot environment. In FY17, the	0.700	4.810	1.820

Exhibit R-2A, RDT&E Project Justification: PB 2019 Air Force		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
program began efforts to develop the HMDCS to take full advantage of advanced weapons such as the AIM-9X and improved battlespace situational awareness during day/night within-visual-range engagements. The HMDCS will be integrated on all Block 30/35 Raptors. In FY19, the program will support studies and integration risk reduction activities for Talon SPITBALL ***FY 2018 Plans:*** Complete a study and analysis on canopy distortion to inform understanding of display solutions compatible with the F-22s unique canopy construction/coatings. Updating market research and releasing the Request for Proposal for Pre-EMD. ***FY 2019 Plans:*** Select F-22 helmet solution. Enter Pre-EMD contract for integration of helmet solution and achieving system-level PDR. Support studies and integration risk reduction activities for Talon SPITBALL ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $2.99M decrease from FY18 to FY19. See above for details.			
Title: Navigation Systems ***Description:*** This major thrust was formally known as F-22 Global Positioning System (GPS) Military Code (M-Code). The Navigation Systems product line consists of the software and hardware development, test, and fielding necessary to ensure the F-22's ability to maintain Precision, Navigation and Timing (PNT) capabilities in GPS degraded environments. This effort will include the integration of Embedded GPS/Inertial Navigation System (INS) Modernization (EGI-M) onto the F-22 for M-Code, replacement of the current GPS antenna with a Controlled Radiation Pattern Antenna (CRPA), as well as other capabilities, to prevent exploitation of the weapon system by adversaries and provide assured PNT. ***FY 2018 Plans:*** Continue studies, analysis, and risk reduction for development of CRPA antenna, to include tasks necessary to prepare engineering data, drawings, and other documentation. ***FY 2019 Plans:*** Complete Tech Maturation and Risk Reduction (TMRR) and Preliminary Design Review for CRPA antenna. Begin Engineering, Manufacturing, and Design (EMD) phase for antenna. Release RFP for TMRR effort of EGI-M integration onto F-22. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $24.61M increase from FY18 to FY19. See above for details.	0.383	3.200	27.810
Accomplishments/Planned Programs Subtotals	166.267	413.149	406.617

	FY 2017	FY 2018
Congressional Add: F-22 Software	12.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0207138F / *F-22A Squadrons*	**Project (Number/Name)** 674785 / *F-22*

	FY 2017	FY 2018
FY 2017 Accomplishments: Update 6 (U6) Interoperability, is an Operational Flight Program (OFP) update providing cryptographic updates required by the National Security Agency (NSA) to Intra-Flight Data Link (IFDL), Link-16, and Tactical Secure Voice (TSV) to maintain interoperability with Link-16 and secure voice networks. The U6 Interoperability program builds upon the development work already accomplished in the KOV-20 Cryptographic Modernization Program and integrates that development into a single OFP for fleet release. In addition, U6 Interoperability will correct other software deficiencies previously identified during operations ***FY 2018 Plans:*** N/A		
Congressional Adds Subtotals	12.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
• APAF 05 Line Item F02200: *F-22A Squadrons, PE 0207138F**	253.390	306.581	338.611	-	338.611	358.086	496.972	494.086	549.196	Continuing	Continuing
• RDTE 07 PE 0605213F: *Increment 3.2B, RDT&E***	70.290	13.600	0.000	-	0.000	0.000	0.000	-	-	0.000	83.890
• APAF 05 Line Item F2232B: *F-22 Increment 3.2B, PE 0207138F****	78.410	105.756	13.081	-	13.081	20.373	6.013	-	-	0.000	223.633
• MILCON PE 0207138F: *MILCON*	-	-	0.000	-	0.000	0.000	0.000	-	-	0.000	0.000
• RDTE 07 PE 0207163F: *AIM-120D, AMRAAM, RDT&E*****	-	-	0.000	-	0.000	0.000	0.000	-	-	0.000	0.000
• RDTE 07 PE 0207138F: *F-22 Tactical Mandates*	101.294	197.793	198.418	-	198.418	76.732	179.378	-	-	0.000	753.615

Remarks

NOTES:

*F-22A Squadrons, APAF/PE 0207138F, includes funding for F-22A Squadrons BPs 11 (Aircraft Modifications), 13 (Post-Production Support), 16 (Initial Spares), and 19 (Depot Activation) only.

**F-22 Increment 3.2B, RDT&E/PE 0605213F, includes funding for FY 2013 and beyond identified in the Increment 3.2B documentation. PEs 0605213F and 0207318F share lab and infrastructure support costs across the F-22 enterprise.

***F-22 Increment 3.2B, APAF/PE 0207138F includes funding for associated Increment 3.2B BPs 11 (Aircraft Modifications) and 16 (Initial Spares) only.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Air Force		Date: February 2018
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C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost

****AIM-120D, AMRAAM RDT&E/PE 0207163F, funding provides for the AIM-120 development as a part of the F-22 Increment 3.2B effort.

D. Acquisition Strategy

The Raptor Enhancement Development & Integration II (REDI II) contract is an Indefinite Delivery/Indefinite Quantity (ID/IQ) Ordering contract that maximizes flexibility to start, stop, accelerate and decelerate projects as required. The (REDI) II contract is a follow-on to the initial REDI contract. REDI II provides maximum flexibility to manage various modernization projects. The REDI II contract allows for the issuance of orders for efforts associated with the planning, analysis, design, development, qualification, test and documentation of F-22 weapon system performance enhancements, life-cycle improvements, Operational Flight Program (OFP) upgrades, and associated efforts essential to accomplishing the F-22 mission.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Air Force		Date: February 2018
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Increment 3.2A	SS/CPIF	Lockheed Martin : Fort Worth, TX	-	0.104		-		-		-		-	0.000	0.104	-
Update 6 Interoperability	SS/ Various	Lockheed Martin : Fort Worth, TX	-	36.920	Mar 2017	48.530	Mar 2018	8.110	Mar 2019	-		8.110	0.000	93.560	-
Operational Software Development	SS/ Various	Lockheed Martin : Fort Worth, TX	-	-		3.400	Nov 2017	7.717	Nov 2018	-		7.717	0.000	11.117	-
Advanced Technology Development	Various	Various : Various	-	19.750	Dec 2016	126.400	Nov 2017	106.020	Nov 2018	-		106.020	Continuing	Continuing	-
Sensor Enhancements	SS/ Various	Lockheed Martin : Fort Worth, TX	-	-		-		91.050	Nov 2018	-		91.050	779.230	870.280	-
System Engineering / Program Management	SS/CPFF	Lockheed Martin : Fort Worth, TX	-	4.080	Jan 2017	9.470	Jan 2018	6.830	Jan 2019	-		6.830	Continuing	Continuing	-
RAMP	SS/CPFF	Lockheed Martin : Fort Worth, TX	-	0.430	Dec 2016	2.500	Dec 2017	1.000	Dec 2018	-		1.000	Continuing	Continuing	-
F-22 Small Projects	Various	Various : Various	-	14.310	Nov 2016	30.380	Dec 2017	15.000	Dec 2018	-		15.000	Continuing	Continuing	-
Pilot Systems	SS/ Various	Lockheed Martin : Fort Worth, TX	-	0.700	Jul 2017	4.810	Jul 2018	1.820	Jul 2019	-		1.820	96.830	104.160	-
Navigation Systems	SS/CPIF	Lockheed Martin : Fort Worth, TX	-	0.383	Sep 2017	3.200	Feb 2018	27.810	Dec 2018	-		27.810	101.243	132.636	-
		Subtotal	-	76.677		228.690		265.357		-		265.357	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Combined Test Force	Various	Various : Various	-	49.870	Nov 2016	54.600	Nov 2017	57.930	Nov 2018	-		57.930	Continuing	Continuing	-
Laboratory Test & Operations (LTO)	SS/ Various	Lockheed Martin : Ft Worth, TX	-	51.720	Nov 2016	129.859	Nov 2017	83.330	Nov 2018	-		83.330	Continuing	Continuing	-
		Subtotal	-	101.590		184.459		141.260		-		141.260	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Air Force			Date: February 2018
Appropriation/Budget Activity 3600 / 7	R-1 Program Element (Number/Name) PE 0207138F / *F-22A Squadrons*	Project (Number/Name) 674785 / *F-22*	

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Mission Support	Various	Various : TBD	-	-		-		-		-		-	Continuing	Continuing	-
		Subtotal	-	-		-		-		-		-	Continuing	Continuing	N/A

	Prior Years	FY 2017		FY 2018		FY 2019 Base		FY 2019 OCO		FY 2019 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	178.267		413.149		406.617		-		406.617	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0207138F / *F-22A Squadrons*	**Project (Number/Name)** 674785 / *F-22*

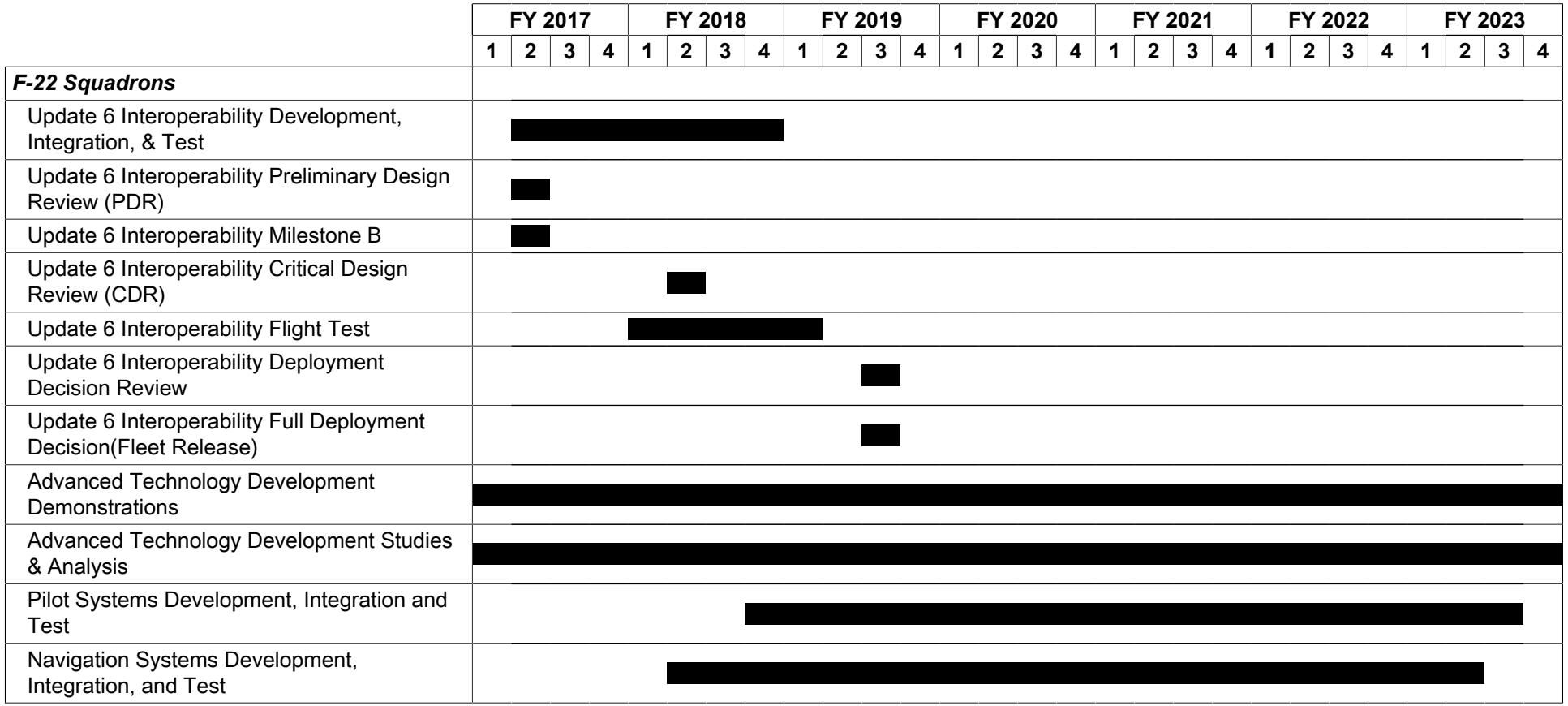

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0207138F / *F-22A Squadrons*	**Project (Number/Name)** 674785 / *F-22*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
F-22 Squadrons				
Update 6 Interoperability Development, Integration, & Test	2	2017	4	2018
Update 6 Interoperability Preliminary Design Review (PDR)	2	2017	2	2017
Update 6 Interoperability Milestone B	2	2017	2	2017
Update 6 Interoperability Critical Design Review (CDR)	2	2018	2	2018
Update 6 Interoperability Flight Test	1	2018	1	2019
Update 6 Interoperability Deployment Decision Review	3	2019	3	2019
Update 6 Interoperability Full Deployment Decision(Fleet Release)	3	2019	3	2019
Advanced Technology Development Demonstrations	1	2017	4	2023
Advanced Technology Development Studies & Analysis	1	2017	4	2023
Pilot Systems Development, Integration and Test	4	2018	3	2023
Navigation Systems Development, Integration, and Test	2	2018	2	2023

Exhibit R-2A, RDT&E Project Justification: PB 2019 Air Force			Date: February 2018
Appropriation/Budget Activity 3600 / 7	R-1 Program Element (Number/Name) PE 0207138F / *F-22A Squadrons*	Project (Number/Name) 674788 / *F-22 Tactical Mandates*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
674788: *F-22 Tactical Mandates*	0.000	186.424	197.793	196.936	0.000	196.936	76.160	178.037	0.000	0.000	0.000	835.350
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In FY 2015, a separate Budget Program Activity Code (BPAC 674788) within Program Element (PE) 0207138F was created for F-22 Tactical Mandates. Under this BPAC, the F-22 TACLink 16 and F-22 Tactical Mandates (TACMan) programs are managed.

A. Mission Description and Budget Item Justification

The F-22 TACLink 16 and F-22 Tactical Mandates programs are follow-on modernization efforts to Increment 3.2B and Update 6. The programs will provide Open Systems Architecture (OSA), Link 16 Transmit and Mode 5 Identification Friend or Foe (IFF) Transpond/Interrogate on the F-22 Block 30/35 combat coded F-22 fleet.

In FY 2017 the budget began to reflect the TACLink 16 program. The F-22 recognized a valuable opportunity to field OSA and Link 16 Transmit earlier than originally planned under the F-22 Tactical Mandates. The Link 16 Transmit enables 5th generation F-22 fighter aircraft to transmit tactical information through datalink to the 5th generation F-35 (a.k.a. 5th-to-5th), as well as to 4th generation aircraft (a.k.a. 5th-to-4th). Transmitting tactical data to other aircraft types via datalink is a top Air Force priority. With Link 16 Transmit, the F-22's superior 5th Generation sensor suite will critically support the situational awareness of all participants in the operational environment. The TACLink 16 program accelerates the installation of this key data link capability. Additionally, the TACLink 16 will enable future life cycle savings opportunities for the F-22 and provide risk reduction effort for the F-22 Tactical Mandates program.

The F-22 Tactical Mandates program (product line) is conducted using AGILE system development environments. The AGILE environment allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs using a schedule cadence for capabilities as they mature.

The F-22 Tactical Mandates program will field Mode 5 IFF on the TACLink 16 baseline. Mode 5 IFF is a Joint Requirements Oversight Council-mandated Blue Force identification capability that improves Raptor survivability and reduces fratricide risk DoD-wide. Mode 5 IFF brings significantly enhanced combat identification in both quality and security over the F-22's legacy Mode 4 capability. This update is particularly critical given Mode 4 functionality may be unavailable when F-22 Tactical Mandates fields.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: TACLink 16	93.194	130.400	79.710
Description: The TACLink 16 program consists of software and hardware development necessary to field Link 16 Transmit capability on the F-22. Link 16 Transmit will be accomplished via an OSA architecture integrated with F-22 legacy avionics. The OSA implementation will provide a pathway to more competitive and open future F-22 modernization. Includes mission support requirements for the F-22 Program Office to include, but not be limited to, travel, computer costs, and other miscellaneous contract support. The TAClink 16 program is conducted using AGILE system development enviroments. The AGILE environment			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0207138F / *F-22A Squadrons*	**Project (Number/Name)** 674788 / *F-22 Tactical Mandates*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs using a schedlule cadence for capabilities as they mature. ***FY 2018 Plans:*** The program will complete Preliminary Design Review (PDR) and enter Engineering, Manufacturing, and Development (EMD). Coding and sub-system lab test will continue. Open Mission Systems and associated hardware will deliver to labs. The program will progress to system lab test of its iterative software drops. ***FY 2019 Plans:*** Program will continue EMD and system lab test. Hardware for Development Test (DT) flight will deliver, DT aircraft will be modified, and DT flights will commence. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $50.69M decrease from FY18 to FY19, See above for details.			
Title: F-22 Tactical Mandates (TACMAN) ***Description:*** The F-22 TACMAN program consists of software development and hardware necessary to provide tactical Mode 5 IFF on the F-22. The program also provides an opportunity to incorporate other updates to Link 16 capabilities into the Raptor. Includes mission support requirements for the F-22 Program Office to include, but not be limited to, travel, computer costs, and other miscellaneous contract support. The F-22 TACMAN program is conducted using AGILE system development environments. The AGILE environment allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs using a schedule cadence for capabilities as they mature. ***FY 2018 Plans:*** The program will continue design, software modeling, prototyping and test. The program will complete PDR and enter EMD and developmental hardware, to include Crypto, Identify Friend or Foe, and antenna electronic units, will deliver to sub-systems labs. ***FY 2019 Plans:*** Program will continue EMD. Production representative hardware will deliver to system labs, followed by the beginning of system lab test of hardware and iterative software releases. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $33.85M increase from FY18 to FY19, See above for details.	93.230	59.700	92.066
Title: Lab and Combined Test Force (CTF) ***Description:*** The Lab Test and Operations (LTO) is a continuous activity that plans and conducts development, integration, test, and verification of F-22 TACMan and TACLink 16 OFPs and hardware. The LTO provides maintenance, staffing, and operation of 18 development labs including five unique major SILs: the AIL, RaIL, ACS, VIF, and VSS. The F-22 Combined Test Force, located	0.000	7.693	25.160

Exhibit R-2A, RDT&E Project Justification: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0207138F / *F-22A Squadrons*	**Project (Number/Name)** 674788 / *F-22 Tactical Mandates*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
at Edwards Air Force Base, conducts full-up weapons system testing to assess the effect of the F-22 combined characteristics of stealth speed, maneuverability, and integrated avionics upon mission accomplishment. The CTF uses operationally significant ground and flight test scenarios to identify system performance deficiencies of TACMAN and TACLink 16 early before they are more difficult and costly to resolve. ***FY 2018 Plans:*** Continue lab testing and planning for CTF testing for TACMan and TACLink 16. ***FY 2019 Plans:*** Continue lab testing and planning for CTF testing for TACMan and TACLink 16. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $17.47M increase from FY18 to FY19, See above for details.			
Accomplishments/Planned Programs Subtotals	186.424	197.793	196.936

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
• RDTE 07 PE 0207138F: *F-22A Squadrons**	178.267	413.149	406.617	-	406.617	420.138	481.526	473.243	481.862	Continuing	Continuing
• APAF 05 Line Item F02200: *F-22A Squadrons, PE 0207138F***	253.390	306.581	338.611	-	338.611	358.086	496.972	494.086	549.196	Continuing	Continuing
• RDTE 05 PE 0605213F: *F-22A Increment 3.2B****	70.290	13.600	0.000	-	0.000	0.000	-	-	-	0.000	83.890
• APAF 05 Line Item F2232B: *F-22A Increment 3.2B, PE 0207138F*****	78.410	105.756	13.081	-	13.081	20.373	6.013	-	-	0.000	223.633

Remarks

*F-22 Squadrons, RDT&E/PE 0207138F, includes funding for F-22A Squadrons modernization and development BPAC 674785.

**F-22A Squadrons, APAF/PE 0207138F, includes funding for F-22A Squadrons BPs 11 (Aircraft Modifications), 13 (Post-Production Support), 16 (Initial Spares), and 19 (Depot Activation) only.

***F-22 Increment 3.2B, RDT&E/PE 0605213F, includes funding for the development of F-22A, Increment 3.2B and share lab and infrastructure costs across the F-22 enterprise.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0207138F / *F-22A Squadrons*	**Project (Number/Name)** 674788 / *F-22 Tactical Mandates*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
****F-22 Squadrons, APAF/PE 0207138F/F2232B, includes funding for F-22 Increment 3.2B BPs 11 (Aircraft Modifications) and 16 (Initial Spares) only.											

D. Acquisition Strategy

The Raptor Enhancement Development & Integration II (REDI) II contract is an Indefinite Delivery/Indefinite Quantity contract that maximizes flexibility to start, stop accelerate and reaccelerate projects as required. manage various modernization projects. The REDI II contract is a follow-on to the initial REDI contract. REDI II provides maximum flexibility to manage various modernization projects. The REDI II contract allows for the issuance of orders for efforts associated with the planning, analysis, design, development, qualification, test and documentation of F-22 weapon system performance enhancements, life-cycle improvements, Operational Flight Program (OFP) upgrades, and associated efforts essential to accomplishing the F-22 mission.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Air Force			Date: February 2018
Appropriation/Budget Activity 3600 / 7	R-1 Program Element (Number/Name) PE 0207138F / *F-22A Squadrons*	Project (Number/Name) 674788 / *F-22 Tactical Mandates*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
F-22 Tactical Mandates	SS/CPIF	Lockheed Martin : Ft Worth, TX	-	93.230	Nov 2017	59.700	Mar 2018	92.066	Mar 2019	-		92.066	308.656	553.652	-
F-22 TACLink 16	SS/CPIF	Lockheed Martin : Ft Worth, TX	-	93.194	Nov 2017	130.400	Mar 2018	79.710	Mar 2019	-		79.710	106.345	409.649	-
		Subtotal	-	186.424		190.100		171.776		-		171.776	415.001	963.301	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test Execution	Various	Various : Various	-	-		7.693	Nov 2017	25.160	Nov 2018	-		25.160	39.527	72.380	-
		Subtotal	-	-		7.693		25.160		-		25.160	39.527	72.380	N/A

	Prior Years	FY 2017		FY 2018		FY 2019 Base		FY 2019 OCO		FY 2019 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	186.424		197.793		196.936		-		196.936	454.528	1,035.681	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0207138F / *F-22A Squadrons*	**Project (Number/Name)** 674788 / *F-22 Tactical Mandates*

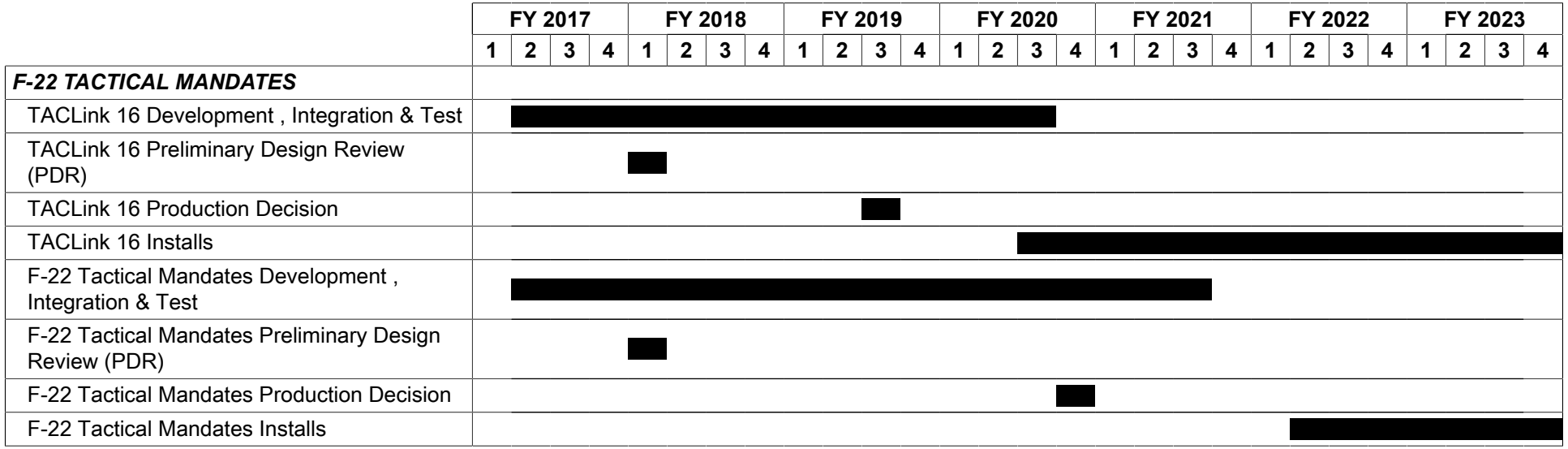

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0207138F / *F-22A Squadrons*	**Project (Number/Name)** 674788 / *F-22 Tactical Mandates*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
F-22 TACTICAL MANDATES				
TACLink 16 Development , Integration & Test	2	2017	3	2020
TACLink 16 Preliminary Design Review (PDR)	1	2018	1	2018
TACLink 16 Production Decision	3	2019	3	2019
TACLink 16 Installs	3	2020	4	2023
F-22 Tactical Mandates Development , Integration & Test	2	2017	3	2021
F-22 Tactical Mandates Preliminary Design Review (PDR)	1	2018	1	2018
F-22 Tactical Mandates Production Decision	4	2020	4	2020
F-22 Tactical Mandates Installs	2	2022	4	2023