

UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Air Force										Date: February 2019		
Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 7: Operational Systems Development					R-1 Program Element (Number/Name) PE 0207138F / F-22A Squadrons							
COST (\$ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
Total Program Element	364.155	584.004	584.743	496.298	0.000	496.298	666.253	500.173	481.862	604.536	0.000	4,282.024
674785: F-22	85.835	390.539	387.807	420.138	0.000	420.138	488.216	500.173	481.862	604.536	Continuing	Continuing
674788: F-22 Tactical Mandates	278.320	193.465	196.936	76.160	0.000	76.160	178.037	0.000	0.000	0.000	0.000	922.918

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 low observability, supercruise, maneuverability and integrated avionics to make it the world's most capable air superiority aircraft. The program is continuing 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, navigations, pilot systems, and electronic warfare.

The F-22 Raptor's Modernization Development is conducted using a rapid acquisition construct leveraging commercial best practices such as Agile and Lean. This allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a scheduled 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.

As directed in the FY 2018 NDAA, Sec 825, amendment to PL 114-92 FY 2016 NDAA, Sec 828 Penalty for Cost Overruns, the FY 2018 Air Force penalty total is \$14.373M. The calculated percentage reduction to each research, development, test and evaluation and procurement account will be allocated proportionally from all programs, projects, or activities under such account.

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.

UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Air Force				Date: February 2019	
Appropriation/Budget Activity		R-1 Program Element (Number/Name)			
3600: Research, Development, Test & Evaluation, Air Force I BA 7: Operational Systems Development		PE 0207138F I F-22A Squadrons			
B. Program Change Summary (\$ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	610.942	603.553	496.298	0.000	496.298
Current President's Budget	584.004	584.743	496.298	0.000	496.298
Total Adjustments	-26.938	-18.810	0.000	0.000	0.000
• Congressional General Reductions	-10.069	-18.810			
• 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	1.826	0.000			
• SBIR/STTR Transfer	-18.695	0.000			
• Other Adjustments	0.000	0.000	0.000	0.000	0.000
Change Summary Explanation					
FY18 - (\$10.069M) Congressional mark for Small projects unjustified growth					
- (\$18.695M) Small Business Innovation Research (SBIR) reduction					
- \$ 1.826M Reprogramming					
FY19 - (\$15.1M) Congressional mark for Navigation Systems program delay					
- (\$3.61M) Federally Funded Research Development Center reduction					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force										Date: February 2019		
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 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
674785: F-22	85.835	390.539	387.807	420.138	0.000	420.138	488.216	500.173	481.862	604.536	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

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 low observability, supercruise, maneuverability and integrated avionics to make it the world's most capable air superiority aircraft. The program is continuing 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, navigations, pilot systems, and electronic warfare.

The F-22 Raptor's Modernization Development is conducted using a rapid acquisition construct leveraging commercial best practices such as Agile and Lean. This allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a scheduled cadence for capabilities as they mature.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2018	FY 2019	FY 2020
Title: Update 6 Interoperability	48.530	8.110	0.000
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 a rapid acquisition construct leveraging commercial best practices such as Agile and Lean. This allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a scheduled cadence for capabilities as they mature.			
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 2020 Plans: N/A			
FY 2019 to FY 2020 Increase/Decrease Statement:			

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force			Date: February 2019		
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 2018	FY 2019	FY 2020
Development program ends in FY19					
Title: Operational Software Development Description: Operational Software Development (OSD) has been utilizing commercially available Agile and Lean best practices to transform and accelerate the F-22 Raptor's Modernization processes to develop, test, and field new capability enhancements. OSD includes but is not limited to the expansion of a cloud-based software development environment and partnering with commercial companies to adopt industry product development best practices. FY 2019 Plans: F-22 will establish an initial cloud-based computing environment to begin leveraging commercially-based Agile software and hardware development best practices and tools. 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 2020 Plans: F-22 will continue maturing and scaling cloud-based computing environment to leverage commercially-based Agile software and hardware development best practices and tools. Also, the F-22 enterprise will continue partnerships with commercial Agile hardware and software companies to increase the speed and quality of product delivery to the warfighter. FY 2019 to FY 2020 Increase/Decrease Statement: \$5.133M increase from FY19 to FY20. See above for details.			3.400	7.717	12.850
Title: Advanced Technology Development (ATD) Description: Technology maturation, risk reduction, studies, demonstrations and prototypes of classified F-22 development efforts. The F-22 ATD Program is conducted using a rapid acquisition construct leveraging commercial best practices such as Agile and Lean. This allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a scheduled cadence for capabilities as they mature. 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 2020 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 to FY 2020 Increase/Decrease Statement:			124.939	102.310	59.088

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force			Date: February 2019		
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 2018	FY 2019	FY 2020
\$43.222M decrease from FY19 to FY20. See above for details.					
<p>Title: Sensor Enhancements</p> <p>Description: As part of the F-22 Capability Pipeline and through Section 804 Middle Tier Acquisition authority, Sensor Enhancements improves sensor capabilities to maintain air dominance and preserve first shot, first kill capability. The F-22 Sensor Enhancement Program is conducted using a rapid acquisition construct leveraging commercial best practices such as Agile and Lean. This allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a scheduled cadence for capabilities as they mature.</p> <p>FY 2019 Plans: Continue integration studies to utilize the results from related ATD efforts as part of assessing the overall program technological readiness to support a 2020 Fielding Decision.</p> <p>FY 2020 Plans: Provide a Fielding Decision and continue software development for fleet release in preparation for fielding.</p> <p>FY 2019 to FY 2020 Increase/Decrease Statement: \$84.560M increase from FY19 to FY20. See above for details.</p>			-	92.870	177.430
<p>Title: System Engineering/Program Management Support</p> <p>Description: Provides F-22 program-wide planning and execution including the following: Strategic Analysis and Support, Cost Estimating Data, and Systems Engineering Process Management.</p> <p>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.</p> <p>FY 2020 Plans: System Engineering/Program Management provides support to include F-22 Program-Wide Planning and Execution, Strategic Analysis and Support, Cost Estimating Data, and Systems engineering Process Management.</p> <p>FY 2019 to FY 2020 Increase/Decrease Statement: \$0.230M increase from FY19 to FY20. See above for details.</p>			9.470	6.830	7.060
<p>Title: Reliability and Maintainability Program (RAMP)</p> <p>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</p>			2.500	1.000	1.150

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force			Date: February 2019		
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 2018	FY 2019	FY 2020
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 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 2020 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.					
FY 2019 to FY 2020 Increase/Decrease Statement: \$0.150M increase from FY19 to FY20. See above for details.					
Title: F-22 Small Projects			20.311	15.000	16.690
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 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 a rapid acquisition construct leveraging commercial best practices such as Agile and Lean. This allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a scheduled cadence for capabilities as they mature.					
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 2020 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 2019 to FY 2020 Increase/Decrease Statement: \$1.690M increase from FY19 to FY20. See above for details.					
Title: Combined Test Force (CTF)			54.601	57.930	60.730

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force			Date: February 2019		
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 2018	FY 2019	FY 2020
<p>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 a rapid acquisition construct leveraging commercial best practices such as Agile and Lean. This allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a scheduled cadence for capabilities as they mature.</p> <p>FY 2019 Plans: Significant programs scheduled for flight test at AFTC include: F-22 Mode 5 Identification Friend & Foe (IFF), Link 16, Sensor Enhancements, refueling certifications, Special Projects, ATD, and CRIIS. Also will continue flight test planning using Agile methods for the following programs: F-22 Mode 5 IFF, Link 16, Sensor Enhancements, Special Projects, Helmet Mounted Display, GPS M-Code, ATD, and CRIIS.</p> <p>FY 2020 Plans: Significant programs scheduled for flight test at AFTC include: F-22 Mode 5 IFF, Link 16, Sensor Enhancements, refueling certifications, Special Projects, ATD, and CRIIS. Also will continue flight test planning using Agile methods for the following programs: F-22 Mode 5 IFF, Link 16, Sensor Enhancements, Special Projects, GPS M-Code, ATD, and CRIIS.</p> <p>FY 2019 to FY 2020 Increase/Decrease Statement: \$2.800M increase from FY19 to FY20. See above for details.</p>					
<p>Title: Laboratory Test and Operations (LTO)</p> <p>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, the Vehicle System Simulator (VSS), and the Flying Test Bed (FTB). 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 a rapid acquisition construct leveraging commercial best practices such as Agile and Lean. This allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a scheduled cadence for capabilities as they mature.</p> <p>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</p>			123.588	83.330	65.290

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force			Date: February 2019		
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 2018	FY 2019	FY 2020
using Agile methods for the following programs: F-22 Mode 5 IFF, Link 16, Update 6, Sensor Enhancements and ATD. The significant programs planned for lab test are F-22 Link 16, Mode 5 IFF, Update 6, ATD and AFWC mission data loads. FY 2020 Plans: LTO plans to incorporate virtual components into the SILs to support faster testing and assessment of F-22 enhancements. 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 Mode 5 IFF, Link 16, Update 6, Sensor Enhancements and ATD. The significant programs planned for lab test are F-22 Link 16, Mode 5 IFF, Update 6, ATD and AFWC mission data loads. FY 2019 to FY 2020 Increase/Decrease Statement: \$18.040M decrease from FY19 to FY20. See above for details.					
Title: Navigation Systems Description: The Navigation Systems product line consists of the software and hardware development, integration, test, and fielding necessary to ensure the F-22's ability to maintain Precision, Navigation and Timing (PNT) capabilities, to include in GPS degraded environments. As part of the F-22 Capability Pipeline and through Section 804 Middle Tier Acquisition authority, this effort will include the integration of Embedded Global Positioning System (GPS)/Inertial Navigation System (INS) Modernization (EGI-M) onto the F-22 for M-Code, replacement of the legacy GPS antenna with a robust Controlled Radiation Pattern Antenna (CRPA), as well as other capabilities, to prevent exploitation of the weapon system by adversaries and provide assured PNT. This major thrust also captures F-22 program activities related to integrating the advanced Talon SPITBALL Link 16 antenna onto the F-22. F-22 Navigation Systems is conducted using a rapid acquisition construct leveraging commercial best practices such as Agile and Lean. This allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a scheduled cadence for capabilities as they mature. FY 2019 Plans: Begin execution of Technical Maturation and Risk Reduction (TMRR) on the F-22 GPS CRPA. Support efforts for Engineering, Manufacturing and Development (EMD) of EGI-M as they relate to integration of EGI-M onto F-22, to include purchase orders of EGI-M Engineering Developmental Models for initial F-22 integration testing. Support studies and risk reduction activities for Talon SPITBALL FY 2020 Plans: Complete TMRR activities for F-22 GPS CRPA and transition to EMD; FY2020 activities will include system level testing of the CRPA in F-22 system labs. Place purchase orders of EGI-M Production Representative Units that will support F-22 system test			3.200	12.710	19.850

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force										Date: February 2019		
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 2018	FY 2019	FY 2020
and flight test of the EGI-M. Transition F-22 Talon SPITBALL activities from Air Force Tactical Exploitation of National Capabilities (TENCAP) office to F-22 Program Office to continue development and integration activities for the F-22 Raptor.												
FY 2019 to FY 2020 Increase/Decrease Statement: \$7.140M increase from FY19 to FY20. See above for details.												
Accomplishments/Planned Programs Subtotals										390.539	387.807	420.138
C. Other Program Funding Summary (\$ in Millions)												
Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost	
• APAF 05 Line Item F02200: F-22A Squadrons, PE 0207138F*	280.593	405.650	436.974	-	436.974	585.822	611.719	651.622	554.501	Continuing	Continuing	
• RDTE 07 PE 0605213F: Increment 3.2B, RDT&E**	13.600	0.000	0.000	-	0.000	0.000	-	-	-	0.000	13.600	
• APAF 05 Line Item F2232B: F-22 Increment 3.2B, PE 0207138F***	102.907	2.000	20.200	-	20.200	5.963	-	-	-	0.000	131.070	
• RDTE 07 PE 0207138F: F-22 Tactical Mandates	197.793	196.936	76.160	-	76.160	178.037	-	-	-	0.000	648.926	
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.												
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.												

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force		Date: February 2019
Appropriation/Budget Activity 3600 / 7	R-1 Program Element (Number/Name) PE 0207138F / F-22A Squadrons	Project (Number/Name) 674785 / F-22

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.

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Air Force												Date: February 2019			
Appropriation/Budget Activity 3600 / 7						R-1 Program Element (Number/Name) PE 0207138F / F-22A Squadrons				Project (Number/Name) 674785 / F-22					
Product Development (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Update 6 Interoperability	SS/ Various	Lockheed Martin : Fort Worth, TX	85.835	48.530	Mar 2018	8.110	Mar 2019	-		-		-	0.000	142.475	-
Operational Software Development	SS/ Various	Lockheed Martin : Fort Worth, TX	0.000	3.400	Nov 2017	7.717	Nov 2018	12.850	Nov 2019	-		12.850	Continuing	Continuing	-
Advanced Technology Development	Various	Various : Various	0.000	124.939	Nov 2017	102.310	Nov 2018	59.088	Nov 2019	-		59.088	Continuing	Continuing	-
Sensor Enhancements	SS/ Various	Lockheed Martin : Fort Worth, TX	0.000	-		92.870	Dec 2018	177.430	Dec 2019	-		177.430	651.220	921.520	-
System Engineering / Program Management	SS/CPFF	Lockheed Martin : Fort Worth, TX	0.000	9.470	Apr 2018	6.830	Apr 2019	7.060	Apr 2020	-		7.060	Continuing	Continuing	-
RAMP	SS/CPFF	Lockheed Martin : Fort Worth, TX	0.000	2.500	Dec 2017	1.000	Dec 2018	1.150	Dec 2019	-		1.150	Continuing	Continuing	-
F-22 Small Projects	Various	Various : Various	0.000	20.311	Feb 2018	15.000	Feb 2019	16.690	Feb 2020	-		16.690	Continuing	Continuing	-
Navigation Systems	SS/ Various	Lockheed Martin : Fort Worth, TX	0.000	3.200	Feb 2018	12.710	Jan 2019	19.850	Jan 2020	-		19.850	123.210	158.970	-
Subtotal			85.835	212.350		246.547		294.118		-		294.118	Continuing	Continuing	N/A
Test and Evaluation (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Combined Test Force	Various	Various : Various	0.000	54.601	Jan 2018	57.930	Jan 2019	60.730	Jan 2020	-		60.730	Continuing	Continuing	-
Laboratory Test & Operations (LTO)	SS/ Various	Lockheed Martin : Ft Worth, TX	0.000	123.588	Jan 2018	83.330	Jan 2019	65.290	Jan 2020	-		65.290	Continuing	Continuing	-
Subtotal			0.000	178.189		141.260		126.020		-		126.020	Continuing	Continuing	N/A
			Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			85.835	390.539		387.807		420.138		-		420.138	Continuing	Continuing	N/A
Remarks															

UNCLASSIFIED

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Air Force

Date: February 2019

Appropriation/Budget Activity

3600 / 7

R-1 Program Element (Number/Name)

PE 0207138F / F-22A Squadrons

Project (Number/Name)

674785 / F-22

	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	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
F-22 Squadrons																												
Update 6 Interoperability Critical Design Review (CDR)																												
Update 6 Interoperability Flight Test																												
Update 6 Interoperability Deployment Decision Review																												
Update 6 Interoperability Full Deployment Decision(Fleet Release)																												
Advanced Technology Development Demonstrations																												
Advanced Technology Development Studies & Analysis																												
Pilot Systems Development, Integration and Test																												
Navigation Systems Development, Integration, and Test																												

UNCLASSIFIED

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Air Force			Date: February 2019
Appropriation/Budget Activity 3600 / 7	R-1 Program Element (Number/Name) PE 0207138F / <i>F-22A Squadrons</i>	Project (Number/Name) 674785 / <i>F-22</i>	

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>F-22 Squadrons</i>				
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	2018	4	2024
Advanced Technology Development Studies & Analysis	1	2018	4	2024
Pilot Systems Development, Integration and Test	4	2018	4	2019
Navigation Systems Development, Integration, and Test	2	2018	4	2024

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force										Date: February 2019		
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 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
674788: F-22 Tactical Mandates	278.320	193.465	196.936	76.160	0.000	76.160	178.037	0.000	0.000	0.000	0.000	922.918
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Budget Program Activity Code focuses on delivering Link 16 and Mode 5 Identification Friend or Foe (IFF) capabilities to the F-22 Raptor.

Link 16 will deliver Link 16 Transmit and enhance existing Receive capabilities. Link 16 capabilities will be enabled by Open System Architecture (OSA) and 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. Mode 5 IFF will deliver IFF Transpond and Interrogate capabilities. 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. All capabilities will be fielded on the F-22 Block 30/35 combat coded F-22 fleet.

The F-22's Link 16 and Mode 5 IFF developments are conducted using a rapid acquisition construct leveraging commercial best practices such as Agile and Lean. This allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a scheduled cadence for capabilities as they mature.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2018	FY 2019	FY 2020
Title: Link 16	126.072	79.710	20.460
Description: This major thrust was formally known as TAClink 16. As part of the F-22 Capability Pipeline and through Section 804 Middle Tier Acquisition authority, Link 16 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 F-22 Link 16 program is conducted using a rapid acquisition construct leveraging commercial best practices such as Agile and Lean. This allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a scheduled cadence for capabilities as they mature.			
FY 2019 Plans: Link 16 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 2020 Plans:			

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force			Date: February 2019		
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 2018	FY 2019	FY 2020
Link 16 will complete DT and operational test (OT).					
FY 2019 to FY 2020 Increase/Decrease Statement: \$59.250M decrease from FY19 to FY20. See above for details.					
Title: Mode 5 Identification Friend or Foe (IFF)			59.700	92.066	41.540
Description: This Major thrust was formally known as F-22 Tactical Mandates (TACMAN). As part of the F-22 Capability Pipeline and through Section 804 Middle Tier Acquisition authority, Mode 5 IFF consists of software development and hardware necessary to provide tactical Mode 5 IFF Transpond and Interrogate on the F-22. Mode 5 IFF 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 Mode 5 IFF program is conducted using a rapid acquisition construct leveraging commercial best practices such as Agile and Lean. This allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a scheduled cadence for capabilities as they mature.					
FY 2019 Plans: Mode 5 IFF Transpond and Interrogate 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. Limited Mode 5 IFF Transpond capabilities will deliver into DT for Release 1.					
FY 2020 Plans: Mode 5 IFF Transpond capabilities will continue DT and OT. Mode 5 IFF Interrogate capabilities will continue EMD and begin system lab test of hardware and software.					
FY 2019 to FY 2020 Increase/Decrease Statement: \$50.526M decrease from FY19 to FY20. See above for details.					
Title: Lab and Combined Test Force (CTF)			7.693	25.160	14.160
Description: The Lab Test and Operations (LTO) is a continuous activity that plans and conducts development, integration, test, and verification of Link 16 and Mode 5 IFF OFPs and hardware. The LTO provides maintenance, staffing, and operation of 18 development labs including five unique major SILs: the AIL, RaIL, ACS, and VSS. 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 of Link 16 and Mode 5 IFF early before they are more difficult and costly to resolve. The F-22 Raptor's Lab and CTF are conducted using a rapid acquisition construct leveraging commercial best practices such as Agile and Lean. This allows the F-22 Raptor program to develop, test, and field software/hardware from multiple programs (product lines) using a scheduled cadence for capabilities as they mature.					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force										Date: February 2019		
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 2018	FY 2019	FY 2020
FY 2019 Plans: Continue lab testing and planning for CTF testing for Link 16 and Mode 5 IFF.												
FY 2020 Plans: Continuous planning and execution of Lab and CTF testing for Link 16 and Mode 5 IFF capabilities.												
FY 2019 to FY 2020 Increase/Decrease Statement: \$11.000M decrease from FY19 to FY20. See above for details.												
Accomplishments/Planned Programs Subtotals										193.465	196.936	76.160
C. Other Program Funding Summary (\$ in Millions)												
Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost	
• RDTE 07 PE 0207138F: F-22A Squadrons*	403.080	406.617	420.138	-	420.138	488.216	500.173	481.862	604.536	Continuing	Continuing	
• APAF 05 Line Item F02200: F-22A Squadrons, PE 0207138F**	281.599	345.650	445.074	-	445.074	585.822	607.669	647.572	554.501	Continuing	Continuing	
• RDTE 05 PE 0605213F: F-22A Increment 3.2B***	13.600	0.000	0.000	-	0.000	-	-	-	-	0.000	13.600	
• APAF 05 Line Item F2232B: F-22A Increment 3.2B, PE 0207138F****	113.038	9.007	20.213	-	20.213	5.963	-	-	-	0.000	148.221	
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.												
****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												

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2020 Air Force		Date: February 2019
Appropriation/Budget Activity 3600 / 7	R-1 Program Element (Number/Name) PE 0207138F / F-22A Squadrons	Project (Number/Name) 674788 / F-22 Tactical Mandates
<p>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.</p>		
<p>E. Performance Metrics</p> <p>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.</p>		

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Air Force												Date: February 2019			
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)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
F-22 Mode 5 IFF	SS/ Various	Lockheed Martin : Ft Worth, TX	146.425	59.700	Mar 2018	92.066	Mar 2019	41.540	Mar 2020	-		41.540	135.329	475.060	-
F-22 Link 16	SS/ Various	Lockheed Martin : Ft Worth, TX	131.825	126.072	Mar 2018	79.710	Mar 2019	20.460	Mar 2020	-		20.460	36.558	394.625	-
Subtotal			278.250	185.772		171.776		62.000		-		62.000	171.887	869.685	N/A
Test and Evaluation (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Test Execution	Various	Various : Various	0.070	7.693	Jan 2018	25.160	Jan 2019	14.160	Jan 2020	-		14.160	6.150	53.233	-
Subtotal			0.070	7.693		25.160		14.160		-		14.160	6.150	53.233	N/A
			Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			278.320	193.465		196.936		76.160		-		76.160	178.037	922.918	N/A
Remarks															

UNCLASSIFIED

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Air Force

Date: February 2019

Appropriation/Budget Activity

3600 / 7

R-1 Program Element (Number/Name)

PE 0207138F / F-22A Squadrons

Project (Number/Name)

674788 / F-22 Tactical Mandates

	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	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
F-22 TACTICAL MANDATES																												
Link 16 Development , Integration & Test																												
Link 16 Preliminary Design Review (PDR)																												
Link 16 & IFF Transpond Developmental Test																												
Link 16 & IFF Transpond Production Decision																												
Link 16 & IFF Transpond Installs																												
Mode 5 IFF Development, Integration & Test																												
Mode 5 IFF Preliminary Design Review (PDR)																												
Mode 5 IFF Interrogate Developmental Test																												
Mode 5 IFF Interrogate Production Decision																												
Mode 5 IFF Interrogate Installs																												

UNCLASSIFIED

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Air Force			Date: February 2019
Appropriation/Budget Activity 3600 / 7	R-1 Program Element (Number/Name) PE 0207138F / <i>F-22A Squadrons</i>	Project (Number/Name) 674788 / <i>F-22 Tactical Mandates</i>	

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>F-22 TACTICAL MANDATES</i>				
Link 16 Development , Integration & Test	1	2018	3	2020
Link 16 Preliminary Design Review (PDR)	1	2018	1	2018
Link 16 & IFF Transpond Developmental Test	3	2019	2	2020
Link 16 & IFF Transpond Production Decision	4	2019	4	2019
Link 16 & IFF Transpond Installs	4	2020	4	2023
Mode 5 IFF Development, Integration & Test	1	2018	3	2023
Mode 5 IFF Preliminary Design Review (PDR)	1	2018	1	2018
Mode 5 IFF Interrogate Developmental Test	2	2022	3	2023
Mode 5 IFF Interrogate Production Decision	3	2022	3	2022
Mode 5 IFF Interrogate Installs	2	2023	4	2024