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Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Air Force **Date:** May 2021

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603680F / <i>Manufacturing Technology Program</i>
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COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	-	133.059	138.748	45.259	0.000	45.259	-	-	-	-	-	-
635280: <i>Manufacturing Technologies</i>	-	133.059	138.748	45.259	0.000	45.259	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This program executes technical efforts to develop and maintain an affordable and reliable industrial base and manufacturing capability responsive to Department of the Air Force warfighter needs. The program develops and improves manufacturing technologies and processes to reduce transition risk, enable cost reduction, improve component and system quality, increase readiness and affordable mission availability, enhance industrial capability and promote transformation through the industrial base. Value stream modifications and manufacturing throughput improvements are implemented to shorten weapon system cycle times during design, development, production and sustainment. Cost savings are realized through early engagement with stakeholders to promote producible designs, ensuring the industrial base will be ready to manufacture at the needed quantities. Manufacturing technologies objectives are conducted through industrial partnerships that enable targeted investment of manufacturing technologies and reduce risk in the industrial supply chain for existing weapon system upgrades and new warfighter systems. Efforts in the program have been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

The Department of the Air Force technologies in this program are both enabling and enduring as we invest in maturing emerging technologies that address established mission gaps, and transformational technologies that address integrated enterprise capabilities intended to reshape the future force across air, space, and cyber warfighting domains. Development of transformational operational capabilities through advanced technology solutions focuses on five strategic capabilities: Global Persistent Awareness; Resilient Information Sharing; Rapid, Effective Decision-Making; Complexity, Unpredictability, and Mass; and Speed and Reach of Disruption and Lethality.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 1206601SF, and 0602298F.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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B. Program Change Summary (\$ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	130.916	0.000	0.000	0.000	0.000
Current President's Budget	133.059	138.748	45.259	0.000	45.259
Total Adjustments	2.143	138.748	45.259	0.000	45.259
• Congressional General Reductions	0.000	-0.253			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	98.600			
• Congressional Directed Transfers	0.000	40.401			
• Reprogrammings	-0.003	0.000			
• SBIR/STTR Transfer	-3.256	0.000			
• Other Adjustments	5.402	0.000	45.259	0.000	45.259

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

Project: 635280: *Manufacturing Technologies*

- Congressional Add: *Program increase - F-35 Battery Technology*
- Congressional Add: *Program increase - Thermal protection for hypersonic vehicles*
- Congressional Add: *Program increase - Materials Development Research*
- Congressional Add: *Program Increase - Modeling Technology for Small Turbine Engines*
- Congressional Add: *Program increase - Low cost manufacturing methods for hypersonic vehicle components*
- Congressional Add: *Program increase - Flexible hybrid electronics*
- Congressional Add: *Program increase - Aerospace composite structures*
- Congressional Add: *Program increase - Certification of bonded aircraft structures*
- Congressional Add: *Program increase - Industrialization of ceramic matrix composites for hypersonic weapons*
- Congressional Add: *Program increase - Thermal batteries*
- Congressional Add: *Program increase - Technologies to repair fastener holes*
- Congressional Add: *Program increase - Manufacturing technology for reverse engineering*
- Congressional Add: *Program increase - Solid state battery research*
- Congressional Add: *Program increase - Agile manufacturing initiatives*
- Congressional Add: *Program increase - Hybrid manufacturing for rapid tooling and repair*

	FY 2020	FY 2021
	9.549	9.600
	9.744	0.000
	4.872	0.000
	4.872	7.000
	7.795	8.000
	4.872	0.000
	4.872	0.000
	4.872	0.000
	9.744	0.000
	1.949	0.000
	4.872	5.000
	4.872	5.000
	2.923	0.000
	9.744	0.000
	0.000	5.000

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Congressional Add Details (\$ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Congressional Add: <i>Program increase - cost reduction for aerospace composite structures</i>	0.000	10.000
Congressional Add: <i>Program increase - flexible thermal protection systems for hypersonics</i>	0.000	10.000
Congressional Add: <i>Program increase - alternative domestic rubber production</i>	0.000	5.000
Congressional Add: <i>Program increase - large scale additive manufacturing for hypersonics</i>	0.000	6.000
Congressional Add: <i>Program increase - manufacturing readiness for hypersonic propulsion systems</i>	0.000	10.000
Congressional Add: <i>Program increase - thermoplastic material systems</i>	0.000	7.000
Congressional Add: <i>Program increase - automated fiber placement for composite structures</i>	0.000	5.000
Congressional Add: <i>Program increase - hypersonic manufacturing capability and supply</i>	0.000	6.000
Congressional Add Subtotals for Project: 635280	85.552	98.600
Congressional Add Totals for all Projects	85.552	98.600

Change Summary Explanation

Increase in FY 2022 is due to realigning the manufacturing efforts to this program.
FY 2020 Other Adjustments due to Civilian pay adjustment.

C. Accomplishments/Planned Programs (\$ in Millions)	FY 2020	FY 2021	FY 2022
<p>Title: Affordable Mission Availability</p> <p>Description: Develop and transition pervasive manufacturing technologies for affordable mission availability of Department of the Air Force components and systems. The name of this effort changed from Sustainment Manufacturing Technologies to Affordable Mission Availability to better reflect the technical objectives.</p> <p>FY 2021 Plans: Continue to advance high demand specialized manufacturing technologies to develop cost effective conventional production, overhaul, and specialty material repair technologies to enable affordable sustainment of aircraft systems. Continue to develop cost-effective manufacturing and repair processes to meet specific needs of Programs of Record and depots. Continue to develop manufacturing methods to meet the needs of the next generation hypersonic platforms. Continue to develop and demonstrate the manufacturability of materials, processes and devices for command and control communication technologies, intelligence, surveillance and reconnaissance systems, and RF, digital and power management components.</p> <p>FY 2022 Plans:</p>	13.302	11.241	13.578

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>Continue to advance high demand specialized manufacturing technologies to develop cost effective conventional production, overhaul, and specialty material repair technologies to enable affordable sustainment of aircraft systems. Continue to develop cost-effective manufacturing and repair processes to meet specific needs of Programs of Record and depots. Continue to develop manufacturing methods to meet the needs of the next generation hypersonic platforms. Continue to develop and demonstrate the manufacturability of materials, processes and devices for command and control communication technologies, intelligence, surveillance and reconnaissance systems, and RF, digital and power management components. Initiate manufacturing repair technologies for turbine engine components.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: FY 2022 funding increased compared to FY 2021 by \$2.337 million. Funding increased due to increased emphasis on manufacturing technologies for weapon system readiness.</p>				
<p>Title: Advanced Manufacturing Technologies</p> <p>Description: Develop and transition affordable advanced manufacturing for Department of the Air Force fielded and future platforms.</p> <p>FY 2021 Plans: Continue to enable and promote advanced manufacturing processes, techniques, and equipment availability for reducing materiel acquisition, maintenance and repair costs. Continue to develop, demonstrate and introduce intelligent robotics and digital engineering concepts into manufacturing processes. Continue to develop, demonstrate and evaluate additively manufactured aerospace components and subcomponents. Continue to develop and demonstrate technologies enabling factory of the future, digital supply chain management, industrial internet of things to provide improvements in production, delivery and support of warfighter capabilities.</p> <p>FY 2022 Plans: Continue to enable and promote advanced manufacturing processes, techniques, and equipment availability for reducing materiel acquisition, maintenance and repair costs. Continue to develop and demonstrate intelligent robotics and digital engineering concepts into manufacturing processes. Continue to develop, demonstrate and evaluate additively manufactured aerospace components and subcomponents. Continue to develop and demonstrate technologies enabling factory of the future, digital supply chain management, industrial internet of things to provide improvements in production, delivery and support of warfighter capabilities.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement:</p>		34.205	28.907	22.630

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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2020	FY 2021	FY 2022
FY 2022 funding decreased compared to FY 2021 by \$6.277 million. Funding decreased due to increased emphasis in other higher demand manufacturing technologies.			
Title: Manufacturing for Transformational Technologies Description: Develop and transition manufacturing technologies that enable advanced technology solutions that will shape the future force across the air, space and cyberspace domains. FY 2021 Plans: Not applicable since this effort will begin in FY 2022. FY 2022 Plans: Refine development of high demand manufacturing technologies including low cost and attritable systems, thermal protection materials for high temperature applications and other manufacturing technologies geared toward realizing the future force and to provide a cost-imposing strategy against adversarial forces. FY 2021 to FY 2022 Increase/Decrease Statement: FY 2022 funding increased compared to FY 2021 by \$9.051 million. Funding increased due to increased emphasis on manufacturing for attritable systems and other transformational manufacturing efforts.	0.000	0.000	9.051
Accomplishments/Planned Programs Subtotals	47.507	40.148	45.259

	FY 2020	FY 2021
Congressional Add: Program increase - F-35 Battery Technology FY 2020 Accomplishments: Conducted Congressionally directed efforts. FY 2021 Plans: Conduct Congressionally directed efforts.	9.549	9.600
Congressional Add: Program increase - Thermal protection for hypersonic vehicles FY 2020 Accomplishments: Conducted Congressionally directed efforts. FY 2021 Plans: Not applicable	9.744	0.000
Congressional Add: Program increase - Materials Development Research FY 2020 Accomplishments: Conducted Congressionally directed efforts. FY 2021 Plans: Not applicable	4.872	0.000
Congressional Add: Program Increase - Modeling Technology for Small Turbine Engines	4.872	7.000

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	FY 2020	FY 2021	
FY 2020 Accomplishments: Conducted Congressionally directed efforts.			
FY 2021 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - Low cost manufacturing methods for hypersonic vehicle components	7.795	8.000	
FY 2020 Accomplishments: Conducted Congressionally directed efforts.			
FY 2021 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - Flexible hybrid electronics	4.872	0.000	
FY 2020 Accomplishments: Conducted Congressionally directed efforts.			
FY 2021 Plans: Not applicable			
Congressional Add: Program increase - Aerospace composite structures	4.872	0.000	
FY 2020 Accomplishments: Conducted Congressionally directed efforts.			
FY 2021 Plans: Not applicable			
Congressional Add: Program increase - Certification of bonded aircraft structures	4.872	0.000	
FY 2020 Accomplishments: Conducted Congressionally directed efforts.			
FY 2021 Plans: Not applicable			
Congressional Add: Program increase - Industrialization of ceramic matrix composites for hypersonic weapons	9.744	0.000	
FY 2020 Accomplishments: Conducted Congressionally directed efforts.			
FY 2021 Plans: Not applicable			
Congressional Add: Program increase - Thermal batteries	1.949	0.000	
FY 2020 Accomplishments: Conducted Congressionally directed efforts.			
FY 2021 Plans: Not applicable			
Congressional Add: Program increase - Technologies to repair fastener holes	4.872	5.000	
FY 2020 Accomplishments: Conducted Congressionally directed efforts.			
FY 2021 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - Manufacturing technology for reverse engineering	4.872	5.000	

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	FY 2020	FY 2021	
FY 2020 Accomplishments: Conducted Congressionally directed efforts.			
FY 2021 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - Solid state battery research	2.923	0.000	
FY 2020 Accomplishments: Conducted Congressionally directed efforts.			
FY 2021 Plans: Not applicable			
Congressional Add: Program increase - Agile manufacturing initiatives	9.744	0.000	
FY 2020 Accomplishments: Conducted Congressionally directed efforts.			
FY 2021 Plans: Not applicable			
Congressional Add: Program increase - Hybrid manufacturing for rapid tooling and repair	0.000	5.000	
FY 2020 Accomplishments: Not applicable			
FY 2021 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - cost reduction for aerospace composite structures	0.000	10.000	
FY 2020 Accomplishments: Not applicable			
FY 2021 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - flexible thermal protection systems for hypersonics	0.000	10.000	
FY 2020 Accomplishments: Not applicable			
FY 2021 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - alternative domestic rubber production	0.000	5.000	
FY 2020 Accomplishments: Not applicable			
FY 2021 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - large scale additive manufacturing for hypersonics	0.000	6.000	
FY 2020 Accomplishments: Not applicable			
FY 2021 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - manufacturing readiness for hypersonic propulsion systems	0.000	10.000	

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	FY 2020	FY 2021
FY 2020 Accomplishments: Not applicable		
FY 2021 Plans: Conduct Congressionally directed efforts.		
Congressional Add: Program increase - thermoplastic material systems	0.000	7.000
FY 2020 Accomplishments: Not applicable		
FY 2021 Plans: Conduct Congressionally directed efforts.		
Congressional Add: Program increase - automated fiber placement for composite structures	0.000	5.000
FY 2020 Accomplishments: Not applicable		
FY 2021 Plans: Conduct Congressionally directed efforts.		
Congressional Add: Program increase - hypersonic manufacturing capability and supply	0.000	6.000
FY 2020 Accomplishments: Not applicable		
FY 2021 Plans: Conduct Congressionally directed efforts.		
Congressional Adds Subtotals	85.552	98.600

D. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

E. Acquisition Strategy

N/A