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Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army **Date:** March 2019

Appropriation/Budget Activity 2040: Research, Development, Test & Evaluation, Army / BA 7: Operational Systems Development					R-1 Program Element (Number/Name) PE 0708045A / End Item Industrial Preparedness Activities							
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	-	118.410	108.696	59.848	-	59.848	61.071	62.543	63.749	64.386	0.000	538.703
E25: Mfg Science & Tech	-	58.610	53.896	59.848	-	59.848	61.071	62.543	63.749	64.386	0.000	424.103
EA2: MANTECH INITIATIVES (CA)	-	59.800	54.800	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	114.600

A. Mission Description and Budget Item Justification

This Program Element (PE) develops, demonstrates, and transitions manufacturing processes that enable improvements in producibility and affordability of emerging and enabling components and subsystems of Army ground and air platforms, Soldier systems, weapons systems, air & missile defense systems, and sensors and electronics. Initiatives within the PE result in cost savings and reduced risk of transitioning military-unique manufacturing processes into production. Project E25 fosters the transfer of new/improved manufacturing technologies to the industrial base, including manufacturing efforts that have potential for high payoff across the spectrum of Army systems.

The cited work is consistent with the Under Secretary of Defense, Research and Engineering science and technology focus areas and the Army Modernization Strategy.

Work in this PE is performed by: the U.S. Army Futures Command; The U.S. Army Medical Research and Materiel Command (MRMC), Ft. Detrick, MD; and the Army Space and Missile Defense Command/Army Forces Strategic Command (SMDC/ARSTRAT), Huntsville, AL.

B. Program Change Summary (\$ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	60.877	53.958	59.848	-	59.848
Current President's Budget	118.410	108.696	59.848	-	59.848
Total Adjustments	57.533	54.738	0.000	-	0.000
• Congressional General Reductions	-0.046	-0.062			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	59.800	54.800			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.221	-			

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

Project: EA2: MANTECH INITIATIVES (CA)

Congressional Add: Additive Manufacturing Technology Insertion

FY 2018	FY 2019
10.000	10.000

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<u>Congressional Add Details (\$ in Millions, and Includes General Reductions)</u>		FY 2018	FY 2019
Congressional Add: <i>Additive Manufacturing Supply Chain</i>		10.000	-
Congressional Add: <i>Inventory Management and Demand Planning Software</i>		9.800	-
Congressional Add: <i>Nanoscale Materials</i>		15.000	20.000
Congressional Add: <i>Advanced Development of Asset Protection Technologies</i>		10.000	-
Congressional Add: <i>Lightweight Transparent Armor</i>		5.000	10.000
Congressional Add: <i>Engineering Data Synchronization</i>		-	9.800
Congressional Add: <i>Power Take-Off Hybridization</i>		-	5.000
Congressional Add Subtotals for Project: EA2		59.800	54.800
Congressional Add Totals for all Projects		59.800	54.800
<u>Change Summary Explanation</u> FY 2018 congressional add of \$59.8M for Additive manufacturing technology insertion and supply chain, Army inventory management and demand planning software, nanoscale materials, advanced development of asset protection technologies, and manufacturing for novel lightweight transparent armor. FY 2019 congressional add of \$54,800 for additive manufacturing technology insertion, nanoscale materials, lightweight transparent armor, engineering data synchronization, and power take-off hybridization.			

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Appropriation/Budget Activity 2040 / 7					R-1 Program Element (Number/Name) PE 0708045A / End Item Industrial Preparedness Activities				Project (Number/Name) E25 / Mfg Science & Tech			
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
E25: Mfg Science & Tech	-	58.610	53.896	59.848	-	59.848	61.071	62.543	63.749	64.386	0.000	424.103
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		
A. Mission Description and Budget Item Justification												
This Project develops and demonstrates manufacturing processes that enable improvements in producibility and affordability of emerging and enabling components and subsystems of Army ground and air platforms, Soldier systems, weapons systems, air & missile defense systems, and sensors and electronics. Focus is on components and subsystems such as advanced armor, lightweight structural components, sensors, propellants, and gun tubes. Additionally, work is performed to advance the state of the art in manufacturing processing and fabrication techniques for coatings, multifunctional materials, and structural elements for Army specific applications.												
The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2018	FY 2019	FY 2020	
Title: Long Range Precision Fires									-	9.956	6.235	
Description: The effort funds manufacturing improvements to support areas such as Advanced Weapon Systems, Fire Control, and Advanced Energetics and Warheads. Work focuses on addressing challenges in areas such as enhanced missile seekers; fuses and initiators for munitions; and boring, honing, and rifling cannon and mortar barrels.												
FY 2019 Plans:												
Complete development of manufacturing processes for battery free initiators for scatterable munitions; and development of manufacturing technologies for complex missile seekers. Develop safer and more cost effective methods for mixing and packing of propellants; enhanced processes to fabricate large-caliber cannon and mortar tubes with longer range and higher durability than existing systems.												
FY 2020 Plans:												
Will demonstrate advanced materials, processing techniques, and tools to fabricate, bore, and rifle large caliber mortar and cannon tubes that enable long range fires; demonstrate more efficient propellant mixing and packing processes for rocket motors.												
FY 2019 to FY 2020 Increase/Decrease Statement:												
The Manufacturing Technology selection process supports planned completions in FY19 and planned new start efforts in FY20 to support the Army's modernization priority of Army Long Range Precision Fires.												
Title: Next Generation Combat Vehicle									15.454	18.529	25.211	

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Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0708045A / End Item Industrial Preparedness Activities	Project (Number/Name) E25 / Mfg Science & Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2018	FY 2019	FY 2020
<p>Description: This effort funds manufacturing technology advances needed for more affordable components and subsystems for tactical and combat vehicles and weapons systems. Work focuses on addressing challenges in areas such as advanced armor, lighter weight components, insensitive propellants, precision munitions, and vehicle power devices.</p> <p>FY 2019 Plans: Develop manufacturing technology to reduce the cost and improve the performance of weight sensitive armor protection systems against future threats; demonstrate manufacturing technologies to reduce cost and improve performance when joining dissimilar materials for ground platform structural components; develop manufacturing techniques for ground vehicle powertrain components with improved efficiency and power density.</p> <p>FY 2020 Plans: Will mature processing of weight sensitive armor and protection systems that meet size, weight and power requirements; demonstrate manufacturing processes and non-destructive evaluation techniques to enable advanced welding for vehicle structures; develop manufacturing technologies that address unit cost and enable lower life cycle costs as compared to currently available modern combat powertrain components; develop manufacturing processes required to produce composite rubber track systems applicable to heavy ground combat systems.</p> <p>FY 2019 to FY 2020 Increase/Decrease Statement: The Manufacturing Technology selection process supports planned completions in FY19 and planned new start efforts in FY20 to support the Army's modernization priority of Next Generation Combat Vehicle.</p>				
<p>Title: Future Vertical Lift</p> <p>Description: This effort funds manufacturing technology advances needed for more affordable manned and unmanned aircraft components and subsystems. Work focuses on addressing challenges in areas such as engine performance and life, reliable component integration/attachment, structural durability at low weight, sensors for aircraft protection and pilotage, and reduced corrosion.</p> <p>FY 2019 Plans: Investigate novel manufacturing methods for fabrication of composite material air platform components with reduced weight and improved fatigue resistance.</p> <p>FY 2020 Plans: Will develop novel automated manufacturing methods for composite air platform components which are lighter weight and more maintainable; develop manufacturing of targeting sensors for airborne applications.</p> <p>FY 2019 to FY 2020 Increase/Decrease Statement:</p>		3.932	1.170	5.058

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2018	FY 2019	FY 2020
The Manufacturing Technology selection process supports planned completions in FY19 and planned new start efforts in FY20 to support the Army's modernization priority of Future Vertical Lift.				
Title: Networks and Command, Control, Communications and Intelligence Description: This effort funds manufacturing technology advances needed for more affordable components and subsystems for intelligence, surveillance, reconnaissance and targeting systems, mission command systems, electronic warfare and improved explosive device detect/defeat systems. Work focuses on addressing challenges in areas such as large format multi-color focal plane arrays, flexible displays, night vision sensors, target detectors, advanced antennas and sensors. FY 2019 Plans: Complete optimization of manufacturing process to produce ultra-thin, wide-band, conformal antennas for Army platforms; investigate process improvements for digital imagers and sensors for aviation protection and pilotage. FY 2020 Plans: Will improve process maturation and material growth and yield of dual band digital imagers for aviation protection and pilotage; demonstrate optics coating deposition techniques for 3rd generation sensor platforms; develop Micro Electro Mechanical Systems (MEMS)-based navigation-grade inertial measurement units. FY 2019 to FY 2020 Increase/Decrease Statement: The Manufacturing Technology selection process supports planned completions in FY19 and planned new start efforts in FY20 to support the Army's modernization priority of Networks and Command, Control, Communications and Intelligence.		8.452	7.819	12.363
Title: Air & Missile Defense Description: This effort funds manufacturing improvements to support areas such as High Energy Laser system components (e.g. diodes, optics), interceptor components, and armament systems for counter-unmanned aerial systems and counter-rocket, artillery, and mortar systems. FY 2019 Plans: Develop processes to improve manufacturing yield for high energy laser diodes. FY 2020 Plans: Will develop prototype tooling, test, and evaluation processes to improve manufacturing yield for high energy laser diodes; optimize manufacturing techniques for High Energy Laser (HEL) optics through manufacturing improvements to reduce lead time; develop improvements to the manufacturing process for electromagnetic mitigation devices to eliminate co-site, jamming,		-	0.588	3.734

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2018	FY 2019	FY 2020
and other threats to radar and other communication systems; design and develop a manufacturing process for critical gyroscope components. FY 2019 to FY 2020 Increase/Decrease Statement: Efforts for AMD were realigned from Lethality beginning in FY19 with continued progression in FY20. This effort builds in FY20 for developing an automated means of manufacturing fiber-coupled Pump Diode Processes for High Energy Lasers resulting in reduced production costs. Such efforts will benefit future Army rotary-wing hard-kill aircraft survivability equipment development and other service fiber laser system development.				
Title: Soldier Lethality Description: This effort funds manufacturing technology advances needed for more affordable components and subsystems in areas such as aerial delivery of supplies, expeditionary basing, Soldier-borne sensors, clothing, and protective equipment. Work focuses on addressing challenges in areas such as multifunctional fabrics for shelters, uniforms and portage equipment; lightweight materials for body armor; and medical technologies such as biotechnology and vaccine production. FY 2019 Plans: Develop manufacturing techniques for low cost freeform prism eyepieces and components for Infantry sighting systems; develop manufacturing process improvement techniques for optical coatings and optical components to reduce cost and improve performance. FY 2020 Plans: Will develop manufacturing scale up for advanced metal organic materials to enable better integrated warfighter protection systems; advance manufacturing processes low light level imagers for night time situational awareness for Soldiers. FY 2019 to FY 2020 Increase/Decrease Statement: Decreases in program results from planned transitions and/or completions of programmable initiators for scatterable munitions, freeform prism eyepieces, and power and energy for medium caliber liquid reserve batteries.		16.830	9.174	5.319
Title: Cross-cutting Description: This effort funds manufacturing technology advances with impact across processes or platforms of Army interest. Work focuses on addressing challenges in areas such as advanced additive manufacturing technologies for fabrication of weapons systems, platforms, and munitions; and novel manufacturing techniques for expedient and cost effective repair of worn or damaged platform components. FY 2019 Plans:		5.042	4.811	1.928

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B. Accomplishments/Planned Programs (\$ in Millions)				FY 2018	FY 2019	FY 2020
Demonstrate advanced additive manufacturing capabilities for the build, remanufacture, and life extension of critical weapon systems components to improve performance, allow fabrication of structures not possible thorough subtractive methods, and/or improve component affordability; demonstrate an integrated augmented reality solution for advanced machining. FY 2020 Plans: Will demonstrate advanced machining solutions for large caliber weapons. FY 2019 to FY 2020 Increase/Decrease Statement: The Manufacturing Technology selection process supports planned completions in FY19 and continued efforts in FY20 for Cross Cutting technologies.						
Title: Lethality Description: The effort funds manufacturing improvements to support areas such as Advanced Weapon Systems, Fire Control, Logistics, Emerging Technologies, and Advanced Energetics and Warheads. Work focuses on addressing challenges in areas such as enhanced missile seekers; fuses and initiators for munitions; and boring, honing, and rifling cannon and mortar barrels.				8.400	-	-
Title: Medical Description: This effort funds manufacturing technology advances needed for more affordable process methods in areas such as manufacturing of lighter weight multi-functional materials, biotechnology, vaccines, medical equipment power sources, and component ruggedization that directly address Soldier rehabilitation.				0.500	-	-
Title: FY 2019 SBIR / STTR Transfer Description: FY 2019 SBIR / STTR Transfer FY 2019 Plans: FY 2019 SBIR / STTR Transfer FY 2019 to FY 2020 Increase/Decrease Statement: FY 2019 SBIR / STTR Transfer				-	1.849	-
Accomplishments/Planned Programs Subtotals				58.610	53.896	59.848
C. Other Program Funding Summary (\$ in Millions) N/A						

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C. Other Program Funding Summary (\$ in Millions)		
Remarks Not applicable for this item.		
D. Acquisition Strategy Not applicable for this item.		
E. Performance Metrics N/A		

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army												Date: March 2019			
Appropriation/Budget Activity 2040 / 7						R-1 Program Element (Number/Name) PE 0708045A / End Item Industrial Preparedness Activities						Project (Number/Name) E25 / Mfg Science & Tech			

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	
TBD	Various	TBD : TBD	291.812	58.610		52.047		59.848		-		59.848	0.000	462.317	-	
FY 2019 SBIR / STTR Transfer	TBD	TBD : TBD	-	-		1.849		-		-		-	0.000	1.849	-	
Subtotal			291.812	58.610		53.896		59.848		-		59.848	0.000	464.166	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	291.812	58.610	53.896	59.848	-	59.848	0.000	464.166	N/A

Remarks

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Exhibit R-4, RDT&E Schedule Profile: PB 2020 Army																Date: March 2019																					
Appropriation/Budget Activity 2040 / 7										R-1 Program Element (Number/Name) PE 0708045A / End Item Industrial Preparedness Activities								Project (Number/Name) E25 / Mfg Science & Tech																			
Event Name										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
N/A																																					
										N/A																											

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Exhibit R-4A, RDT&E Schedule Details: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0708045A / <i>End Item Industrial Preparedness Activities</i>	Project (Number/Name) E25 / <i>Mfg Science & Tech</i>	

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
N/A	1	2016	4	2019

Note

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Army										Date: March 2019		
Appropriation/Budget Activity 2040 / 7					R-1 Program Element (Number/Name) PE 0708045A / End Item Industrial Preparedness Activities				Project (Number/Name) EA2 / MANTECH INITIATIVES (CA)			
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
EA2: MANTECH INITIATIVES (CA)	-	59.800	54.800	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	114.600
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This effort accelerates manufacturing technology for more affordable electronic warfare, communications and sensors systems components and subsystems to include radio frequency amplifiers, antennas, and focal plane arrays. This effort accelerates and supplements manufacturing technology for more affordable components and subsystems for tactical and combat vehicles and weapon systems. Work focuses benefit from working to develop and scale up the manufacturing process for nano-tungsten carbide powders and high-volume single-crystal tungsten rod manufacturing processes. This effort accelerates and supplements manufacturing technology for more advanced manufacturing and enterprise solutions. Work focuses on accelerating model based manufacturing to specific organic Army facilities and novel ways of applying additive manufacturing and monitoring material powder beds and process controls during additive manufacturing part build for weapon system components.

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

	FY 2018	FY 2019
Congressional Add: Additive Manufacturing Technology Insertion	10.000	10.000
FY 2018 Accomplishments: Additive Manufacturing Technology Insertion		
FY 2019 Plans: Additive Manufacturing Technology Insertion		
Congressional Add: Additive Manufacturing Supply Chain	10.000	-
FY 2018 Accomplishments: Additive Manufacturing Supply Chain		
Congressional Add: Inventory Management and Demand Planning Software	9.800	-
FY 2018 Accomplishments: Inventory Management and Demand Planning Software		
Congressional Add: Nanoscale Materials	15.000	20.000
FY 2018 Accomplishments: Nanoscale Materials		
FY 2019 Plans: Nanoscale Materials		
Congressional Add: Advanced Development of Asset Protection Technologies	10.000	-
FY 2018 Accomplishments: Advanced Development of Asset Protection Technologies		
Congressional Add: Lightweight Transparent Armor	5.000	10.000

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2018	FY 2019
FY 2018 Accomplishments: Lightweight Transparent Armor		
FY 2019 Plans: Lightweight Transparent Armor		
Congressional Add: Engineering Data Synchronization	-	9.800
FY 2019 Plans: Engineering Data Synchronization		
Congressional Add: Power Take-Off Hybridization	-	5.000
FY 2019 Plans: Power Take-Off Hybridization		
Congressional Adds Subtotals	59.800	54.800

C. Other Program Funding Summary (\$ in Millions)
N/A

Remarks

D. Acquisition Strategy
N/A

E. Performance Metrics
N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army												Date: March 2019			
Appropriation/Budget Activity 2040 / 7						R-1 Program Element (Number/Name) PE 0708045A / End Item Industrial Preparedness Activities				Project (Number/Name) EA2 / MANTECH INITIATIVES (CA)					

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
TBD	TBD	TBD : TBD	12.000	59.800		54.800		-		-		-	0.000	126.600	-
Subtotal			12.000	59.800		54.800		-		-		-	0.000	126.600	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	12.000	59.800		54.800		-		-		-	0.000	126.600	N/A

Remarks

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Exhibit R-4, RDT&E Schedule Profile: PB 2020 Army																Date: March 2019																			
Appropriation/Budget Activity 2040 / 7								R-1 Program Element (Number/Name) PE 0708045A / End Item Industrial Preparedness Activities								Project (Number/Name) EA2 / MANTECH INITIATIVES (CA)																			
								FY 2011				FY 2012				FY 2013				FY 2014				FY 2015				FY 2016				FY 2017			
								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
N/A																																			
								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
N/A																																			

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Exhibit R-4A, RDT&E Schedule Details: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0708045A / End Item Industrial Preparedness Activities	Project (Number/Name) EA2 / MANTECH INITIATIVES (CA)

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
N/A	1	2016	4	2016