Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy												Date: March 2019
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603680N *I (U)Manufacturing Technology Program*							
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	0.000	66.173	58.657	60.138	-	60.138	60.122	61.318	62.582	63.840	Continuing	Continuing
1050: *Manufacturing Tech*	0.000	56.516	58.657	60.138	-	60.138	60.122	61.318	62.582	63.840	Continuing	Continuing
9999: *Congressional Adds*	0.000	9.657	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.657

A. Mission Description and Budget Item Justification

The Manufacturing Technology (ManTech) Program is intended to improve the productivity and responsiveness of the U.S. defense industrial base by funding the development, optimization, and transition of enabling manufacturing technologies to key naval suppliers. In general, investments transition emerging Science and Technology (S&T) results to acquisition programs; improve industrial capabilities in production, maintenance, repair and industrial base responsiveness; and advance manufacturing technology to reduce cost, improve performance, and responsiveness. Currently, the ManTech Program is focused on affordability improvements for specific key acquisition platforms as defined in the Navy ManTech Investment Strategy. Key platforms currently targeted include: VIRGINIA Class Submarine (VCS)/ OHIO Replacement Program (ORP); DDG 51 Class Destroyer; CVN 78 Class Carrier; Joint Strike Fighter (JSF); and CH-53K Heavy Lift Helicopter. Office of Naval Research (ONR) ManTech helps these Navy programs achieve their respective affordability goals by transitioning developed manufacturing technology which, when implemented, results in needed cost reduction or cost avoidance.

Due to the number of efforts in this Program Element (PE), the programs described herein are representative of the work included in this PE.

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	57.797	58.657	60.500	-	60.500
Current President's Budget	66.173	58.657	60.138	-	60.138
Total Adjustments	8.376	0.000	-0.362	-	-0.362
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.625	0.000			
• Rate/Misc Adjustments	0.001	0.000	-0.362	-	-0.362
• Congressional Add Adjustments	10.000	-	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: 9999: *Congressional Adds*		

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy	Date: March 2019
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603680N *I (U)Manufacturing Technology Program*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Congressional Add: *Program Increase*	9.657	0.000
Congressional Add Subtotals for Project: 9999	9.657	0.000
Congressional Add Totals for all Projects	9.657	0.000

Change Summary Explanation

The increase from FY 2019 to FY 2020 is to perform additional technology development efforts to support the submarine industrial base ramp up and workload increase for VIRGINIA Payload Module and COLUMBIA Class Submarine production in addition to the continuing VIRGINIA Class Submarine 2 per year production.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy			Date: March 2019
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603680N / *(U)Manufacturing Technology Program*	Project (Number/Name) 1050 / *Manufacturing 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
1050: *Manufacturing Tech*	0.000	56.516	58.657	60.138	-	60.138	60.122	61.318	62.582	63.840	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Manufacturing Technology (ManTech) Program is intended to improve the productivity and responsiveness of the U.S. defense industrial base by funding the development, optimization, and transition of enabling manufacturing technologies to key naval suppliers. In general, investments transition emerging Science and Technology (S&T) results to acquisition programs; improve industrial capabilities in production, maintenance, repair and industrial base responsiveness; and advance manufacturing technology to reduce cost, improve performance, and responsiveness. Currently, the ManTech Program is focused on affordability improvements for specific key acquisition platforms as defined in the Navy ManTech Investment Strategy. Key platforms currently targeted include: VIRGINIA Class Submarine (VCS)/ COLUMBIA Class Submarine (CLB); DDG 51 Class Destroyer; CVN 78 Class Carrier; Joint Strike Fighter (JSF); and CH-53K Heavy Lift Helicopter. Office of Naval Research (ONR) ManTech helps these Navy programs achieve their respective affordability goals by transitioning developed manufacturing technology which, when implemented, results in needed cost reduction or cost avoidance.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: Composites Processing and Fabrication	8.000	8.000	8.000	0.000	8.000
Description: The primary technical goal of the Composites Processing and Fabrication activity is improving weapon systems affordability, enhancing weapon system effectiveness and improving reliability/war-fighter readiness through the increased utilization of composite materials and structures. This is being achieved through the development, maturation, and transition of affordable and robust manufacturing, assembly, and repair processes that fully exploit the benefits of composite materials. Concentration is on affordability for the following platforms: VIRGINIA Class Submarine (VCS)/COLUMBIA Class Submarine (CLB), DDG 51 Class Destroyer, CVN 78 Class Carrier, Joint Strike Fighter (JSF), and CH-53K Heavy Lift Helicopter. Composites processing and fabrication technology areas include but are not limited to fiber-reinforced polymeric (organic) resin composites; ceramic-matrix, metal-matrix, and carbon-carbon composites; composite internal stiffening core materials such as foam, ceramic, balsa wood, polymeric or metallic honeycomb, or other materials; composite external stiffening concepts such as hat and blade stiffeners and methodologies to manufacture them; materials for radomes and other electrical applications; composite manufacturing and similar processes and related equipment technology; and adhesives, adhesive bonding, and related technologies (i.e., surface preparation techniques), as well as mechanical fastening, and other methodologies for joining composites to other composites or metals, and similar assembly technologies.					
FY 2019 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603680N / *(U)Manufacturing Technology Program*	**Project (Number/Name)** 1050 / *Manufacturing Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Continue Composite Materials and Process Improvement Thrust and fabrication efforts for VCS/ORP, CVN 78, DDG51, JSF, CH-53K. Continue Composite Materials and Process Improvement Thrust for other high interest NAVSEA, NAVAIR, and Marine Corps platforms and components. Includes support of affordability initiatives for the six acquisition platforms in the Navy ManTech investment strategy. ***FY 2020 Base Plans:*** Technical activities include (1) the design of a flexible robotic composites manufacturing cell for CH-53K fabrication for improved process repeatability, increased part quality, and reduced risk as production rates increase; (2) development of an improved and more affordable false deck panel concept for use in equipment spaces on DDG 51 Class destroyers constructed at both Bath Iron Works and HII-Ingalls and CVN 78 Class carriers constructed at HII-Newport News Shipbuilding; (3) development and proof of manufacturing technology for composite exhaust uptakes for the DDG 51 Class destroyers (for both Bath Iron Works and HII-Ingalls ships) for cost neutral or better acquisition cost, 60% reduction in maintenance costs, and 30% weight reduction; and (4) development of the equipment, processes, and methods needed to implement a system capable of fully automated optical inspection of MOD's (minor optical defects) on F-35 production transparencies and eliminate subjective, variable visual analysis currently done by individual operators. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** There is no change in the requested budget from FY 2019 to FY 2020.					
Title: Electronics Processing and Fabrication	12.000	12.000	12.000	0.000	12.000
Description: The primary technical goal of the Electronics Processing and Fabrication activity is improving electronic weapon systems affordability by developing and transitioning affordable, robust manufacturing processes and capabilities for electronics critical to defense applications over their full life-cycle. Efforts create new and improved electronics/electro-optics manufacturing processes for transition to the production floor. Emphasis is on affordability for the following platforms: VIRGINIA Class Submarine (VCS)/COLUMBIA Class Submarine (CLB), DDG 51 Class Destroyer, CVN 78 Class Carrier, Joint Strike Fighter (JSF), and CH-53K Heavy Lift Helicopter. Electronics processing and fabrication technology areas include but are not limited to Electronics manufacturing technology (materials, devices, circuits, modules, subsystems); Semiconductor devices/vacuum electronics/passive components; compound semiconductors/wide bandgap semiconductors; low-cost, high-throughput manufacturing and assembly techniques; nanoelectronics; electronics packaging technologies (including tamper proof and non-hermetic approaches); optics manufacturing technology (materials					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603680N / *(U)Manufacturing Technology Program*	**Project (Number/Name)** 1050 / *Manufacturing Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
devices, circuits, modules, subsystems); optical interconnects; fiber optics and photonics; technologies for electronics and electro-optics testing and evaluation; optical imaging for manufacturing operations; and directed energy weapons. ***FY 2019 Plans:*** Continue Electronics/Electro-Optics Thrust and fabrication efforts for JSF, CH-53K, VCS/ORP, DDG51, CVN 78. Continue Electronics/Electro-Optics Thrust for other high interest NAVSEA, NAVAIR, and Marine Corps platforms and components. Includes support of affordability initiatives for the six acquisition platforms in the Navy ManTech investment strategy. ***FY 2020 Base Plans:*** Technical activities include (1) development of the technology to repurpose digital electronics currently used in the F-35 Joint Strike Fighter Active Electronically Scanned Array (AESA) radar system to accommodate Joint Strike Fighter (JSF) global positioning system (GPS) system functions with significantly improved anti-jamming capabilities; (2) development of a reduced cost manufacturing process for two of the most costly of seven elements in the optical train of the F-35 Helmet Mounted Display (HMD) Relay Optical Assembly (ROA) for the F-35 Joint Strike Fighter; (3) development of drone technology for the inspection of CVN 78 Class carrier tanks to replace currently used manual inspection techniques which are labor intensive, inefficient, and risky from a safety perspective; and (4) prototype a modern radar system architecture with open and common Radio Frequency (RF) components that demonstrate the capability to implement requirements for two significantly different radar systems to support the baseline for the Next Generation Surface Search Radar (NGSSR) for both CVN 79 Class carrier and DDG 51 Class destroyer. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** There is no change in the requested budget from FY 2019 to FY 2020.					
Title: Metals Processing and Fabrication ***Description:*** The primary technical goal of the Metals Processing and Fabrication activity is to develop affordable, robust manufacturing and repair processes/capabilities for metals and special materials critical to Navy weapon system applications. Emphasis is on affordability for the following platforms: VIRGINIA Class Submarine (VCS)/COLUMBIA Class Submarine (CLB), DDG 51 Class Destroyer, CVN 78 Class Carrier, Joint Strike Fighter (JSF), and CH-53K Heavy Lift Helicopter. This activity also includes the development,	12.000	12.000	12.000	0.000	12.000

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603680N / *(U)Manufacturing Technology Program*	**Project (Number/Name)** 1050 / *Manufacturing Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
optimization, and transition of repair technology for the repair, overhaul, and sustainment of key navy systems. Metals processing and fabrication technology areas include but are not limited to: processing methods; metals additive manufacturing; metallic materials-based systems; casting; joining techniques; machining; surface and heat treatments; coating/cladding; assembly; metal/non-metals interfaces issues; and inspection and compliance verification. ***FY 2019 Plans:*** Continue Metals Processing Thrust and fabrication efforts for DDG51, CVN 78, CH-53K, VCS/OR and JSF. Continue Metals Processing Thrust for other high interest NAVSEA, NAVAIR, and Marine Corps platforms and components. Continue Repair Technology (RepTech) Thrust to develop, optimize, and transition repair technology for key naval platforms at depots and logistics centers. Includes support of affordability initiatives for the six acquisition platforms in the Navy ManTech investment strategy. ***FY 2020 Base Plans:*** Technical activities include (1) developing a manufacturing cell concept for the automated welding of submarine appendages (for both VIRGINIA and COLUMBIA construction) to replace the currently used manual approaches that are both labor-and time-intensive; (2) improvement of hull frame fabrication for the VIRGINIA and COLUMBIA Class submarines by developing and implementing a robotic solution that increases weld quality, decreases out-of-circularity fit up issues, and reduces the amount of welding and inspection man hours; and (3) improvement of foundry castings at HII-Newport News for CVN 78 Class carriers and VIRGINIA Class submarines by validating the use of shrouds to minimize air exposure of the molten metal and developing devices, procedures, and processes needed to implement the process with NNS legacy equipment and processes. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** There is no change in the requested budget from FY 2019 to FY 2020.					
Title: Manufacturing Enterprise/Other	24.516	26.657	28.138	0.000	28.138
Description: The Manufacturing Enterprise/Other activity includes: (1) efforts targeted towards improving, in general, the manufacturing enterprise for the production of key naval platforms (both shipbuilding and aircraft); (2) energetic efforts; (3) naval research enterprise and laboratory support for key projects; and (4)					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603680N / *(U)Manufacturing Technology Program*	**Project (Number/Name)** 1050 / *Manufacturing Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
technical program support. Manufacturing Enterprise addresses the development, optimization, and transition of manufacturing enterprise technology to key naval platform suppliers. Emphasis is on affordability for the following shipbuilding platforms: VIRGINIA Class Submarine (VCS)/COLUMBIA Class Submarine (CLB), DDG 51 Class Destroyer, CVN 78 Class Carrier, Joint Strike Fighter (JSF), and CH-53K Heavy Lift Helicopter. Manufacturing enterprise technology areas include, but are not limited to design for easier production/design for manufacturability; development of build/assembly strategies; modeling and simulation technologies; model-based tools and approaches to optimize ease of production; intelligent manufacturing planning and factory execution; elimination of inefficiencies in design optimization, material usage, labor utilization, work flow, etc.; supply chain procedures and improvements (such as network centric manufacturing capabilities to facilitate resilient and adaptable supply chains); development of more efficient structural fabrication product lines; streamlining of outfitting operations; prediction and reduction of welding distortion; advanced automation and robotics for manufacturing; advanced data analytics, artificial intelligence and machine learning for production environments; and inspection technologies such as digital radiography and ultrasonic technologies. Energetics efforts concentrate on developing energetics solutions to ensure the availability of safe, affordable, and quality energetics products largely in support of Program Executive Office (PEO) Integrated Warfare Systems (IWS).					
FY 2019 Plans: Continue Manufacturing Enterprise Thrust and fabrication efforts for DDG, CVN 78, JSF and CH-53K. Continue Energetics Thrust for PEO IWS and Other Acquisition Programs. Included energetics efforts to support PEO IWS and other acquisition programs. Continue efforts to provide naval research enterprise and laboratory support for key projects. Continue efforts to provide technical engineering support for the ManTech Program. Includes support of affordability initiatives for the six acquisition platforms in the Navy ManTech investment strategy.					
FY 2020 Base Plans: Technical activities include (1) applying augmented reality (AR) and virtual reality (VR) by exploiting product model data to improve shipbuilding affordability for VIRGINIA Class and COLUMBIA Class (VCS and CLB) submarines, CVN 78 Class carrier, and DDG 51 Class destroyer; (2) creating a digital build sequence from the legacy VCS model to include the operations, material, joints, and views a worker needs to accomplish a particular unit of work to streamline both development time and rework required; and (3) develop Rapid Automated Technology Evaluation (RATE) capabilities for high rate automated F-35 aircraft assembly line automation processes to identify and predict any corrective actions necessary to not impact production schedules and product quality.					
FY 2020 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603680N / *(U)Manufacturing Technology Program*	**Project (Number/Name)** 1050 / *Manufacturing Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The Manufacturing Enterprise/Other activity is increasing from FY19 to FY20 in order to perform additional technology development efforts to support the submarine industrial base ramp up and workload increase for VIRGINIA Payload Module and COLUMBIA Class Submarine production in addition to the continuing VIRGINIA Class Submarine 2 per year production.					
Accomplishments/Planned Programs Subtotals	56.516	58.657	60.138	0.000	60.138

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Efforts are focused on affordability improvements (both acquisition and life-cycle) for specific key acquisition platforms as defined in the Navy ManTech Investment Strategy. Currently, the majority of Navy ManTech efforts are focused on affordability improvements for: VIRGINIA Class Submarine (VCS)/COLUMBIA Class Submarine (CLB), DDG 51 Class Destroyer, CVN 78 Class Carrier, Joint Strike Fighter (JSF), and CH-53K Heavy Lift Helicopter.

E. Performance Metrics

The ManTech Program's overall goal is to transition production technology to reduce the cost of Navy weapon systems. Metrics are currently collected on the cost savings per hull or per aircraft for each of the primary affordability platforms: VIRGINIA Class Submarine/COLUMBIA Class Submarine (VCS/CLB), DDG 51 Class Destroyer, CVN 78 Class Carrier, Joint Strike Fighter (JSF), and CH-53K Heavy Lift Helicopter.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy											Date: March 2019	
Appropriation/Budget Activity 1319 / 3					R-1 Program Element (Number/Name) PE 0603680N / *(U)Manufacturing Technology Program*				Project (Number/Name) 9999 / *Congressional Adds*			
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**
9999: *Congressional Adds*	0.000	9.657	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.657

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Program Increase	9.657	0.000
FY 2018 Accomplishments: This effort addressed shipbuilding affordability for the ships in the Navy ManTech investment strategy VIRGINIA Class Submarine (VCS)/COLUMBIA Class (CLB), DDG 51 Class Destroyer, and CVN 78 Class Carrier. The work focused on automation and robotics technology development, application and connection to product model data.		
FY 2019 Plans: N/A		
Congressional Adds Subtotals	9.657	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

Congressional Interest Items not included in other Projects.