Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Office of the Secretary Of Defense	Date: February 2018
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602751D8Z / *Software Engineering Institute (SEI) Applied Research*

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	8.105	8.955	9.300	-	9.300	9.608	9.692	9.791	9.844	Continuing	Continuing
278: *Software Engineering Institute (SEI) Applied Research*	-	8.105	8.955	8.300	-	8.300	8.608	8.692	8.791	8.844	Continuing	Continuing
817: *Cyber Security, Applied Research*	-	0.000	0.000	1.000	-	1.000	1.000	1.000	1.000	1.000	Continuing	Continuing

Note

Service Requirements Review Board (SRRB) efficiencies are included.

A. Mission Description and Budget Item Justification

Software is a key to meeting the Department of Defense's (DoD) increasing demand for high-quality, affordable, and timely national defense systems. With growing global parity in software engineering, the DoD must maintain leadership to avoid strategic surprise. To assist the DoD in retaining a long-term differential advantage over potential adversaries, the Software Engineering Institute (SEI) Applied Research program element (PE) develops and evaluates the feasibility and practicality of software and computer science concepts, with the potential to improve future DoD systems. The research conducted by this PE directly benefits the technical domains such as Command, Control, Communications, Computers, and Intelligence (C4I), Autonomy, Cyber, and Engineered Resilient Systems.

B. Program Change Summary ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	8.420	8.955	9.365	-	9.365
Current President's Budget	8.105	8.955	9.300	-	9.300
Total Adjustments	-0.315	0.000	-0.065	-	-0.065
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.305	-			
• FFRDC Transfer	-0.009	-	-	-	-
• Other Program Adjustments	-0.001	-	-0.003	-	-0.003
• Economic Assumption	-	-	-0.062	-	-0.062

Change Summary Explanation

FY 2019 adjustments are reflective of higher priority DoD requirements.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Office of the Secretary Of Defense			Date: February 2018
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602751D8Z / *Software Engineering Institute (SEI) Applied Research*	Project (Number/Name) 278 / *Software Engineering Institute (SEI) Applied Research*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
278: *Software Engineering Institute (SEI) Applied Research*	-	8.105	8.955	8.300	-	8.300	8.608	8.692	8.791	8.844	Continuing	Continuing

A. Mission Description and Budget Item Justification

Work conducted under this PE will enable resilient mission assurance in heterogeneous and contested environments through the verification and validation of system performance and architecture. The program will also assist the DoD in retaining a long-term advantage in the areas of software-intensive systems and cybersecurity by enhancing assurance, exploiting automation, and understanding human-computer interaction.

The SEI Applied Research PE has two main research thrusts with known military applications: 1) Software Engineering, Systems Verification and Validation, and Mission Assurance (formerly Mission Assurance) and 2) Information Assurance.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: SEI Applied Research in the Area of Software Engineering, Systems Verification and Validation, and Mission Assurance (formerly Mission Assurance)	6.686	7.152	6.023
Description: This thrust seeks to develop verification techniques for requirements identification, systems of systems architectures, and virtual integration of components. Additionally, research in this area will enable requirements verification for software assurance, analysis and control of unverified code, and automated repair of damaged code. Software production and code analysis methods developed through this program will also improve the accuracy of behavior prediction of complex software system in untested environments. Increasingly numerous lines of code will require a commensurate increase in sophistication of verification and validation mechanisms.			
FY 2018 Plans: In FY 2018 there will be two main lines of effort: create verification and validation research solutions focused on time-sensitivity and reliability for safety-critical systems; and create containment technology that will enable software systems to continue to function under duress.			
FY 2019 Plans: In FY 2019, plans will include developing formal methods for explaining decision patterns in planning and learning systems, thus maximizing human-machine teaming effectiveness, developing and building benchmarks and datasets, using emerging machine learning computing technologies for evaluating and enhancing decision making systems, and developing techniques to assess risks and greatly increase the pervasiveness and adaptability of programmability in devices and Information Technology systems.			
FY 2018 to FY 2019 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Office of the Secretary Of Defense		Date: February 2018
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602751D8Z / *Software Engineering Institute (SEI) Applied Research*	**Project (Number/Name)** 278 / *Software Engineering Institute (SEI) Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
The decrease in budget from FY 2018 to FY 2019 reflects the release of resources as prototyping efforts in containment technologies conclude.			
Title: SEI Applied Research in the areas of Information Assurance (IA) ***Description:*** Information assurance ensures the integrity of information and data produced by software. Software developed from an unknown supply chain may include intentionally or unintentionally introduced vulnerabilities. This thrust seeks to develop scalable automated methods to locate, understand, and mitigate the effects of these vulnerabilities. Automated solutions developed through this thrust will be used to discover vulnerabilities in system software (binary only) and to generate proofs of correctness or fault. Additionally, they will be used to model and simulate operational environments to support software and cyber tactics, techniques, and procedures testing. ***FY 2018 Plans:*** In FY 2018, this project will develop technologies to increase the resiliency and assurance of software intensive systems. This includes improvement in data analytics development and deployment, including scalability, data bias control and mitigation. ***FY 2019 Plans:*** In FY 2019, this project plans to develop advanced analytics and machine learning technologies to enable self-adaptive cyber defenses that can evade and confuse adversaries. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The increase in budget from FY 2018 to FY 2019 reflects additional resources required for technology maturation efforts.	1.419	1.803	2.277
Accomplishments/Planned Programs Subtotals	8.105	8.955	8.300

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
• BA 3, PE# 0603781D8Z: *Software Engineering Institute (SEI)*	13.726	15.047	15.151	-	15.151	15.267	15.398	15.570	15.874	Continuing	Continuing

Remarks

The SEI Applied Research PE represents a pivot toward more fundamental research that enables the DoD to address longer-term challenges in software technology and engineering. The SEI Applied Research PE bolsters the organic research at the SEI Federally Funded Research and Development Center (FFRDC), enables stronger collaborations between the SEI FFRDC and academia, attracts top researchers to the SEI, and gives the DoD access to top experts in information science, which generally enhances the DoD's ability to benefit from the military applications of research in software and computer science.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Office of the Secretary Of Defense		Date: February 2018
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602751D8Z / *Software Engineering Institute (SEI) Applied Research*	**Project (Number/Name)** 278 / *Software Engineering Institute (SEI) Applied Research*

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics for this project include the transition of solutions, methods, and practices for use in DoD technology development programs and programs of record; the transition of solutions, methods, and practices to the Defense Industrial Base to support DoD technology development programs and programs of record, the number of citations in peer reviewed journals and reports, and the number of external research collaborations and interactions with the broader software and computer science community.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Office of the Secretary Of Defense			Date: February 2018
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602751D8Z / *Software Engineering Institute (SEI) Applied Research*	Project (Number/Name) 817 / *Cyber Security, Applied Research*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
817: *Cyber Security, Applied Research*	-	0.000	0.000	1.000	-	1.000	1.000	1.000	1.000	1.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Work conducted under this project will enable resilient mission assurance in heterogeneous and contested environments through the verification and validation of system performance and architecture. The program will also assist the DoD in retaining a long-term advantage in the area of cybersecurity by enhancing assurance, exploiting automation, and understanding human-computer interaction.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Cyber Security	-	-	1.000
Description: Warfighting in the cyber domain often operates at sub-second timescales and across multiple domains of authority. Methods used to accomplish many tasks (e.g., malware analysis, coordinating multiple agents) demand large amounts of time, attention, and special skills and are not scalable. This thrust seeks to develop and increase the use of automation to simplify the completion of these tasks. Example activities include automation of moving target defenses, code artifact reverse engineering, analysis of network flows at enterprise scale, and development and assessment of workforce skills. ***FY 2019 Plans:*** This program will create tools and methods to automatically identify, mitigate, and repair unique vulnerabilities (including those from malware or deliberate nefarious interference) in software-enabled DoD systems (including emerging systems reliant on machine learning). ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no notable change in the Cyber investment between FY 2018 and FY 2019. Note the Cyber effort was funded in Project P781 in FY 2018.			
Accomplishments/Planned Programs Subtotals	-	-	1.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Office of the Secretary Of Defense		Date: February 2018
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602751D8Z / *Software Engineering Institute (SEI) Applied Research*	**Project (Number/Name)** 817 / *Cyber Security, Applied Research*

E. Performance Metrics

Metrics for this program include transition of tools, methods, and practices for use in DoD technology development programs and programs of record; transition of tools, methods, and practices to the Defense Industrial Base to support DoD technology development programs and programs of record; the number of citations in peer reviewed journals and reports; and the number of external research collaborations and interactions with the broader software and computer science community.