Exhibit R-2a, RDT&E Project Justification					Date: February 2003		

Appropriation/Budget Activity RDT&E, DW/ BA 3				Project Name and Number **781**/Software Engineering Institute PE 0603781D8Z			
Cost ($ in millions)	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Total PE	21.876	22.189	22.652	22.627	23.330	23.325	23.535	24.024
Software Engineering Institute **P781**	19.470	19.748	20.107	20.049	20.706	20.667	20.852	21.286

A. Mission Description and Budget Item Justification: P781

(U) Software is key to meeting DoD's increasing demand for high-quality, affordable, and timely national defense systems. There is a critical need to rapidly transition state-of-the-art technology and best practices to improve the acquisition, engineering, fielding, and evolution of software-intensive DoD systems. This project funds the technology transition activities of the Software Engineering Institute (SEI) at Carnegie Mellon University. The SEI is an R&D Laboratory Federally Funded Research and Development Center (FFRDC) sponsored by the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics. It was established in 1984 as an integral part of the DoD's software initiative to identify, evaluate, and transition high-leverage software engineering technologies and practices. The SEI fosters disciplined software engineering practices by DoD acquisition and life-cycle support programs and by the industrial base where the bulk of defense software is produced. The Institute works across government, industry, and academia to: (1) improve current software engineering activities from engineering, management, and acquisition perspectives; (2) facilitate rapid, value-added transition of software engineering technology into practice; and (3) evaluate and calibrate emerging software engineering technologies to determine their potential for improving the evolution of software-intensive DoD systems.

(U) The SEI enables the exploitation of emerging software technology by bringing engineering discipline to software acquisition, development, and evolution. The SEI focuses on software technology areas judged to be of the highest payoff in meeting defense needs. Focus areas are: Acquisition Practices for DoD Software-Intensive Systems (including pilot demonstrations of new technologies, dissemination of lessons learned, and provision of selected important services to the DoD acquisition community); Software Engineering Technical Practices (including Survivable Systems practices, Architecture-centered Software Engineering, and Commercial Off-The-Shelf (COTS)-Based Software Engineering); and Software Engineering Management Practices (including personal and team software development processes and Capability Maturity Model Integration (CMMI)).

B. Accomplishments/Planned Program

Acquisition Practices for DoD Software	FY 2002	FY 2003	FY 2004	FY 2005
Accomplishment/ Effort/Subtotal Cost	0.750	2.200	2.200	2.202

(U) Acquisition Practices for DoD Software-Intensive Systems

FY 2002 Accomplishments:
- Established new Acquisition Support Program to initiate pilot demonstrations of adopting new technology within the DoD program-office environment, coordinate and broadly disseminate lessons learned from these pilots, and provide selected and strategically important software engineering services to the DoD acquisition community.
- Conducted more than 40 training courses in information security for technical staff, managers, and executives from the DoD, federal agencies, and industry.
- Adapted the Survivable Systems Analysis method to be used during the acquisition process within the DoD.
- Created and published second version of *Software Product Line Acquisition—A Companion to A Framework for Software Product Line Practice*.
- Trained more than 1000 people in COTS-Based Systems for Executives and COTS-Based Systems for Program Managers courses
Provided substantial measurement guidance and direction for the DoD, including support for the Joint Mission Planning System (JMPS), the Software Engineering Center Communications Electronics Command, and the United Space Alliance Flight Software Program.

FY 2003 Plans:
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FY 2004-2005 Plans:
The DoD has provided to the SEI an approved set of challenge problems that form the foundation for SEI project planning. The SEI's program of work consists of nine initiatives and a new program called the Acquisition Support Program. In addition, SEI-managed independent research and development (IR&D) activities will now be focused over the next years on the DoD-approved challenge problems. These challenge problems are focused on the following areas: security and survivability; interoperability; software technology research and development; acquisition management; software metrics for acquisition management; sustainment; and commercial off-the-shelf (COTS) products. Specific activities will also include:

- Codifying product line organizational management and DoD acquisition practices
- Producing DoD product line practice case studies
- Developing and refining architecture guidelines for DoD acquisition organizations
- Analyzing results of independent technical assessment to characterize the state of practice in acquisition programs and their industry partners

Software Engineering Technical Practices	FY 2002	FY 2003	FY 2004	FY 2005
Accomplishment/ Effort/Subtotal Cost	10.666	11.625	11.983	11.916

U) Software Engineering Technical Practices

FY 2002 Accomplishments:
- Successfully developed, piloted, and positioned the Operationally Critical Threat, Asset, and Vulnerability Evaluation^{SM} (OCTAVE^{SM}) self-directed security evaluation. The method is being used in the DoD medical community, supporting the implementation of the Medical Information Security Readiness Team (MISRT) strategy.
- Co-chaired, with the Naval Research Lab, the September 2002 International Workshop on Requirements for High Assurance Systems.
- At the request of the DoD, the National Security Council, and the Department of State, served as a member of the U.S. Delegation to India on Critical Infrastructure Protection, April 2002
- Supported Defense Information Systems Agency (DISA) DoD CERT in the development of certification and accreditation standards for computer network defense service providers.
- Made key contributions to Homeland Security Office (Cyber Security). Provided insight into the current state of vulnerabilities, intruder tools, and use of patches; discussed the potential for high-impact attacks.
- Published SEI book, *Software Architecture in Practice* in January 1998; now in its twelfth printing, has sold over 15,000 copies, and has been cited over 156 times in published research papers.
- Defined the Acquisition/Assembly Process for COTS-Based Systems (A/APCS), a process framework incorporating development, acquisition, management, and business factors for DoD COTS-based programs.
- Defined COTS-based Architecture and Design Assessment technique (CADA) and developed CADA assessment tool that focuses on DoD COTS-based systems design and engineering competencies.
- Developed tutorial materials for DoD COTS-based system design and engineering techniques

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FY 2004-2005 Plans:
- Analyzing data collected from software architecture evaluations of DoD systems to document costs and benefits as well as to validate and refine the evaluation method
- Providing technical leadership through a new initiative, Predictable Assembly from Certifiable Components, to help solve DoD-approved challenge problems such as the need to "Develop improved, enhanced or new processes, principles, methods, and tools for determining expected properties of software systems before they are built and for confirming their as-built properties"; and the needs to explicitly address the system properties of security, survivability, availability, interoperability, as well as to find a way to more effectively obtain benefits from commercial off-the-shelf (COTS) components.
- Developing empirical techniques and formal methods for component analysis, composition, measurement, and assembly-level prediction; developing techniques for trusted, certified components and predictions
- Continuing the successful FY 2002 efforts cited above

Software Engineering Management Practices	FY 2002	FY 2003	FY 2004	FY 2005
Accomplishment/ Effort/Subtotal Cost	7.900	5.923	5.924	5.931

(U) Software Engineering Management Practices

FY 2002 Accomplisments:
- Publicly released Capability Maturity Model Integration (CMMI) baseline models and appraisal products.
- Accelerated pace of CMMI adoption, with 74 organizations licensed by the SEI to provide CMMI training and 88 organizations licensed to provide appraisal services (as of June 2002); trained more than 3000 people in the Introduction to CMMI
- Updated Lead Appraiser program for CMMI (e.g., by providing updated materials and guidance material for application in special uses, such as DoD outsourcing)

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FY 2004-2005 Plans:
- Updating Team Software Process (TSP) to reflect experience with its use; extending TSP to support multiple geographically distributed teams and functional or department teams; integrating TSP with CMMI-based organizational improvement strategies.
- Integrating value-added measurement and analysis techniques into systems and software process improvement efforts
- Continue to support CMMI transition efforts throughout DoD and the acquisition support community

Exhibit R-2a, RDT&E Project Justification						Date: February 2003	
Appropriation/Budget Activity RDT&E, DW/ BA 3				Project Name and Number 782/Software Engineering Institute PE 0603781D8Z			
Cost ($ in millions)	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Total PE	21.876	22.189	22.652	22.627	23.330	23.325	23.535	24.024
Software Intensive Systems **P782**	2.406	2.441	2.545	2.578	2.624	2.658	2.683	2.738

B.   Mission Description and Budget Item Justification: P782
(U) P782 Software-Intensive Systems (SIS). The Software Intensive Systems (SIS) Directorate's mission is to improve DoD SIS acquisition and sustainment. The SIS Directorate is the focal point for DoD initiatives that reduce software risk. SIS is founded in the recommendations of the FY 2000 DSB Task Force on Software, and guided by the SIS Steering Group (SISSG) chaired by OUSD(AT&L) with senior software representatives from ODUSD(S&T), ASD(C3I), and the Services. SIS activities are organized into elements that ensure coverage of the breadth of responsibilities necessary to achieve the mission of improving SIS acquisition performance, and to act as the DoD software community focal point. These elements focus on Policy & Guidance, Education, Best Practices, Software Engineering Technology, and Collaboration. SIS conducts its efforts by understanding DoD needs, issues, and solutions; and acting on/transitioning improvements to DoD Enterprise-, Program- and practitioner-levels. SIS maintains and coordinates the Defense Software Collaborators, an organization of more than 30 defense and other government organizations that are involved with the development, maintenance, and/or acquisition of software-intensive systems.

B. Accomplishments/Planned Program
(U)
FY 2002 Accomplishments:
Policy and Guidance:
- Developed and disseminated interactive web-based guidance on the use of Capability Maturity Model Integrated (CMMI), for source selection and for organizational improvement.
- Developed a CMMI discipline extension for Safety and Security.
- Conducted research into process improvement appraisal methodologies, to provide alternatives for programs that reduce cost of appraising process maturity in source selection.

Education:
- Instituted a long term software education strategy aimed at practitioners, acquisition managers, enterprise managers and academia.
- Initiated a strategic partnership concept for a graduate-level program for software acquisition with George Washington and Catholic Universities.

Best Practices:
- Independent Expert Program Reviews (IEPRs): Performed assessments via the Tri-service Assessment Initiative (TAI) for 10 program managers, providing identification of risk and mitigation strategies. TAI developed a systemic analysis methodology and tool, analyzed IEPR data and developed partnership strategies to encourage use of a common assessment method for all DoD program managers.
- Measurement: Chartered the DoD Measurement Initiative to increase the number of programs using measures to support decision-making. Updated the Practical Systems/Software Measurement Program, conducted research into measures for spiral development and interoperability.
- Published research on use of best practices, implementation issues and expected benefits.

Software Engineering Technology:
- Provided direct software technology assistance to the Army's Future Combat Systems (FCS) program. Established an empirical software engineering environment for FCS.
Collaboration:
- Participated in the update of the Guideline for Software Acquisition Management (GSAM), participated as the DoD representative on various IEEE and NATO software and

systems engineering standards activities.
  - Established a Bi-lateral Software Acquisition Working Group with the United Kingdom. Developed list of common interests and initiated information sharing. Investigated expanding it to a Tri-lateral group with Australia.

FY 2003 Plans:
Policy and Guidance:
- Implement Defense Authorization Section 804 language on Process Improvement, develop guidance for implementation by the Services and Agencies, monitor their implementation, and establish a clearinghouse for best practices.
- Develop software acquisition management guidance to account for the recent update to the DoD 5000 policy series.
- Transition the use of the Safety and Security Capability Maturity Model extension.
Best Practices:
- Independent Expert Program Reviews (IEPRs): Continue the Tri-service Assessment Initiative assessment and systemic analysis activities. Publish and disseminate report on systemic findings; begin to formulate corrective action strategies based upon the systemic root causes identified. Improve the systemic analysis tool and continue partnering with other DoD IEPR organizations to promote use of a single methodology.
- Measurement: Support Practical Systems/Software Measurement program research into evolutionary acquisition measures and measures to track process improvement programs (in response to Section 804 language). Continue efforts of the DoD Measurement Initiative.
Software Engineering Technology:
- Participate in the DUSD(S&T) study into software engineering technology gaps and investment needs.
- Continue the software expertise and experience factory support to the Army's Future Combat Systems program, collect lessons learned from this experience database and analyze data for application to other DoD programs and acquisition processes.
- Identify additional pilot opportunities in the Services to evaluate software engineering technologies.
Collaboration:
- Continue the Bi-lateral Software Acquisition Working Group with the UK, and the parallel relationship with Australia. Identify areas for joint study and develop/initiate cooperative study plans.

FY 2004 – FY2005 Plans:
Policy and Guidance:
- Continue Section 804 implementation activities, track establishment of Process improvement programs in the Services and DoD Agencies

Best Practices:
- IEPRs: Implement regular adoption of IEPRs by program managers, implement use of the systemic analysis as an enterprise level resource for tracking software acquisition performance issues and improvements. Begin to predict software acquisition performance shortfalls and use this information to impact acquisition decisions.
- Measurement: Publish Practical Systems/Software Measurement research into evolutionary acquisition and process improvement measures. Use the DoD Measurement Initiative to provide tools, training and guidance for implementing measurement into program and enterprise decisionmaking.

Technology:
- Further the use of the Center for Empirically Based Software Engineering experience factory pilots in DoD acquisition programs; use data from experiences to influence DoD software acquisition policy, guidance and education.
- Continue the technology watch activities, software engineering technology needs studies
Collaboration:
- Continue collaborative efforts across DoD and the international community