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**DoD Systems and Software  
Engineering  
A Strategy for Enhanced  
Systems Engineering**

***Kristen Baldwin***

*Acting Director, Systems and Software Engineering*

*Office of the Deputy Under Secretary of Defense*

*(Acquisition and Technology)*



# **Dod Software Engineering**

**Loren J. Dugan**



# Dod Software Engineering

*Innovations in Software Engineering for Defense Systems* Oversight Committee for the Workshop on Statistical Methods in Software Engineering for Defense Systems, Committee on Applied and Theoretical Statistics, Committee on National Statistics, Division on Engineering and Physical Sciences, Division of Behavioral and Social Sciences and Education, National Research Council, 2003-10-06 Recent rough estimates are that the U S Department of Defense DoD spends at least 38 billion a year on the research development testing and evaluation of new defense systems approximately 40 percent of that cost at least 16 billion is spent on software development and testing There is widespread understanding within DoD that the effectiveness of software intensive defense systems is often hampered by low quality software as well as increased costs and late delivery of software components Given the costs involved even relatively incremental improvements to the software development process for defense systems could represent a large savings in funds And given the importance of producing defense software that will carry out its intended function relatively small improvements to the quality of defense software systems would be extremely important to identify DoD software engineers and test and evaluation officials may not be fully aware of a range of available techniques because of both the recent development of these techniques and their origination from an orientation somewhat removed from software engineering i e from a statistical perspective The panel s charge therefore was to convene a workshop to identify statistical software engineering techniques that could have applicability to DoD systems in development

**Innovations in Software Engineering for Defense Systems** National Research Council, Division on Engineering and Physical Sciences, Committee on Applied and Theoretical Statistics, Division of Behavioral and Social Sciences and Education, Committee on National Statistics, Oversight Committee for the Workshop on Statistical Methods in Software Engineering for Defense Systems, 2003-10-22 Recent rough estimates are that the U S Department of Defense DoD spends at least 38 billion a year on the research development testing and evaluation of new defense systems approximately 40 percent of that cost at least 16 billion is spent on software development and testing There is widespread understanding within DoD that the effectiveness of software intensive defense systems is often hampered by low quality software as well as increased costs and late delivery of software components Given the costs involved even relatively incremental improvements to the software development process for defense systems could represent a large savings in funds And given the importance of producing defense software that will carry out its intended function relatively small improvements to the quality of defense software systems would be extremely important to identify DoD software engineers and test and evaluation officials may not be fully aware of a range of available techniques because of both the recent development of these techniques and their origination from an orientation somewhat removed from software engineering i e from a statistical perspective The panel s charge therefore was to convene a workshop to identify statistical

software engineering techniques that could have applicability to DoD systems in development

**Ada and Beyond** National Research Council, Computer Science and Telecommunications Board, Committee on the Past and Present Contexts for the Use of Ada in the Department of Defense, 1997-03-03 The Ada programming language was created by the U S Department of Defense DOD nearly two decades ago to provide a general purpose programming language for defense and commercial use but has evolved into a niche solution for safety critical systems primarily in defense applications Ada and Beyond presents an approach for the DOD to move beyond the debate over its policy that requires the use of Ada for all new software development It describes the importance of the software engineering process and recommends to DOD mechanisms for more effective review of software development and improved collection of data on software project outcomes The volume also analyzes the technical empirical and business cases for using Ada and other programming languages makes recommendations regarding the appropriate conditions under which DOD should continue to require the use of Ada and details activities that require funding by DOD in order for Ada to remain a viable programming language

**Critical Code** National Research Council, Division on Engineering and Physical Sciences, Computer Science and Telecommunications Board, Committee for Advancing Software-Intensive Systems Producibility, 2010-11-27 Critical Code contemplates Department of Defense DoD needs and priorities for software research and suggests a research agenda and related actions Building on two prior books Summary of a Workshop on Software Intensive Systems and Uncertainty at Scale and Preliminary Observations on DoD Software Research Needs and Priorities the present volume assesses the nature of the national investment in software research and in particular considers ways to revitalize the knowledge base needed to design produce and employ software intensive systems for tomorrow s defense needs Critical Code discusses four sets of questions To what extent is software capability significant for the DoD Is it becoming more or less significant and strategic in systems development Will the advances in software producibility needed by the DoD emerge unaided from industry at a pace sufficient to meet evolving defense requirements What are the opportunities for the DoD to make more effective use of emerging technology to improve software capability and software producibility In which technology areas should the DoD invest in research to advance defense software capability and producibility

*Air Force Software Sustainment and Maintenance of Weapons Systems* National Academies of Sciences, Engineering, and Medicine, Division on Engineering and Physical Sciences, Air Force Studies Board, Committee on Software Sustainment and Maintenance of Weapons Systems, 2020-08-09 Modern software engineering practices pioneered by the commercial software community have begun transforming Department of Defense DoD software development integration processes and deployment cycles DoD must further adopt and adapt these practices across the full defense software life cycle and this adoption has implications for software maintenance and software sustainment across the U S defense community Air Force Software Sustainment and Maintenance of Weapons Systems evaluates the current state of software sustainment within the U S Air Force and

recommends changes to the software sustainment enterprise This report assesses how software that is embedded within weapon platforms is currently sustained within the U S Air Force identifies the unique requirements of software sustainment develops and recommends a software sustainment work breakdown structure and identifies the necessary personnel skill sets and core competencies for software sustainment

**The Composition and Employment of Software Personnel in the U.S. Department of Defense** Bonnie L. Triezenberg, Jason M. Ward, Jonathan Cham, Devon Hill, Sean Robson, 2020-12-24 Attempts by the U S Department of Defense DoD to address persistent challenges with software development have been hampered by an inability to identify the many software professionals working within DoD s programs In this report the authors identify and characterize a subset of DoD s software workforce the types of software developed within DoD and the variety of methods DoD programs use when employing that workforce to develop software

*The Impact of Case Tools, ADA, and Software Reuse on a DOD Software Development Project* Loren J. Dugan, 1996-03-01 Software continues to be the single greatest challenge facing DoD systems developers The criticality of software as a integral component of system design continues to grow in importance as DoD moves into the 21st Century To meet this ever increasing challenge software development organizations are incorporating new design requirements and practices into their development processes These new requirements practices properly implemented into the development process can reduce software development and maintenance costs and increase software quality and development productivity This thesis investigates the impact of three management selected software development requirements practices CASE tools Ada and software reuse on the progress of a particular DoD software development project known as Project X After a brief introduction the thesis presents background literature on the three development requirements of Project X The background literature is used to support the Project X case study Information required for the case study is obtained through interviews with Project X affiliated development personnel Interview results are analyzed and interpreted through a comparison with information found in the background literature Results of the case study identify several problems with management s plan to implement the three development requirements into Project X The thesis identifies specific root causes for the implementation problems and makes recommendations to reduce the impact of these problems on Project X and other present and future DoD software development projects

*Software Maintenance Success Recipes* Donald J. Reifer, 2016-04-19 Dispelling much of the folklore surrounding software maintenance *Software Maintenance Success Recipes* identifies actionable formulas for success based on in depth analysis of more than 200 real world maintenance projects It details the set of factors that are usually present when effective software maintenance teams do their work and instructs on

*Contracting in the Software Engineering Crisis*, 1992 The Department of Defense DoD is currently experiencing extremely serious problems with Software Engineering As weapons systems become increasingly more dependent upon the software programs which they employ it becomes evermore apparent that DoD projects are consistently late and over budget because of software To this end

software has become the dominant risk to cost and schedule and has caused the demise of more than a few DoD development projects The DoD repeatedly demonstrates requisite experience to efficiently manage the development of hardware Hardware development projects for which the DoD readily implements tried and proven practices to systematically address all aspects of the development are relatively risk free at their onset Software development projects on the other hand are often times initiated without the benefit of similarly institutionalized methodologies and practices Because an understanding of proper Software Engineering practice is only now developing standard well accepted measures do not yet exist The DoD seems only to be scratching at the surface of state of the art software engineering and herein lies the basis of the problem

**DOD Information Technology** United States. General Accounting Office,2001 DOD Information Technology Software and Systems Process Improvement Programs Vary in Use of Best Practices Carl Higginbotham,2001-10 The DoD relies heavily on software intensive systems to support mil operations and associated bus functions such as logistics personnel and financial mgmt One important determinant of the quality of these systems is the quality of the processes used to develop acquire and engineer them Successful public and private org s have adopted and implemented software systems process improvement SPI programs This report compares and contrast DoD IT practices with leading practices It reviews DoD components SPI mgmt activities to ensure that DoD is taking the necessary steps to continuously strengthen its software and systems development acquisition and engineering processes *Software Engineering* Richard F Schmidt,2013-04-30 Software Engineering Architecture driven Software Development is the first comprehensive guide to the underlying skills embodied in the IEEE s Software Engineering Body of Knowledge SWEBOK standard Standards expert Richard Schmidt explains the traditional software engineering practices recognized for developing projects for government or corporate systems Software engineering education often lacks standardization with many institutions focusing on implementation rather than design as it impacts product architecture Many graduates join the workforce with incomplete skills leading to software projects that either fail outright or run woefully over budget and behind schedule Additionally software engineers need to understand system engineering and architecture the hardware and peripherals their programs will run on This issue will only grow in importance as more programs leverage parallel computing requiring an understanding of the parallel capabilities of processors and hardware This book gives both software developers and system engineers key insights into how their skillsets support and complement each other With a focus on these key knowledge areas Software Engineering offers a set of best practices that can be applied to any industry or domain involved in developing software products A thorough integrated compilation on the engineering of software products addressing the majority of the standard knowledge areas and topics Offers best practices focused on those key skills common to many industries and domains that develop software Learn how software engineering relates to systems engineering for better communication with other engineering professionals within a project environment **Test and Evaluation** United States. General Accounting Office,1993 *DoD Ada Software*

*Engineering Education and Training* ADA JOINT PROGRAM OFFICE ARLINGTON VA.,1987 Early in the development of the Ada program the Ada Joint Program Office AJPO recognized that in order to realize the full potential of Ada an effective timely Ada education and training program must be developed The AJPO began coordinating efforts to develop an Ada software engineering education and training program and established the Ada Software Engineering Education Working Group Ada SEEDWG in early 1985 to provide preliminary guidance in planning for the education and training effort A charter for this group was written and coordinated with the Air Force Army and Navy A copy of the charter is provided on the next page By June 1985 this group had evolved from a working group into the Ada Software Engineering Education and Training ASEET Team in order to be consistent with other tasks under the AJPO s purview The purpose of the ASEET Task is to support the Office of the Undersecretary of Defense for Acquisition Research and Advanced Technology Computer and Electronics Technology in formulating policy and in promoting implementation activities that will result in high quality software engineering SDW Achieving Effective Acquisition of Information Technology in the Department of Defense National Research Council,Division on Engineering and Physical Sciences,Computer Science and Telecommunications Board,Committee on Improving Processes and Policies for the Acquisition and Test of Information Technologies in the Department of Defense,2010-07-01 In the military information technology IT has enabled profound advances in weapons systems and the management and operation of the defense enterprise A significant portion of the Department of Defense DOD budget is spent on capabilities acquired as commercial IT commodities developmental IT systems that support a broad range of warfighting and functional applications and IT components embedded in weapons systems The ability of the DOD and its industrial partners to harness and apply IT for warfighting command and control and communications logistics and transportation has contributed enormously to fielding the world s best defense force However despite the DOD s decades of success in leveraging IT across the defense enterprise the acquisition of IT systems continues to be burdened with serious problems To address these issues the National Research Council assembled a group of IT systems acquisition and T E experts commercial software developers software engineers computer scientists and other academic researchers The group evaluated applicable legislative requirements examined the processes and capabilities of the commercial IT sector analyzed DOD s concepts for systems engineering and testing in virtual environments and examined the DOD acquisition environment The present volume summarizes this analysis and also includes recommendations on how to improve the acquisition systems engineering and T E processes to achieve the DOD s network centric goals *Proceedings of 4th International Conference in Software Engineering for Defence Applications* Paolo Ciancarini,Alberto Sillitti,Giancarlo Succi,Angelo Messina,2016-01-25 This book presents high quality original contributions on new software engineering models approaches methods and tools and their evaluation in the context of defence and security applications In addition important business and economic aspects are discussed with a particular focus on cost benefit analysis new business models organizational evolution

and business intelligence systems The contents are based on presentations delivered at SEDA 2015 the 4th International Conference in Software Engineering for Defence Applications which was held in Rome Italy in May 2015 This conference series represents a targeted response to the growing need for research that reports and debates the practical implications of software engineering within the defence environment and also for software performance evaluation in real settings through controlled experiments as well as case and field studies The book will appeal to all with an interest in modeling managing and implementing defence related software development products and processes in a structured and supportable way

**Test and Evaluation** Michael E. Motley, Lester C. Farrington, 1997-02 This report addresses Test and Evaluation T E of software intensive systems and the DoD s efforts to improve the software process DoD software costs total over 30 billion a year of which 2 3 s is for maintaining upgrading and modifying operational systems already in production Today s major defense systems depend largely on the quality of this complex and increasingly costly software Because software error can cause a system to fail possibly with life threatening consequences software intensive systems need to be thoroughly tested before production Charts and tables *A DoD Software Measurement Pilot: Applying the SEI Core Measures*, 1995 In January 1992 the Software Engineering Institute SEI was requested to make recommendations for a basic set of software measurements to support the software measurement initiative under the software action plan SWAP sponsored by the Department of Defense DoD software technology strategy The recommendations published in September 1992 included materials and guidelines for a set of basic measures size effort schedule and quality that were intended to help the DoD plan monitor and manage its internal and contracted software projects Carleton In the fall of 1992 a policy memorandum addressing software measurement for information management IM was proposed as a key element for improvement of software development and maintenance within the DoD Although the policy memorandum had not been issued the Defense Information Systems Agency Center for Software DISA CFSW was tasked to conduct a pilot study on the core measures The DISA CFSW sponsored and managed the software measurement pilot The purpose of the pilot program was to gain an understanding of the key issues that need to be resolved before a DoD wide metrics program is initiated Specifically the intent was to use the lessons learned from the pilot to help develop a set of software measurement program guidelines for the DoD KAR P 10 Engineering Software for Interoperability Through Use of Enterprise Architecture Techniques Jennifer L. Parenti, 2003-03-01 There are many efforts underway that are focused on resolving the system and software interoperability problems within the Department of Defense DoD While several of these efforts are attempting to attack this issue using new technologies and standardization experience suggests most of these interoperability problems are caused by deficiencies in the way interoperability requirements are defined and captured within DoD s acquisition processes and policies To affect real progress towards department wide interoperability it will be necessary to change the methods by which interoperability is considered in the acquisition process This thesis proposes a new structured methodology for



incorporating the use of enterprise architecture techniques into the DoD software acquisition process to provide a means by which interoperability requirements can be captured defined and levied at the appropriate time in a system s development It discusses the necessary components of these architectural models how these models capture DoD s interoperability needs and how these interoperability needs form the basis for meaningful dialogue between the DoD s acquisition and planning communities While this methodology is applicable to many domains and functional areas for the purposes of this thesis the focus will be solely on software systems including systems with embedded software within the DoD 29 tables 15 figures 17 refs

**Costs and Benefits of Software Process Improvement** Karen D. Prenger,Naval Postgraduate School (U.S.),1997-12-01 There are numerous problems in DoD software development projects The ad hoc practices used in the military services and in industry have resulted in unpredictable costs and schedules and low quality products This thesis proposes that one solution to these problems is to integrate Software Process Improvement SPI activities based on a proven model into software development projects Both a formal and an informal approach to SPI will be discussed The thesis will also describe not only the problems encountered in most software development projects but also the activities defined in these SPI approaches that are designed to solve these problems A case study of a military project that has spent several years implementing SPI activities based on Software Engineering Institute s SEI Capability Maturity Model CMM is presented The SPI activities were implemented in an effort to deliver a high quality product with high reliability while maintaining a high level of control of costs and schedule This project has succeeded in its goals and the costs and benefits of the project s efforts will be presented

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