Software Acquisition Management "As-Is State" Report

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Executive Summary

Problems with the acquisition of software intensive systems are numerous and well recognized. They have been studied and re-studied, and literally dozens of reports have been issued to educate readers on how to recognize, mitigate, and avoid such problems. A major contributor to software acquisition problems is the fact that software is often misunderstood and treated like hardware, even though there are significant differences between the two. Software isn't manufactured and doesn't wear out; when software fails to perform as expected or required it is primarily because of flaws in the design or implementation.

Software problems and their solutions are documented in reports issued by entities such as the Defense Science Board (DSB), Government Accountability Office (GAO), Software Program Managers Network (SPMN), Software Engineering Institute (SEI), Tri-Service Assessment Initiative (TAI), Naval Research and Advisory Council (NRAC), and the National Defense Industrial Association (NDIA).

Industry began addressing these problems several years ago with, among other things, model-based process improvement. The Software Engineering Institute recently issued a report that model-based process improvement works. Credible, quantitative results from their report are shown in Table 1.

Performance Category	Median Improvement
Cost	34%
Schedule	50%
Productivity	61%
Quality	48%
Customer Satisfaction	14%
Return on Investment	4.0 : 1

Source: Performance Results of CMMI ® - Based Process Improvement CMU/SEI-2006-TR-004, ESC-TR-2006-004, August 2006

Table 1: Performance Improvements Over Time by Category

The good news, that there is a viable solution to our software acquisition problems, is tempered by the hard work that will be required and a culture that is resistant to change. The challenge is to change Navy culture and adopt these solutions, which include awareness training, cultivating competent leaders/managers who understand software, adherence to rigorous processes, and good requirements management. As an integral part of this education and training, we envision consolidated, easy-to-read, readily-available handbooks that will assist Program Managers and technical personnel in the acquisition of software intensive systems.

Background

Software systems are inherent in all the complex programs, both information technology and weapon systems, acquired by the Navy. Software is frequently the primary cost, schedule, and performance driver in our programs — the "Achilles' heel". In order to achieve the desired software improvements, we must address the issues that are hampering program success. As more and more system functionality is implemented via software, it is essential that we pay particular attention to this critical component within the overall context of weapon systems acquisition. To focus senior management attention to this issue, ASN(RDA) set in motion a process improvement initiative as outlined in a 15 May 2006 memo. A copy of the memo is provided in Appendix A.

It is important to note that the subject here is software ***acquisition management*** as practiced in a Program Office and not those processes used by an organization to *develop* software. A key concept to understand is that program failure can and does result due to low Program Office software acquisition process maturity, even when that Program Office is linked with a high process maturity software developer.

[Note on the term "software intensive system": As mentioned above, with the vast majority of system functionality now being implemented via software (vice hardware) in our Naval weapons and information systems, this focus team believes that all current systems should be considered to be "software intensive" unless the Program/Project Manager can explain why they are not. Therefore no definition of a "software intensive system" need be provided.]

Purpose

This report is a first step in identifying and transitioning to best management practices for the acquisition of software intensive systems across the Naval Enterprise. The approach used was to base-line software acquisition management policies, instructions, processes and practices Navy-wide; identify similarities, differences, and/or gaps; and include analysis of any lessons learned. The ultimate goal is to leverage best existing practices and implement new practices in software acquisition management in order to improve cost and schedule predictability and product quality, and use quantitative data to measure performance improvement.

Approach

The SPII-sponsored Software Acquisition Management (SAM) team is comprised of members from several Systems Commands (SYSCOMs) and Navy Program Executive Officer (PEO) organizations to ensure diversity of viewpoints and experience. In order to understand the current state the team reviewed relevant documents from the following sources:

Document Type	***Source(s)***
Academia	Dr. R. Turner PhD Dissertation
Briefings	SEI, Tri-Service Assessment Initiative, Naval Research and Advisory Council (NRAC), NDIA
Handbooks and Guidebooks	PEO, SYSCOM
Instructions	DoD, SECNAV, PEO, SYSCOM
Reports	Defense Science Board, Government Accountability Office Software Project Management Practices: Failure versus Success© *By Capers Jones, Software Productivity Research LLC*
Standards	IEEE/EIA-12207 (Software Lifecycle Processes) ANSI/PMI 99-001-2004, A Guide to the Project Management Book of Knowledge, Third Edition (PMBOK® Guide)
Technical Reports	Software Engineering Institute (SEI)

A complete listing of documents reviewed is provided in Appendix B. In addition, members of the SAM team received substantial anecdotal inputs from Navy program offices.

The primary objectives of the review were to: (1) identify conflicts, lack of clarity, and gaps in policy and/or direction regarding the acquisition of software intensive systems; (2) quantify the software acquisition management problem either anecdotally or in terms of cost overruns, schedule slippages, and technical capability not delivered; and (3) verify that solutions to software acquisition problems exist.

In addition to policy documents (e.g., directives and instructions) the team also reviewed handbooks, guidebooks, technical reports and widely available briefs to gain a fuller picture of the software acquisition environment.

The five SPII focus teams identified and described 24 issues. Of those 24, four were allocated to the SAM team. These four issue areas were given special attention during the document review.
They are:

- Capabilities and Requirements
- CMMI Level Improvements
- EVMS for Software
- Inability to Accurately Predict Cost and Schedule

Findings and Recommendations

Review of existing policy documents did not indicate there is conflicting information that needs to be corrected. Nor does it appear there are any gaps that need to be filled in. The team did find the expected hierarchical structure of DoD to SECNAV to SYSCOM/PEO instruction generation. Often this resulted in a refinement or 'next level' of implementation detail. While beneficial in defining the "how", this usually leads to each organization developing its own policy and processes. Therefore, the team sees great value in the proposed "*Naval Software Acquisition Process Improvement Guidebook for Program Managers*" as a single, coordinated source of software acquisition information for the project office.

While a list of software acquisition issues could literally reach 100 or more, the SAM team found the following problems to be most troublesome and most commonly documented:

- ***Lack of effective acquisition management*** is considered the most serious systemic problem that the Navy faces in the acquisition, development, and sustainment of software intensive systems. While processes used by Navy organizations and prime contractors to develop software have improved much in the past few years, processes used to acquire the software have not kept pace. Poorly planned acquisitions can offset robust developer processes, and often have significant impacts on successful program execution. When a low maturity Program Office (PO) works with a high process maturity software developer, overall program performance often suffers. While a good developer can overcome the weaknesses of a PO, the PO may either (1) make decisions that inhibit the developers, or (2) allows the developers too much latitude, such that problems occur. Further, some programs are inherently high risk due to directed cost and schedule constraints levied on the program. To develop and acquire the system and its software under severe constraints will make good software practices unworkable. Acquisition management covers a broad spectrum of disciplines and processes. The elements which follow are specific areas that should be addressed.

- An ***immature acquirer*** often cannot identify whether or not a developer is capable of successfully performing the required software work. CMMI rating alone is not a reliable indicator of a developer's ability to deliver quality products within cost and on schedule. Acquirers, as smart buyers, must be able to critically examine the developer's processes, historical performance on similar programs, expertise in the specific technical domain, as well as the skills and abilities of the people who will actually perform the work. DOD acquirers must also be able to monitor and control the documented processes of developers. Mandatory submission of the Software Development Plan (SDP) with the proposal (as required by ASN (RDA) memo of 17 Nov 2006) is a step in the right direction, but only if the acquirer can capably evaluate the information contained in the proposals and SDP. The acquirer must also assure that the SDP is followed and actually used in the development process, and not just "shelfware"

after contract award. The "RESET" teams suggested by the NRAC study group would help mitigate this problem by assisting at the start to set up the program for success.

- ***Ineffective requirements management*** is a prevalent problem at both the software and the systems level. It is normal to experience some requirements changes (added, deleted, or modified) over time; the rate at which software requirements change runs between one percent and three percent per calendar month during the design and coding stages. However, if the scope and extent of changes are not consistently tracked, assessed, controlled, and applied to software cost estimates, then the likelihood of program failure (cost / schedule/ quality) increases significantly.

- ***High personnel turnover in the acquiring organization*** has a significant impact on any activity with cost and schedule constraints. In the case of a PMO that lacks documented acquisition processes, there is little chance of maintaining consistency or continuity in terms of how work gets done. Churn and chaos in a PMO leads to confusion and frustration for the supplier, as well as internal cost and schedule overruns.

- ***Cost and schedule estimation needs to be realistic***. Estimates must be allowed to reflect the dynamic nature of program execution by funding normal requirements growth and risk mitigation. Successful programs maintain a historical database of cost and schedule performance measures and use them in their cost and schedule estimating process. This appears to be a weakness in DOD programs. Program Office personnel also need the expertise (i.e., training, tools, and experience) to accurately predict cost and schedule and to manage the risk associated with those estimates throughout the various phases of the program, e.g., when unrealistic cost and schedule constraints are 'imposed' on a program. Bottom line is that the program initial budget and subsequent budget cycles must be realistic and be reflected in the PM process, including allowances for unseen "program management taxes". Much discipline is needed to recognize realistic estimates, and to resist the pressure to apply unrealistic estimates based on political pressure.

- The use of ***Earned Value Management*** as applied to software is inconsistently, and often incorrectly implemented. A useful EVMS is closely tied to good estimating and an accurate, detailed Work Breakdown Structure. Milestones or completion measures acceptable for hardware frequently fail when assessing the progress of software. Unlike hardware, software can appear to meet critical milestones by delivering limited functionality with a resulting false impression of true cost and schedule status. It takes a trained, educated, and experienced supplier and program office staff to properly structure a quality EVM system for the software portion of the program. Guidance and lessons learned in this area are not as prevalent as other software acquisition issues.

- Sources of software engineering ***Best Practices and Lessons Learned*** exist, are either free or relatively inexpensive, and have been accepted as industry standards. However, few DOD acquisition program managers are using them. As can be seen in Appendix B, there is an overwhelming proliferation of policy documents, handbooks, and guidebooks. Program Managers have too many choices for guidance, so consequently, they often use none of it. There is currently no mechanism in place at the Enterprise level to disseminate, distill, and implement policy information or direction to the PEO / PMO levels. Expert advisory support to program managers for the most part does not exist. References 56 and 57 in Appendix B were developed by the worldwide community of Systems/Software engineering and Program Management practitioners, peers of our Navy program teams, as easy-to-read, common sense solutions to the problems being addressed by the ASN (RDA) SPI Initiatives. The CMMI is a de facto international standard for systems and software engineering standards. The PMBOK is an ANSI standard for project management. All versions of the CMMI are available on-line and free. The PMBOK costs about $30 per copy.

While it is not the intent of this report to provide detailed solutions to these problems (that will be the goal of the "to-be" report and efforts of other SPII teams), the recommended solutions will be in the areas of awareness, education, training, cultivating competent leaders/managers who really understand software, adherence to rigorous processes, and consolidated, clear-cut guidance.

Summary

The problems described above are not unique to DOD; they are pandemic to software development and acquisition programs throughout industry. Industry, however, seems to have identified viable solutions, primarily model-based process improvement. Over the last 15 years since the first Capability Maturity Model was released, industry has transitioned to a process culture, and their bottom lines are vastly improved.

With the proper resources, sustained management support, training, compliance mechanisms, and socialization, many of these software problems can be addressed, but a disciplined and consistent focus on acquisition process improvement will be necessary to achieve long-term success

The attention to software acquisition has greatly increased with the issuance of the 15 May 2006 and 17 Nov 2006 ASN (RDA) memos which mandate a minimum level of training for program office employees (Software Acquisition Management 101 and Introduction to Capability Maturity Model Integration (CMMI)) as well as the requirement to address CMMI the in the contract Statements of Work and Evaluation Criteria. The SAM team believes there is great value in the ASN (RDA) sponsored Software Process Improvement Initiative to tackle this difficult but important challenge.

Appendix A – ASN (RDA) Software Process Improvement Initiative Memo

DEPARTMENT OF THE NAVY
OFFICE OF THE ASSISTANT SECRETARY
RESEARCH, DEVELOPMENT AND ACQUISITION
1000 NAVY PENTAGON
WASHINGTON DC 20350-1000

MAY 15 2006

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Software Process Improvement Initiative

Successful development and acquisition of software is paramount for acquiring Naval Warfighting and business systems. There are many parallel and related efforts underway that address improvement in the acquisition of software products: mandates such as Public Law 107-3 14 Section 804 and the Clinger-Cohen Act; initiatives such as Software Assurance and Open Architecture (OA); and the development of best practice models such as the Capability Maturity Model Integration (CMMI) for Acquisition. To consolidate these efforts into a focused initiative, I have formed a steering group composed of my senior engineering professionals and led by the ASN (RD&A) Chief Engineer. This group will evaluate existing policies and implement process improvements to enhance our ability to develop and acquire software without sacrificing the cost, schedule and performance goals of our acquisition programs.

Additionally, five focus teams, led by department software engineering professionals, have been established to achieve our strategic software goals (see attachment):

Software Acquisition Management (SAM) Focus Team
Software Systems Engineering (SSE) Focus Team
Software Development (SWDEV) Techniques Focus Team
Business Implications Focus Team
Human Resources Focus Team

To energize the process, I am initiating two projects immediately -software education and software acquisition discipline. These will initially be required for all ACAT I and I1 level acquisition programs.

The first project is to ensure key government program office personnel have a minimum level of knowledge of software acquisition and engineering management

practices. The objective is to quickly establish a solid foundation of trained government software acquisition professionals. To enable this understanding, the following courses will be required for all government Program Managers, Deputy Program Managers, and Technical Directors,/Chief Engineers assigned to an ACAT I or I1 program and must be completed within 18 months:

1. DAU course SAM 101 -Basic Software Acquisition Management (24 hour distance learning course)
2. SEI course -Introduction to CMMI (3 days of classroom training)

The second project is to ensure that software development efforts in software intensive system programs are conducted by contractors who have a software process improvement program established that addresses at a minimum:

Software Acquisition Planning
Requirements Development and Management
Project Management and Oversight
Risk Management.

These functional processes must be demonstrated and exercised by the developer in a continuous manner and be equivalent to that articulated by CMMI capability level 3. They will be assessed by ASN RDA Chief Engineer and the senior steering group on a. periodic basis. Statements of Work for all applicable future procurements after 1 October, 2006 must address these requirements.

The development, acquisition, and delivery of software are key to the Navy's ability to successfully conduct its Warfighting and Business operations. I need your commitment and I most strongly encourage your support as we address this significant challenge.

Delores M. Etter

Attachment: As Indicated

SUBJECT: Software Process Improvement Initiative

Distribution:
COMNAVSEASYSCOM
COMNAVAIRSYSCOM
COMSPAWARSYSCOM
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NAVSEA (05,06)
NAVAIR (4.0)
SPAWAR (05)
COMNAVFACSYSCOM
COMNAVSUPSYSCOM

Software Process Improvement Initiative Teams

Software Acquisition Management (SAM) Focus Team - is chartered to adopt a standard software acquisition life cycle model, develop a tailor able organizational structure with roles and responsibilities, and establish a set of software events and products that will' apply over the acquisition life cycle including earned value management system (EVMS) benchmarks for tracking software development progress. This team will also draft the software policy documents with input from the other four teams for submission to the senior steering group.

Software Systems Engineering (SSE) Focus Team - is chartered to integrate software engineering events and products into traditional systems engineering practices. This team will establish compliance methodologies, develop a tailorable set of software metrics, and examine the use of a software systems engineering plan (SSEP) as a means to institutionalize these software practices for presentation at milestone decision points.

Software Development (SWDEV) Techniques Focus Team - is chartered to research and evaluate current and emerging software development methodologies and their supporting standards, to understand their positive and negative attributes, and determine how they could be applied to enhance our software development and acquisition activities. This team will interface with FFRDC's, government labs, academia, and industrial communities in searching out these potentially innovative methodologies.

Business Implications Focus Team - is chartered to examine our business, acquisition, and contracting strategies and practices to ensure the Navy is a "smart buyer" of software products whether they are "off the shelf' purchases or sponsored developments. This should include a fundamental understanding of the implications of emergent software development techniques upon our internal practices and the potential ramifications upon our industrial base. This group will also be expected to develop standardized contract language for the software procurement and development efforts.

Human Resources Focus Team - is chartered to refine the required skills and capabilities needed by government software acquisition and engineering professionals, and to identify a required set training courses tailored to the respective roles and responsibilities of these professionals.

Attachment

Appendix B – Document Listing

Ref No.	Type	ID	LONG TITLE
1	1	DOD 5000.4-M-1	DRAFT -- Cost and Software Data Reporting (CSDR) Manual
2	1	DoDD 5000.1	The Defense Acquisition System
3	1	DoDI 5000.2	Operation of the Defense Acquisition System
4	1	NAVAIRINST 4200.36C	Acquisition Plans
5	1	NAVAIRINST 4200.39B	Principles & Procedures for Competitive Source Selection
6	1	NAVAIRINST 4355.19B	Systems Engineering Technical Review Process
7	1	NAVAIRINST 5000.21	Program/Project Risk Management
8	1	NAVAIRINST 5234.1	Policy on Software Evaluations for Naval Air Systems Command Programs
9	1	NAVAIRINST 5234.2	Requirements for Process Improvement Actions for Naval Air Systems Command Software Acquisition, Development, and Life-Cycle Support
10	1	NAVAIRINST 5234.3	Naval Air Systems Command Systems Leadership Council Operations And Organization
11	1	NAVAIRINST 5234.4	Naval Air Systems Command Independent Expert Program Reviews for Software Intensive Programs
12	1	NAVAIRINST 5234.5A	Naval Air Systems Command Measures For Software Intensive Programs
13	1	PEOIWSINST 3058.1	Risk Management Process Instruction
14	1	PEOTSCINST 4810.2	SOFTWARE DEVELOPMENT, VERIFICATION AND VALIDATION (V&V), DESIGN REUSE, AND METRICS POLICY
15	1	PUBLIC LAW 107–314 / DEC. 2, 2002	SEC. 804. IMPROVEMENT OF SOFTWARE ACQUISITION PROCESSES
16	1	SECNAVINST 5000.2C	Implementation & Operation of the Defense Acquisition System and the Joint Capabilities Integration & Development System
17	2		DoD Architecture Framework Working Group, DoD Architecture Framework Version 1.0, Volume II, Product Descriptions, 09 Feb 2004
18	2		DoD, Systems Engineering Plan (SEP) Preparation Guide, Version 1.02, 10 Feb 2006.
19	2		Program Manager's Guide: A Modular Open Systems Approach (MOSA) To Acquisition, Version 2.0 September 2004
20	2		ASN RDA Memo: Naval Open Architecture Scope and Responsibilities (5 Aug 04)
21	2	DoD Guidebook	DoD Acquisition Guidebook

Ref No.	Type	ID	LONG TITLE
22	2	DoN Guidebook	DoN Acquisition & Capabilities Guidebook
23	2	NAVAIRSYSCOM	IPT Guidebook
24	2	NAVAIRSYSCOM	NAVAIR Acquisition Guide of Apr 05 [guidance]
25	2	NAVAIRSYSCOM	SOFTWARE METRICS PROGRAM HANDBOOK (SW-DIV-HDBK-7)
26	2	NAVAIRSYSCOM	Using Software Metrics and Measurement for Earned Value Toolkit
27	2	PEO IWS	Systems Engineering Operations Manual (SEOM), April 2003.
28	2	PEO IWS/314	Open Architecture Computing Environment Technologies and Standards (Version 1.0), Open Architecture Computing Environment Design Guidance (Version 1.0), and Net-Centric Enterprise Solutions for Interoperability Guidance 05 AUG 2005
29		PEO C4I/002	
30	2	PEO TSC	Technical Review Manual (TRM), April 2003.
31	2	Ser N6N7 / 5U916276	Requirement for Open Architecture (OA) Implementation (23 Dec 05)
32	3	CMU/SEI-2005-TR-011	CMMI Acquisition Module, v1.1
33	3	IEEE/EIA 12207	Software Lifecycle Processes
34	3	ISO-15939	SOFTWARE ENGINEERING - SOFTWARE MEASUREMENT PROCESS; MAR 03
35	4		Defense Science Board Task Force on An Open Systems Process for DoD (Nov 00), 25 Sept 1998
36	4		Navy Research Advisory Council (NRAC): Science and Technology for Modular Systems (5 Aug 2004)
37	4	CMU/SEI-2004-TR-003	Army Strategic Software Improvement Program (ASSIP) Survey of Army Acquisition Program Management
38	4	CMU/SEI-2005-HB-006	Software Acquisition Planning Guidelines (Dec 2005)
39	4	CMU/SEI-2005-SR-014	U.S. Army Acquisition – The Program Office Perspective
40	4	Defense Software 0011.pdf	Defense Science Board Task Force on Defense Software; Report of the (Nov 00)
41	4	Dissertation; 31 Jan 02	Implementation of Best Practices in US DoD Software-Intensive System Acquisition [Dissertation by Dr. Richard Turner; Jan 02]
42	4	DoD Sw Acq Policy 0201.pdf	Inconsistent Software Acquisition Processes at the Defense Logistics Agency Increase Project Risks (GAO-02-9)
43	4	DoD Sw and Sys PI Prgms 0103.pdf	Software and Systems Process Improvement Programs Vary in Use of Best Practices (GAO-01-016)
44	4	DoD Sw Intensive Systems Acq 0403.pdf	Stronger Management Practices Are Needed to Improve DoD's Software Intensive Weapon Acquisitions (GAO-04-393)

Ref No.	Type	ID	LONG TITLE
45	4	GAO-01-116	Software and Systems Process Improvement Programs Vary in Use of Best Practices
46	4	GAO-02-9	Inconsistent Software Acquisition Processes at the Defense Logistics Agency Increase Project Risks
47	4	GAO-04-393	Stronger Management Practices Are Needed to Improve DoD's Software-Intensive Weapon Acquisition
48	4	GAO-04-722	DoD's Acquisition Policies and Guidance Need to Incorporate Additional Best Practices and Controls
49	4	GAO-05-395T	Unmanned Aerial Vehicles: Improved Strategic and Acquisition Planning Can Help Address Emerging Challenges; Mar. 9, 2005
50	4	GAO-06-447	Unmanned Aircraft Systems: New DOD Programs Can Learn from Past Efforts to Craft Better and Less Risky Acquisition Strategies; Mar 2006
51	4	GAO-06-610T	Unmanned Aircraft Systems: Improved Planning and Acquisition Strategies Can Help Address Operational Challenges; Apr 6, 2006
52	4	Report of the Defense Science Board; May 2003	Air Force Scientific Advisory Board Joint Task Force on Acquisition of National Security Space Programs
53	5	ISBN 0-201-70454-4	Managing Software Acquisition (2001); Meyers & Oberndorf [SEI]
54	3/4	Crosstalk Magazine, OCT 2004 www.stsc.hill.af.mil	Software Project Management Practices: Failure versus Success© By Capers Jones, Software Productivity Research LLC
55	4	CMU/SEI-2006-TR-004 ESC-TR-2006-004	Performance Results of CMMI ® - Based Process Improvement
56	3	CMU/SEI-2006-TR-008 ESC-TR-2006-008	CMMI® for Development, Version 1.2, CMMI-DEV V1.2, August 2006
57	3/5	ANSI Standard ANSI/PMI 99-001-2004	A Guide to the Project Management Book of Knowledge, Third Edition (PMBOK® Guide)

Legend:
1 = Policy
2 = Guidance
3 = Industry Practice
4 = Report
5 = Book

Discussion Questions

1. What activities involved in the acquisition, development, and maintenance of software associated with software intensive systems fall within the scope of the ASN(RDA) Software Process Improvement Initiative (SPII)?

   Possible answer would include: The full range of activities associated with the acquisition, development and maintenance of software intensive systems whether they are performed by a government organization or industry. This includes those activities associated with program management and the development of software, whether done at the contractor's (or developer's) facility or at the government program office. The DSB report, the GAO reports, and the Capers Jones report all indicate that technical management is not the primary issue. Program Management is where we seem to need the most work.

2. Software acquisition management improvement should focus on what organizational activities?

   Possible answers would include:

   a. Activities as performed in the government and developer's program offices including Project Planning, Project Monitoring and Control, Supplier Agreement Management, Risk Management, Requirements Development and Management, Measurement and Analysis, Decision Analysis and Resolution, Organizational Process Definition, Organizational Training (selected process areas from the SEI CMMI)

   b. A good place to start is CMMI Level 2; The Community of Practitioners that developed the model created Level 2 as the things they would do to start-up a new program. Given that most Navy programs are at level 1, it seems logical that they focus on level 2 process areas and add anything else that they consider critical to their success, e.g., Risk Management, Requirements Development, Validation, and/or Verification.

   c. They might also look at the PMBOK which focuses exclusively on how to manage a program. It has excellent material on planning, initiating, executing, monitoring and controlling, and closing a project.

3. Issues that cause problems in the acquisition or development of software intensive systems are well known and documented, so why are they still so prevalent?

Possible answers would include:

a. Although the process solutions seem to be well known successful implementation requires a change in government program office business culture.

b. A paradigm shift is always challenging; the things one hears that indicate a strong resistance to cultural change include:

- *"We are doing fine."*
- *"We have always done it this way."*
- *"We are too busy to try something new."*
- *"Who are you to tell us how to do our job?"*
- *"We can't afford to do this."*
- *"If we drag our feet long enough, maybe they will go away."*
- *"Nobody else is doing this, so we won't either."*

c. Three things are always included in the solution to cultural resistance: executive leadership, education, and more executive leadership.

4. The problems inherent in acquiring a complex software intensive system can be solved easily by choosing a competent software developer. Do you agree or disagree with this statement. Please explain.

Possible answers would include:

a. (1) hiring a competent developer would greatly reduce the risk of project failure but is no guarantee of success; (2) need to ensure the specific people performing this development are actually using mature processes; (3) need to evaluate the developer's past performance for evidence of competence and ability to deliver.

b. Disagree with the statement. It can be done, but it rarely seems to be easy. A significant factor in getting a competent developer to deliver as expected is that a high-maturity software developers becomes less competent when working with a government PMOs with immature software development and acquisition practices.

5. Why do you think the DoD continues to have schedule and cost issues related to the acquisition of software intensive systems?

Possible answers would include:

a. (1) lack of requirements management and understanding of requirements changes and their impact on cost and schedule; (2) poor initial cost and schedule estimates that are not updated or revised as the

program progresses (more known) or changes over time; (3) inadequate staffing or program office personnel not trained in software acquisition; (4) developers with proven, mature processes not selected to perform the work; (5) developers and program offices do not continually improve their processes to incorporate industry best practices.

b. Real planning is more comprehensive than most people admit, realize, or do. It starts with being able to estimate resource requirements (time, material, and people) to accomplish tasks which are applied to a detailed WBS. Without good estimates, the cost baseline is just a guess, and EVMS becomes pointless number-crunching. Planning also includes creating a Staffing Plan, a Training Plan, a Communications Plan, a Stakeholder Involvement Matrix, etc. As Patton said "A plan is nothing. Planning is everything."

c. Autopsies of failed programs usually include a finding that the following processes were not done well: Risk Management, Planning, and Requirements Management. It could be that we aren't very good at one or more of them. Assessing and improving those processes would be a good first step.

d. Programs should "post-flight" all activities, i.e., analyze what they did, right or wrong, and document what they learned. This is a Maturity Level 3 activity. Navy Repositories of Lessons Learned from the local level to the SECNAV level combined with a mechanism to disseminate lessons learned would enable programs to apply lessons learned. Acquisition and development mistakes would become less frequent and less consequential in terms of cost and schedule.

e. Programs do not use risk management as a fundamental precept of managing their programs. Every time they make a decision, at the end of every meeting, the question should be asked "What risk have we just assumed and how could that risk affect cost, schedule, and quality?"

6. In the acquisition of a software intensive system, how does your role as the acquirer differ from the developer in this Software Process Improvement Initiative?

   Possible answers would include:

   a. (1) focused improvements in software development have been going on for the past 15-20 years via the Software Engineering Institute and other entities; (2) the acquisition office is more involved in developing an unambiguous statement of requirement and request for proposal, evaluation of proposal responses and selection of a qualified developer,

and providing technical oversight of the developer's activities and progress.

b. While the Acquirer has less of a role in the on-hands development and testing of software, s/he needs to be able to provide technical oversight of the developer's progress and activities. To do that the acquirer must be a well-attuned planner, observer, and monitor and controller of all program activities from WBS development to engineering activities and program management.