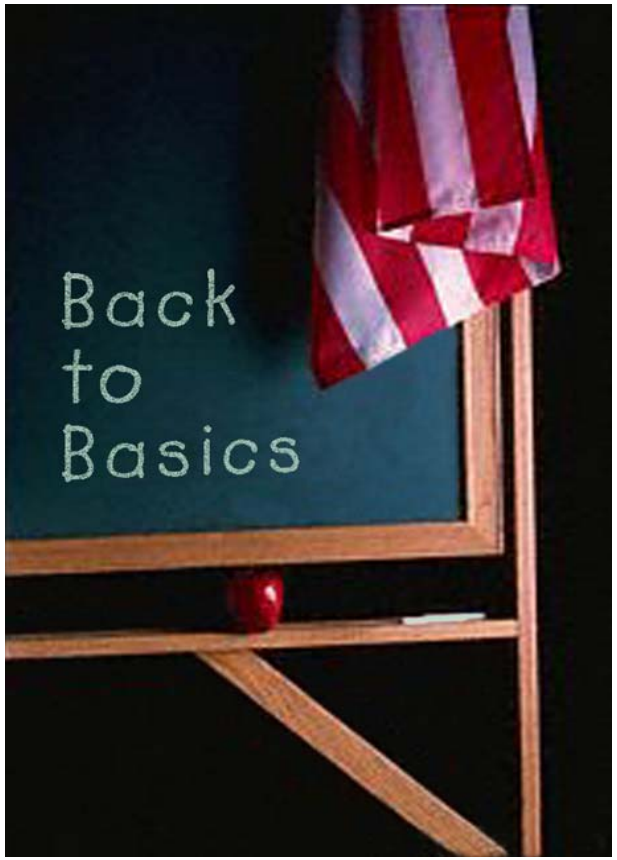
# Software Intensive System Acquisition: Best Practices and Assessment Framework




**Anita King**

**JoAnn Brooks**

**Mark T. Maybury**

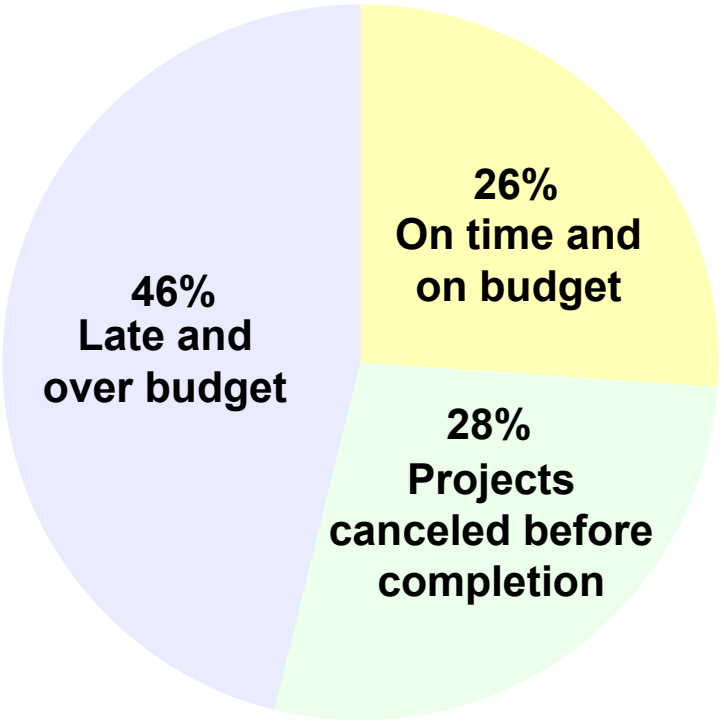
**27 July 2003**

U.S. AIR FORCE

# Background

- Defense acquisition programs continue to experience "software problems"
  - Requirements are much too complex or rigid
  - Developer lacks software skills and experience
  - Poor software management practices
  - Lack of effort up front on system architecture
  - Lack of system engineering trading hardware/software
  - Adherence to policy & directives at expense of system performance & functionality
  - No real financial incentives
  - Program management does not anticipate or cannot fix the problems
- ESC made significant progress in the past to reform software acquisition processes
- Are our best practices still relevant?

Average cost growth exceeds 89%




The average final product contains 61% of the originally specified features

Ref: CHAOS Study, Standish Group Summer 1999

# Pilot Program - 6 SM

- Develop a framework for assessing projects
- Complete baseline survey for pilot programs
  - Global Combat Support System (GCSS)
  - Financial Information Resource System (FIRST)
  - Enterprise Data Warehouse (EDW)
  - Enhanced Technical Information Management System (ETIMS) a.k.a. Tech Orders
- Analyze results
- Provide individual reports to program managers and roll-up information to the PEO
- Assess effort and usefulness of reports
- Develop plan for follow-on effort

# Project Assessment

- Goal: to leverage existing materials in this area
  - Capability Maturity Model (CMM)
  - Capability Maturity Model Integration (CMMI)
  - Tri-Service Assessment Initiative
  - MITRE Program Assessment Toolkit
  - OSD Equivalency Core Criteria and Questions
  - Airlie nine practices
  - Software Program Managers Network 16 Critical Software Practices™
  - Defense Science Board (DSB) reports
- Selection: SPMN 16 Critical Software Practices™ supplemented by findings of DSB Report on Defense Software (Nov 2000)

# Self Assessment Questionnaire

- Attempts to quickly assess the health of an individual program based on best practices
- One page questionnaire
  - Program Management – 10 questions
  - Software Development Process – 11 questions
  - Software Product Quality – 3 questions
  - People - 3 questions
- Count one point for each yes score
  - Very Low Risk: 22-27
  - Low Risk: 15-21
  - Moderate Risk: 10-15
  - High Risk: 5-10
  - Very High Risk: 0-5

U.S. AIR FORCE

# Full Assessment Questionnaire

- Translated into a 45 page questionnaire
  - General interviewee and program information
  - Questions (3-7) related to the specific practice
  - Three best/worst practices
- Interviewed three people on each project
  - Program manager
  - Chief engineer or chief architect
  - Software knowledgeable person in the program office
- Team of two interviewers for each program
  - Interviewed program manager together, split other two
  - Took about 2.5 hours for each person (goal was 2 hours)

# Assessment Framework

U.S. AIR FORCE

| Project Management | Product Construction | Product Stability & Integrity |
|---|---|---|
| ■Adopt a Program Risk Management Process | ■Adopt Life Cycle Configuration Mgmt | ■Inspect Requirements and Design |
| ■Estimate Cost and Schedule Empirically | ■Manage and Trace Requirements | ■Manage Testing as a Continuous Process |
| ■Use Metrics to Manage | ■Use Systems Based Software Design | ■Compile and Smoke Test Frequently |
| ■Track Earned Value | ■Ensure Data and DB Interoperability | |
| ■Track Defects against Quality Targets | ■Define and Control Interfaces | |
| ■Treat People as the Most Important Resource | ■Design Twice, Code Once | |
| ■*Improve Software Skills of Acquisition Managers* | ■Assess Reuse Risks and Costs | |
| ■*Adopt Effective Contract Incentives* | ■*Use Executable Architectures* | |
| ■*Stress Past Performance and Process Maturity* | ■*Employ Iterative Design/Devel Cycles* | |
| ■*Exploit Independent Expert Reviews* | ■*Maintain a Strong Technology Base* | |

**Source:**

**Software Program Managers Network 16 Critical Software Practices™**

*DSB Report on Defense Software (Nov 2000)*

U.S. AIR FORCE

# Adopt Continuous Program Risk Management

| | |
|---|---|
| 1-1 | Does this program have an active Risk Management process? (Consider risk management by any name – watch list, top ten list, etc.) |
| | On a scale of one to seven (one being the least and seven being the most) how effective is it? |
| 1-2 | Have the program office and the developer agreed on a risk management plan? |
| | If so, can we get a copy? |
| | Who is actively involved in the risk management activity (check all that apply)? |
| 1-3 | Is there someone in the program office responsible for risk management (e.g. a risk officer)? |
| | If so, what % of time does he/she spend on risk management? |
| | Who is it? |
| | On a scale of one to seven (one being the least and seven being the most) how qualified is he/she to operate in this position? |
| | What resources (in terms of staff or budget) does he/she have to mitigate risk (as a percentage of the program)? |
| 1-4 | How often is the program manager briefed on risks? |
| | When was the last time the program manager was briefed on risks? |
| | Can we get a copy of the briefing or report? |
| | In the last period (week, month, quarter) how many new risks were proposed, accepted, retired, realized? (Trying to determine if the process is active.) |
| 1-5 | How does the program office incentivise the contractor staff to address risk management? |
| 1-6 | Does this program office have a strategy for "off ramping" (i.e. a way of limiting contractual obligations, short of program termination)? |
| | If so, could you describe it? |

# Estimate Cost and Schedule Empirically

| | |
|---|---|
| 2-1 | At the last program review, were costs-to-complete along with deviations from the original cost baseline presented? |
| | On a scale of one to seven (one being the least and seven being the most) how accurate were they? |
| | At the last program review, was the current schedule along with deviations from the original schedule baseline presented? |
| | On a scale of one to seven (one being the least and seven being the most) how accurate was the schedule? |
| 2-2 | How often do you receive costs-to-complete and rescheduling numbers from the contractor? |
| 2-3 | Has someone independently validated the contractor's cost and schedule estimates for the program office? |
| | Who is it? Organization? |
| | On a scale of one to seven (one being the least and seven being the most) how qualified is he/she to operate in this position? |
| | Have you compared the contractor's estimates to current industry norms? |
| | Have you compared the contractor's estimates with their past performance? |
| 2-4 | When was the last time the program manager was briefed on costs-to-complete and/or rescheduling? |
| | Can we get a copy of the briefing or report? |

U.S. AIR FORCE

# Use Metrics to Manage

| | |
|---|---|
| 3-1 | Does this program use metrics as an input for program decisions, and to monitor issues and identify risks? |
| | On a scale of one to seven (one being the least and seven being the most) how effective is the metrics program? |
| 3-2 | Is there someone in the program office responsible for looking at, analyzing, and/or actively managing metrics received from the contractor? |
| | If so, who is it? |
| | On a scale of one to seven (one being the least and seven being the most) how qualified is he/she to operate in this position? |
| 3-3 | How often do you receive metrics from the contractor? |
| | How current are the metrics when you receive them? |
| | On a scale of one to seven (one being the least and seven being the most) how satisfied are you with the quality of the metrics? |
| | May we get a copy of the last metrics briefing or report? |
| 3-4 | In which of the following categories does the program office receive metrics from the contractor (or subcontractor)? |
| 3-5 | Do you monitor the metrics continuously across all suitable program phases? |
| | Has the program office established a warning threshold for each metric? |
| | Does the program office have a plan for what to do if/when a specific threshold is exceeded? |
| 3-6 | Are there any incentives in place for the contractor on the basis of current metrics? |

U.S. AIR FORCE

# Track earned value

| | |
|---|---|
| 4-1 | Do you use earned value to track progress on your program? |
| | On a scale of one to seven (one being the least and seven being the most) how effective is it? |
| 4-2 | How is earned value credit given? |
| 4-3 | Who on your staff best understands the entry and exit criteria for each task the contractor has defined? |
| | On a scale of one to seven (one being the least and seven being the most) how qualified is s/he to operate in this position? |
| 4-4 | Does the cost reporting system segregate the software effort from the non-software related tasks? |
| 4-5 | How often is earned value reported, collected and reviewed? |
| | How often is the program manager usually briefed on earned value? |
| | When was the last time the program manager was briefed on earned value? |
| | Can we get a copy of the briefing or report? |

# Track Defects against Quality Targets

| | |
|---|---|
| 5-1 | Do you track defects against quality targets? |
| | On a scale of one to seven (one being the least and seven being the most) how effective is the quality program? |
| 5-2 | Have you and the contractor agreed to the quality targets for each subsystem software component? |
| | Is someone in the program office responsible for looking at, analyzing, and/or actively managing defects against quality targets received from the contractor? |
| | Who is it? |
| | On a scale of one to seven (one being the least and seven being the most) how qualified is he/she to operate in this position? |
| 5-3 | Do you have quality targets defined and under change control in the following areas? |
| 5-4 | How often are defects against quality targets reported by the contractor? |
| | How current are these metrics when you receive them? |
| | On a scale of one to seven (one being the least and seven being the most) how satisfied are you with the quality metrics? |
| | May we get a copy of the most recent briefing or report that included defects against quality targets? |
| 5-5 | Are defects against quality targets a subject at every major program review? |
| | If so, are the risks associated with failing to meet these targets also included in the program review? |
| | When was the last time the program manager was briefed on defects against quality targets? |

# Treat People as the Most Important Resource

| | |
|---|---|
| 6-1 | How does the size of the government acquisition program office compare to that of the contractor development team? |
| | On a scale of one to seven (one being the least and seven being the most) how appropriately sized is the program office? |
| 6-2 | What is the annual turnover rate among the staff in the program office? |
| | What portion of this turnover is voluntary? (do not count scheduled rotations) |
| 6-3 | Does the staff in the program office routinely work more than 50 hours per week? |
| | Has the majority of the staff in the program office taken time for a training course in the past 6 months? |
| 6-4 | What is the annual turnover rate among the contractor(s) staff? |
| | What portion of this turnover is voluntary? |
| 6-5 | Does the contractor(s) technical staff routinely work more than 50 hours per week? |
| | Has the majority of the contractor(s) technical staff taken time for a training course in the past 6 months? |
| 6-6 | What rewards are in place for the contractor(s) technical staff when performance exceeds expectations? |
| 6-7 | On a scale of one to seven (one being the least and seven being the most) how well do the program office and contractor teams work together? |

# Improve Software Skills of Acquisition Managers

U.S. AIR FORCE

| | |
|---|---|
| **PM1-1** | **On a scale of one to seven (one being the least and seven being the most) how qualified are the program office staff regarding software intensive system acquisition?** |
| **PM1-2** | **Does your ACAT program office have an expert software systems architect?** |
| | **Who is it?** |
| | **On a scale of one to seven (one being the least and seven being the most) how qualified is he/she to operate in this position?** |
| **PM1-3** | **Has the program manager and key staff in the program office taken the two-week course at DSMC?** |
| **PM1-4** | **Has the program manager and key staff in the program office attended Gen. Dehnert's STSC Software Best Practices (two-day) training?** |
| **PM1-5** | **List any additional professional software systems training.** |

U.S. AIR FORCE

# Adopt effective contract incentives

| | |
|---|---|
| **PM2-1** | **Does this program have a cost-type contract?** |
| | **Is there an award fee for this contract?** |
| | **If so, what is it?** |
| **PM2-2** | **On a scale of one to seven (one being the least and seven being the most) how effective do you believe the award fee is as a major contract incentive for good performance?** |
| **PM2-3** | **What other contract incentives does this program use to reward good contractor performance?** |
| **PM2-4** | **What measures are in place on this program to guard against poor contractor performance?** |

# Stress past performance and process maturity

| | |
|---|---|
| **PM3-1** | **Has the software development contractor for this program been certified within the past 24 months as CMM level 3 or above?** |
| | **On a scale of one to seven (one being the least and seven being the most) how valuable has the CMM certification (or lack thereof) been to the success of your program?** |
| | **Did you independently verify this certification?** |
| **PM3-2** | **If the software development contractor is not certified as CMM level 3 or above, what evidence (if any) exists that they are at an equivalent maturity level?** |
| **PM3-3** | **What honors or awards has this software development project or team received? From whom?** |
| **PM3-4** | **On a scale of one to seven (one being the least and seven being the most) how much did past performance influence your selection of this software development contractor?** |

# Exploit Independent Expert Reviews

| | |
|---|---|
| **PM4-1** | **Since this program began, how many Independent Expert Reviews (IERs) have you had?** |
| **PM4-2** | **When was the most recent?** |
| **PM4-3** | **On a scale of one to seven (one being the least and seven being the most) how effective was it?** |
| | **Do you believe most of the IER recommendations were implemented?** |

# Adopt Life Cycle Configuration Management

U.S. AIR FORCE

| | |
|---|---|
| 7-1 | Does this program office have a configuration management process for managing formal project information? (Formal baselines are information/products delivered by the development contractor and accepted by the program office.) |
| | On a scale of one to seven (one being the least and seven being the most) how effective is it? |
| | Does your contractor have a configuration management process for managing developmental project information? (Developmental baselines include all information/products not yet approved for delivery to the program office.) |
| | On a scale of one to seven (one being the least and seven being the most) how effective do you think it is? |
| 7-2 | Who is actively involved in configuration management activity? |
| | Does each party know which information they are responsible for managing? |
| | Have all configuration items been identified? |
| 7-3 | Is there someone in the program office responsible for configuration management? |
| | Who is it? |
| | On a scale of one to seven (one being the least and seven being the most) how qualified is he/she to operate in this position? |
| 7-4 | On a scale of one to seven (one being the least and seven being the most) how timely are the Configuration Control Boards in evaluating and approving changes? |
| | Is there a "higher authority" to appeal to if the CCB can't come to consensus? |
| 7-5 | What tool(s) are you currently using for configuration management? |

U.S. AIR FORCE

# Manage and Trace Requirements

| | |
|---|---|
| 8-1 | Does this program have a process to develop, manage and trace technical requirements? |
| | On a scale of one to seven (one being the least and seven being the most) how effective is it? |
| | Who is actively involved in the process (check all that apply)? |
| 8-2 | Is there someone in the program office responsible for developing and managing technical requirements? |
| | If so, who is it? |
| | On a scale of one to seven (one being the least and seven being the most) how qualified is he/she to operate in this position? |
| 8-3 | Which statement better reflects this program's approach to software development? |
| 8-4 | Does this program trace technical requirements through specification, design, code, testing (check all that apply)? |
| | If so, do you use a tool for this? |
| | If yes, what is the tool? |
| | Who has access to this tool (check all that apply): |
| 8-5 | Are this program's requirements kept under configuration management? |
| | On a scale of one to seven (one being the least and seven being the most) how current are the requirements under CM? |
| | In the last period (week, month, quarter) how many changes to requirements were proposed and accepted? |
| 8-6 | Has this program ever traded off requirements for cost and/or schedule or to reduce risk? |
| | When was the last time the program manager was briefed on changes to requirements? |
| | Can we get a copy of the briefing or report? |

# Use System-Based Software Design

U.S. AIR FORCE

| | |
|---|---|
| **9-1** | **Does this program have a software development plan?** |
| | **On a scale of one to seven (one being the least and seven being the most) how up to date is it?** |
| | **Can we get a copy?** |
| **9-2** | **Are this program's methods for defining system architecture and software design evaluated through independent audits?** ***(independent program organization)*** |
| | **How often?** |
| | **By whom?** |
| **9-3** | **How involved are software engineers in the systems engineering tasks that influence software?** |
| | **Do software engineering staff members participate in the definition of system architectures?** |
| | **Do software engineering staff members authorize (have "sign off") the system architecture before software requirements are defined?** |
| | **On a scale of one to seven (one being the least and seven being the most) how closely do software and system engineering work together?** |
| **9-4** | **Which of the following are placed under CM control when they are approved for program implementation (check all that apply)?** |

# Ensure Data and Database Interoperability

| | |
|---|---|
| 10-1 | Do you have program standards for database implementation and for the data elements that are included? |
| | On a scale of one to seven (one being the least and seven being the most) how effective are they? |
| 10-2 | What are your process standards for defining the database and entering information into it? |
| | Are they consistent with DoD standards (e.g. JTA)? |
| 10-3 | What are your product standards that define the structure, elements, and other essential database factors? |
| | Are they consistent with DoD standards (e.g. JTA)? |
| 10-4 | Have you ensured that data redundancy is reduced to a minimum and each data item is updated only once (with the changes propagated automatically everywhere)? |

# Define and Control Interfaces

| | |
|---|---|
| 11-1 | Does this program have a process to define and control all external interfaces? |
| | On a scale of one to seven (one being the least and seven being the most) how effective is it? |
| | Who is actively involved in the process (check all that apply)? |
| 11-2 | Is there someone in the program office responsible for tracking interfaces? |
| | If so, who is it? |
| | On a scale of one to seven (one being the least and seven being the most) how qualified is he/she to operate in this position? |
| 11-3 | Was a complete inventory of all external interfaces prepared before completion of the system-level requirements? |
| | On a scale of one to seven (one being the least and seven being the most) how complex is the collection of interfaces? Consider number, detail, assortment, etc. |
| 11-4 | Are all external interfaces documented and maintained under CM control? |
| | On a scale of one to seven (one being the least and seven being the most) how detailed are the descriptions? |
| 11-5 | Is there an active Interface Control Working Group for each interface (where needed)? |
| | On a scale of one to seven (one being the least and seven being the most) how timely are they in evaluating and approving changes to an interface? |

# Design Twice, Code Once

| | |
|---|---|
| 12-1 | Which statement most closely describes this program?<br>a) System and software design was completed and verified before coding began.<br>b) A prototyping activity was included prior to the completion of the final software design.<br>c) A series of prototypes have been completed and evaluated by the end-user resulting in changes to the software design. |
| 12-2 | Are designs evaluated through a structured inspection prior to release to CM? |
| | If so, does this inspection consider (check all that apply): |
| 12-3 | For incremental releases, are the system and software architectures (choose one): |
| 12-4 | Do system and software architecture undergo structured inspections (in addition to the software design)? |
| | On a scale of one to seven (one being the least and seven being the most) how effective are the structured inspections? |
| 12-5 | Is a Computer Aided Software Engineering (CASE) tool used to assist in software design and documentation? |
| | If so – which CASE tool do you use? |

# Assess Reuse Risks and Costs

U.S. AIR FORCE

| | |
|---|---|
| 13-1 | Is reuse of COTS, GOTS or any other non-developmental items (NDI) a significant part of this program? |
| | If so, on a scale of one to seven (one being the least and seven being the most) how valuable has reuse been to the success of this program? |
| 13-2 | Before the decision was made to reuse COTS, GOTS or any NDI (or not to reuse) were "build vs. buy" trade studies conducted? |
| | Before the decision was made to reuse COTS, GOTS or any NDI (or not to reuse) were full life cycle costs taken into consideration? |
| | If reuse is not a significant part of this program, skip to section DSB PC1. |
| 13-3 | Does your contractor plan to modify the reuse components (COTS, GOTS or other NDI)? |
| 13-4 | Who will maintain your reuse components (COTS, GOTS, or any other NDI)? |
| 13-5 | Are reuse components (COTS, GOTS, or any other NDI) acceptance tested prior to integration with the other software/system components? |
| | Are reuse components (COTS, GOTS, or any other NDI) then re-tested as part of the integrated software and system? |
| 13-6 | When integrating COTS, GOTS, and in-house software, do cost estimates include (check all that apply): |

# Use executable architectures

| | |
|---|---|
| PC1-1 | Is the software architecture for this program described using the Unified Modeling Language (UML) or similar declarative notation? |
| | If so, on a scale of one to seven (one being the least and seven being the most) how valuable has this been to the success of the program? |
| PC1-2 | How soon after contract award is there an executable skeleton of the architecture? (An executable architecture typically starts with the necessary components defined but implemented as skeletons only.) |
| PC1-3 | At what point will a critical path version of the architecture have been exercised? |

U.S. AIR FORCE

# Employ iterative design/ development

| | |
|---|---|
| **PC2-1** | **What is the time period between the beginning of this contract and the first operational deliverable to the end user?** |
| **PC2-2** | **After the first operational deliverable to the end user, how long until the next planned operational deliverable?** |
| | **Which best describes this next delivery?** |
| | **Does the development contractor for this program have usage scenarios planned for iterative releases?** |
| **PC2-3** | **Does the development contractor for this program use demonstrations or prototypes between deliveries/releases as a way of receiving feedback?** |
| | **How often are demonstrations scheduled during the development process?** |
| | **Who attends these demonstrations (check all that apply)?** |

# Maintain a strong technology base

| | | |
|---|---|---|
| PC3-1 | On a scale of one to seven (one being the least and seven being the most) how closely does this program track commercial technology advances and incorporating them into the development cycle as appropriate? | |
| | Has this program incorporated at least one new COTS or GOTS technology in the past year (improving core functionality)? | |
| | On a scale of one to seven (one being the least and seven being the most) how easily does your infrastructure accommodate this new technology? | |
| PC3-2 | What current technologies and structured methodologies are in use on this program (check all that apply): | |
| | Requirements<br>___ Requirements Traceability Tools | System<br>___ Fixed, 3-Tier Architecture |
| | Architecture<br>___ Domain Modeling Tools<br>___ Drawing Tools<br>___ 3-Tier Architecture<br>___ Grid Programming | Analysis<br>___ LINT<br>___ Reverse Engineering Tools<br>___ Security Analysis Tools |
| | Integration/Components<br>___ Component Libraries<br>___ DCOM, CORBA, XML<br>___ Digital Certificates<br>___ Application Service Providers | Management<br>___ Configuration Management Tools<br>___ Spiral Refinement<br>___ SEI's CMM, TSP |
| | Implementation<br>___ Integrated Development Environments<br>___ GUI Builders<br>___ Aspect-Oriented Programming<br>___ Design Patterns<br>___ Visual Programming<br>___ Application Generators<br>___ Domain Modeling Tools | |

# Inspect Requirements and Design

| | |
|---|---|
| 14-1 | Has the development contractor implemented a formal, structured inspection/peer review process? |
| | On a scale of one to seven (one being the least and seven being the most) how effective is it? |
| 14-2 | Are all products that are placed under CM (and used as a basis for subsequent development) required to pass a formal inspection or structured peer review prior to release to CM? |
| | When are such inspections conducted (check all that apply)? |
| 14-3 | Does the development contractor collect and report metrics on the number of defects found and the efficiency of removal? |

U.S. AIR FORCE

# Manage Testing as a Continuous Process

| | |
|---|---|
| 15-1 | Does this program have a comprehensive test process (across all program phases)? |
| | On a scale of one to seven (one being the least and seven being the most) how effective is it? |
| 15-2 | Have the program office and the development contractor agreed on an overall software test plan? |
| | If so, can we get a copy? |
| | Who is actively involved in the testing process? |
| | On a scale of one to seven (one being the least and seven being the most) how trained, skilled and motivated are the test team? |
| 15-3 | Is there someone in the program office responsible for monitoring the test activity? |
| | Who is it? |
| | On a scale of one to seven (one being the least and seven being the most) how qualified is he/she to operate in this position? |
| 15-4 | Which of the following does this program use (check all that apply)? |
| 15-5 | Which types of testing does this program use (check all that apply)? |
| 15-6 | On a scale of one to seven (one being the least and seven being the most) are the time and resources reserved for testing adequate? |
| | On a scale of one to seven (one being the least and seven being the most) how well does the testing being done balance risk with available time and resources? |

# Compile and Smoke Test Frequently

| | |
|---|---|
| 16-1 | Does the development contractor use a process of frequent (one- to two-week intervals) software compile-builds as a means for finding software integration problems early? |
| | On a scale of one to seven (one being the least and seven being the most) how valuable has this been to the success of your program? |
| | How soon after contract award did the contractor begin this process? |
| | Are new software builds regression tested by CM prior to release to the test organization? |
| 16-2 | Does the development contractor try to provoke error conditions in the software (test to fail) and not just enter valid data or do valid operations (test to pass)? |
| | Are these "test to fail" tests run by someone other than the engineers who produced the software? |

# Sample Results to Program Manager

U.S. AIR FORCE

| PROJECT Management | PRODUCT Construction | PRODUCT Stability & Integrity |
|---|---|---|
| 1- Adopt a Program Risk Management Process | 7- Adopt Life Cycle Configuration Management | 14- Inspect Requirements and Design |
| 2- Estimate Cost and Schedule Empirically | 8- Manage and Trace Requirements | 15- Manage Testing as a Continuous Process |
| 3- Use Metrics to Manage | 9- Use Systems Based Software Design | 16- Compile and Smoke Test Frequently |
| 4- Track Earned Value | 10- Ensure Data and Database Interoperability* | |
| 5- Track Defects against Quality Targets | 11- Define and Control Interfaces | |
| 6- Treat People as the Most Important Resource | 12- Design Twice, Code Once | |
| DSB PM1 Improve Software Skills of Acquisition Managers | 13- Assess Reuse Risks and Costs | |
| DSB PM2 Adopt Effective Contract Incentives | DSB PC1 Use Executable Architectures | |
| DSB PM3 Stress Past Performance and Process Maturity | DSB PC2 Employ Iterative Design/ Development Cycles | |
| DSB PM4 Exploit Independent Expert Reviews | DSB PC3 Maintain a Strong Technology Base | |

**Source:**

Software Program Managers Network 16 Critical Software Practices™

*DSB Report on Defense Software (Nov 2000)*

Green
Yellow
Red

***DSB PM1 Improve Software Skills of Acquisition Managers – Red***

**Program Office has no chief architect and many of the staff are not highly skilled in software acquisition. Program manager has attended the DSMC software acquisition course but none of his key staff members have.**

U.S. AIR FORCE

# Sample Report to Program Manager

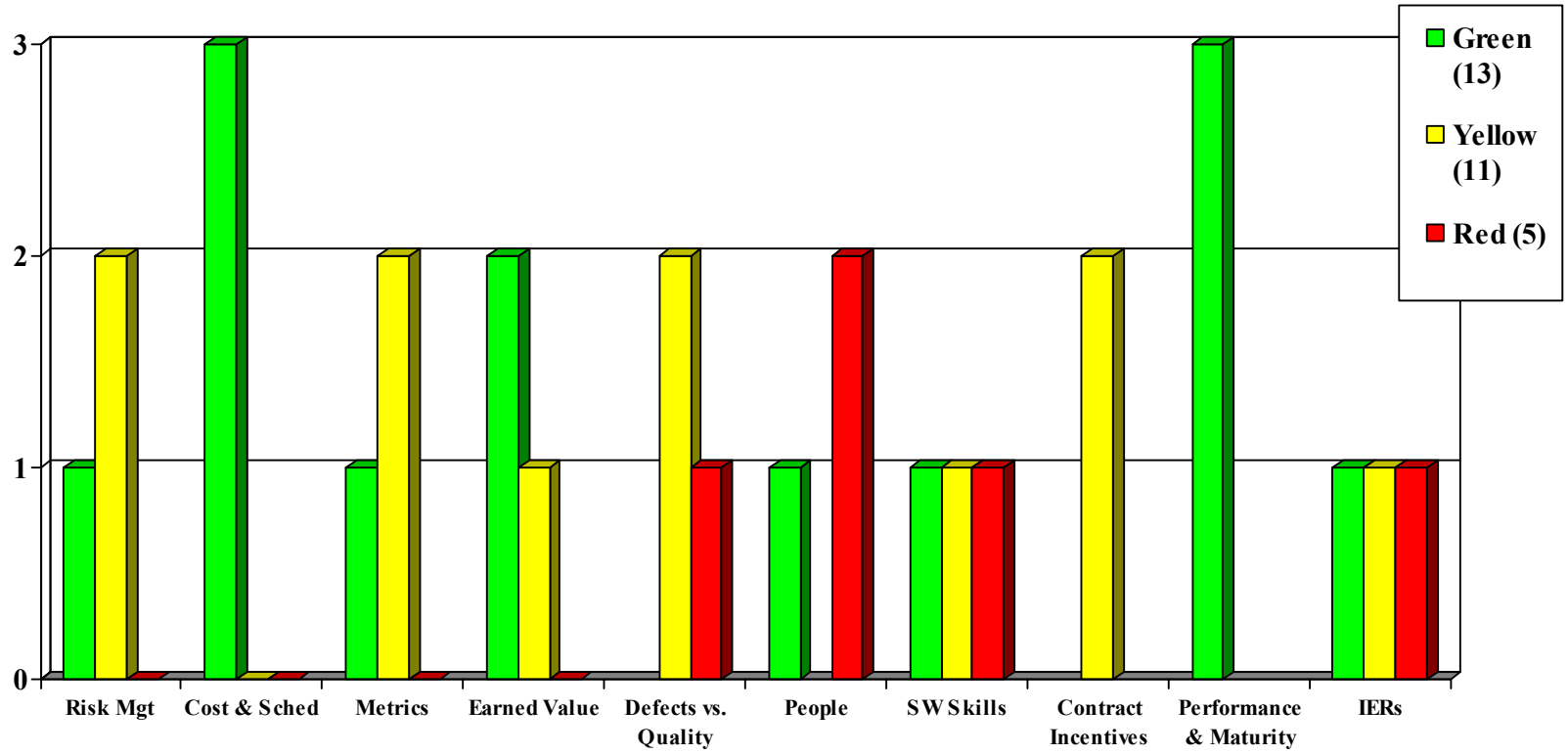
- Executive Summary
- Success Ratings and Comments
  - Program office, PEO, customer/user
- Background on initiative
- Names of people interviewed
- Detailed explanation of ratings
- Self nominated best practices and concerns
- Appendices: SPMN Critical Software Practices and selections from the Defense Science Board Report on Best Practice Recommendations

# Incomplete Data Issues

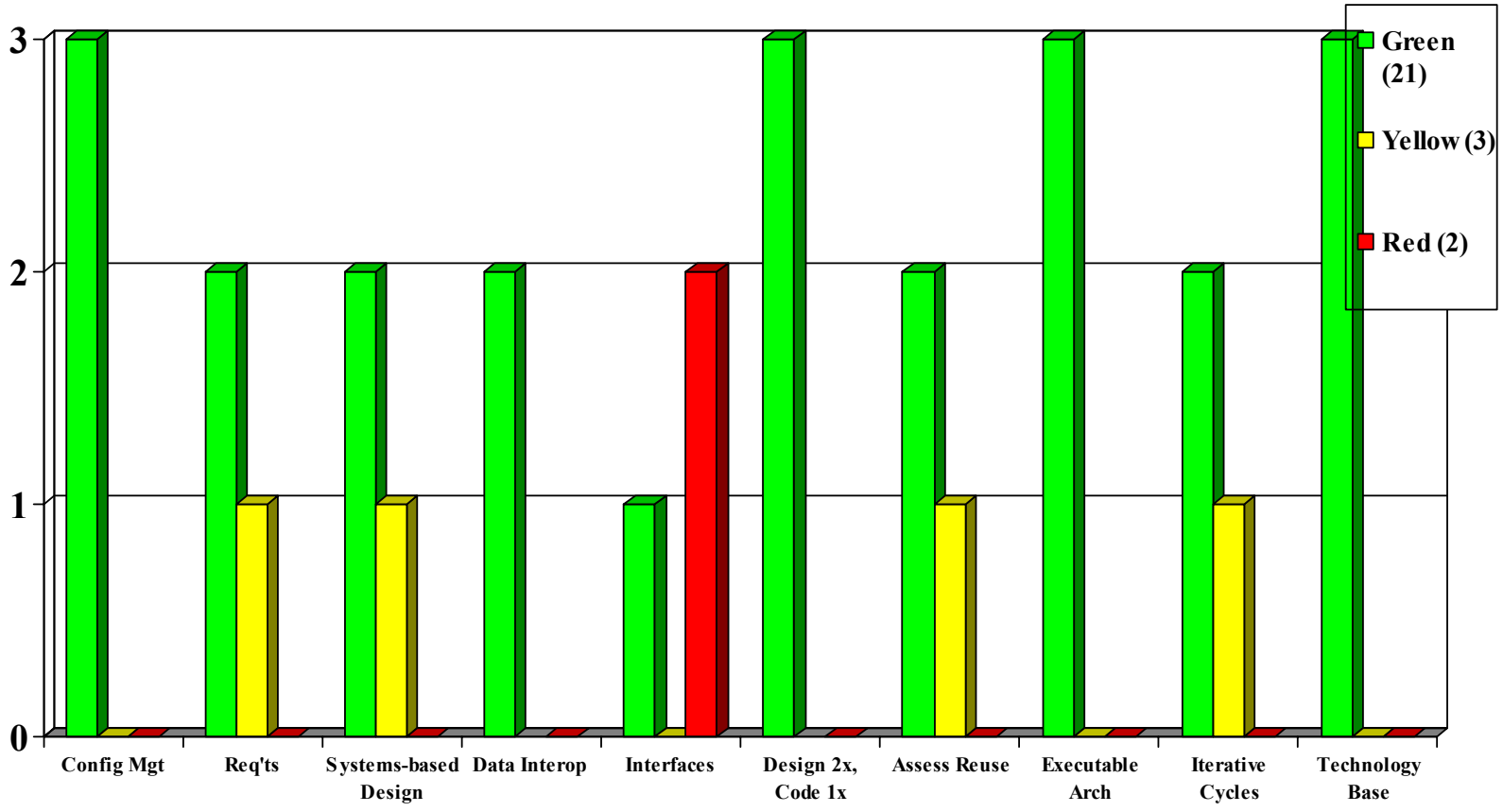
- Not all data complete, due to:
  - Unavailability of fully knowledgeable persons for interviews
  - Mismatch between Best Practices and program structures
  - Program too young (e.g. ETIMS)

U.S. AIR FORCE

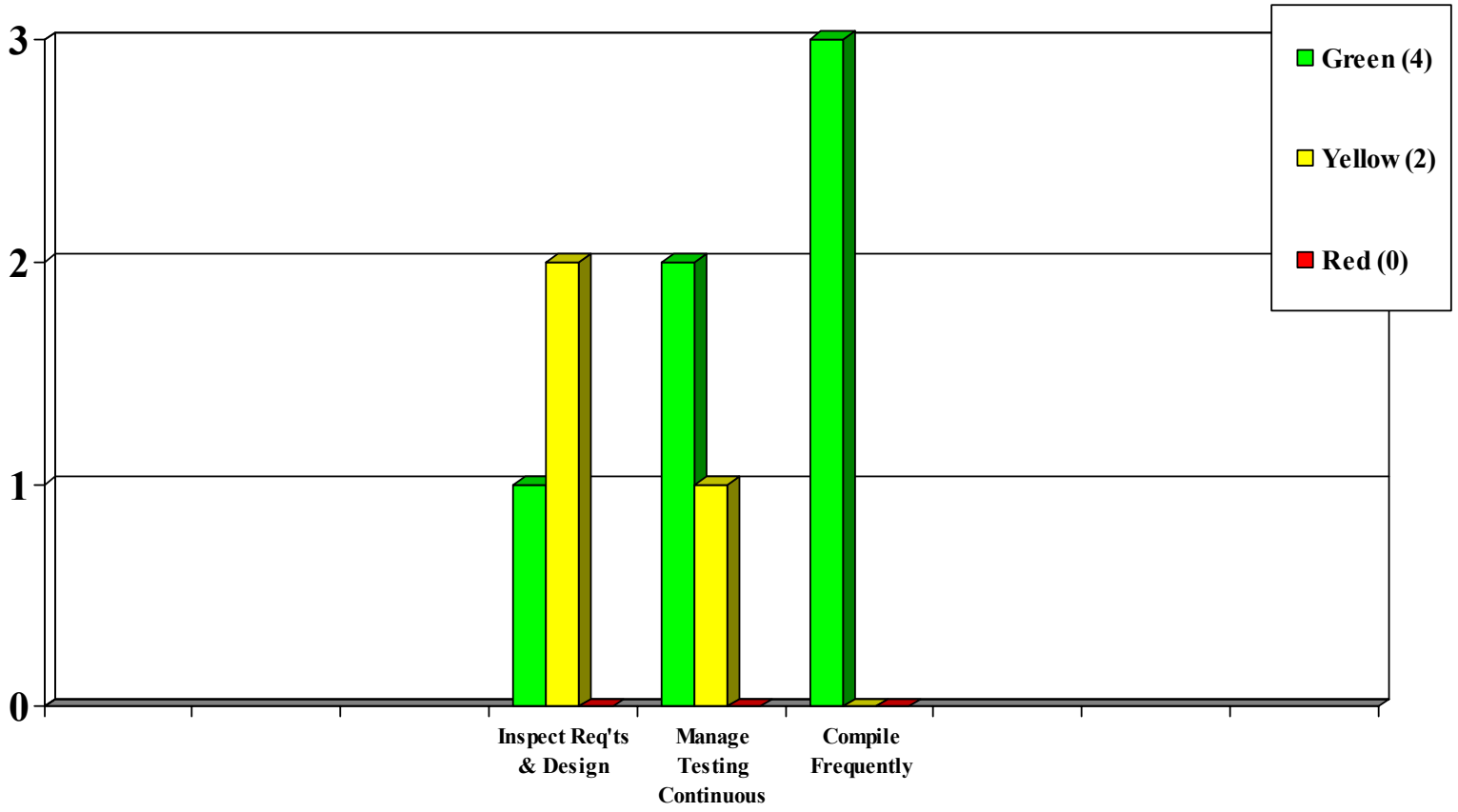
# Summary Project Management Results



# Summary Product Construction Results

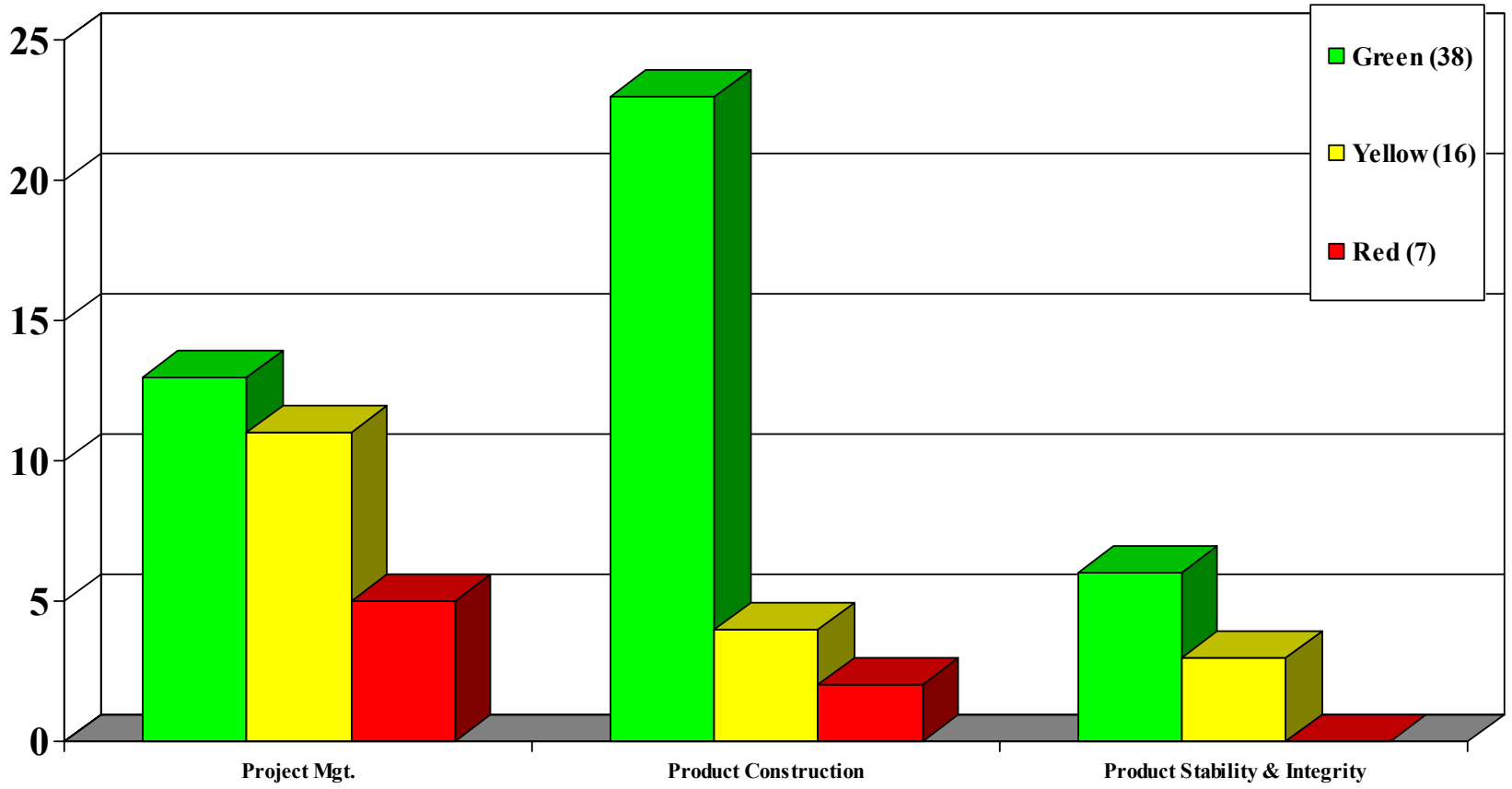


# Summary Product Stability & Integrity Results



U.S. AIR FORCE

# Overall Summary



# Best Practice Trends?

- Doing Well (3/3 green)
  - Estimate cost & schedule empirically
  - Stress past performance and process maturity
  - Adopt life cycle configuration management
  - Design twice, code once
  - Use executable architectures
  - Maintain a strong technology base
  - Compile and smoke test frequently
- Not Doing So Well (2/3 red)
  - Treat people as the most important resource
  - Define and control interfaces

# Self Nominated Highlights

- **Best**
  - Dedicated resources
  - Close working relationship with contractor, shared tools
- **Worst**
  - Need help with evolutionary acquisition, enterprise requirements
  - Need help with interfaces – technical and procedural
  - Some misunderstanding around PEO metrics

# Work Remaining

- Prepare lessons learned
  - Interview protocol necessary
  - Contractor interviews should be part of the process
  - Survey needs to be tailored to phase of program
  - Framework needs updating
- Finish sending reports to Program Managers and conduct short follow-on session
  - Value of report?  Process?
- Prepare summarization report for PEO
  - Look for trends/training opportunities
- Complete two program funded assessments!
- Prepare plan for FY04

# Notional Work Plan

U.S. AIR FORCE

| | FY 03 | | | | FY 04 | | | | ACQ TAX | | Direct | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | 03 | 04 | 03 | 04 |
| Develop Assessment Framework | | | | | | | | | .3 | .1 | | |
| Update Framework | | | | | | | | | | | | |
| Pilot Baseline Survey | | | | | | | | | .1 | | | 1+ |
| Continue Surveys... | | | | | | | | | | | | |
| Analyze/Present Results | | | | | | | | | .1 | | | 1+ |
| Analyze/Present Results... | | | | | | | | | | | | |
| Identify Best Practice "Gaps" | | | | | | | | | | .2 | | |
| Create TTPs for selected practices | | | | | | | | | | .2 | | |