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# Briefing to NDIA
# SEP to SEMP

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# SEP to SEMP

- What is Systems Engineering?
- Why is Systems Engineering important?
- Is a Systems Engineering Plan required? Why or why not?
- What is in the Systems Engineering Plan?
- What is a Systems Engineering Management Plan?
- How does the SEP relate to the SEMP?
- Why can we not just use the SEP or SEMP from a prior program?
- Can we combine the SEP and the SEMP into one document?

# What is Systems Engineering?

Process?

Profession?

A Design Approach?

A Way of Thinking?

YES

# Why is Systems Engineering Important?

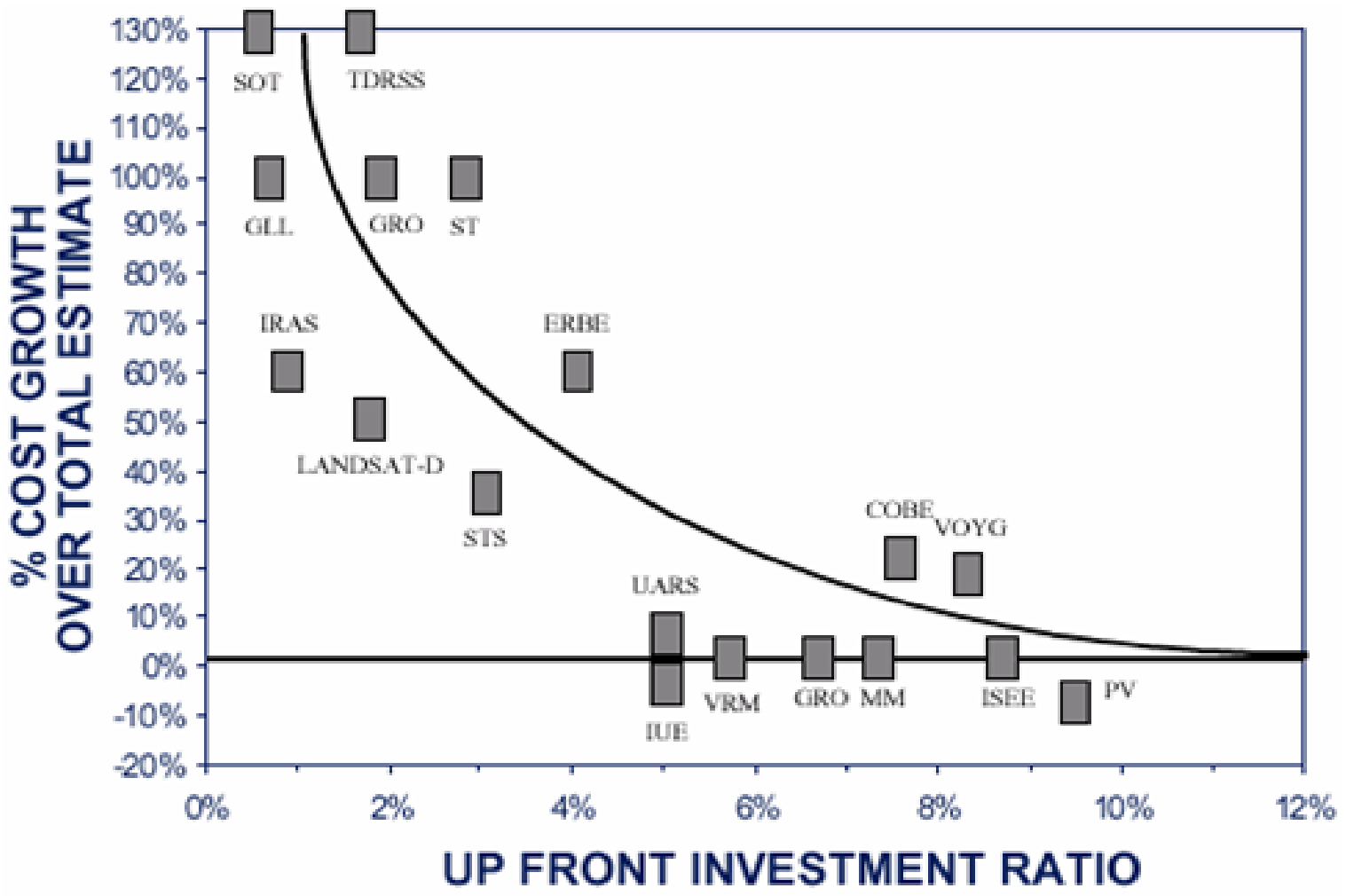
- General increase in system complexity (requirements, design, etc.), and a decrease in resources with which to develop, use, and sustain the system
- Customer requirements are often difficult to translate into design specifications.
- System Life Cycle requirements have a greater impact on the design, utilization, and disposal of the system.
- Increase in the number and complexity of sub-system interfaces. This is where most problems occur.

# Top Five SE Issues

- Lack of awareness of the importance, value, timing, accountability, and organizational structure of SE on programs
- Adequate, qualified SE resources are generally not available within Government and industry for allocation on major programs
- Insufficient SE tools and environments exist to effectively execute SE on programs
- Requirements definition, development and management is not applied consistently and effectively
- Poor initial program formulation

http://www.ndia.org/Content/NavigationMenu/Meetings_and_Events/Schedule_of_Events/Events/687l/February2003_top_5_issues.pdf).

# NASA Analysis of Up Front Investment in SE



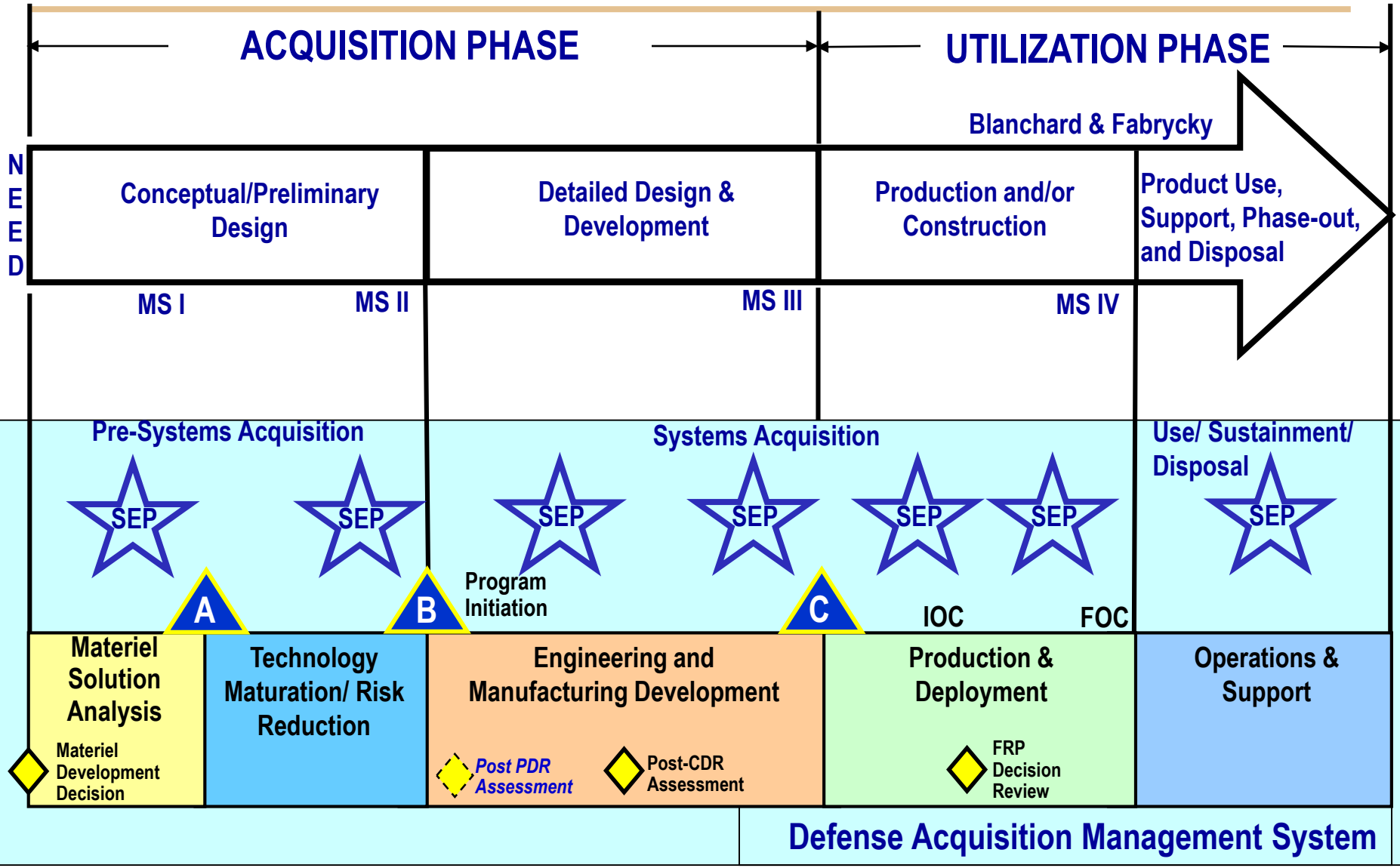

**The Systems Engineering Challenge is to bring products and systems into being that meet expectations in a cost effective manner.**

# How Do We Do This?

- We plan for it.
- We start SE planning and implementation early in the System Life Cycle.
- We continually assess how we are doing.
- We modify the SE Plan as we progress through the System Life Cycle.

# System Life Cycle

aka, Acquisition Management Framework



# Questions (?) and Answers (!)

**Q: Who directed and where is the requirement or policy?**

**A: The requirement for the SEP is now found in DoDI 5000.02, Operation of the Defense Acquisition System, Enclosure 3 (Systems Engineering). The Acting Undersecretary of Defense for Acquisition, Technology, and Logistics, issued the original policy in a USD(AT&L) systems engineering policy memorandum, dated Feb 20, 2004, requiring: "All programs responding to a capabilities or requirements document, regardless of acquisition category, shall employ a robust systems engineering (SE) approach that balances total system performance and total ownership costs within the family-of-systems, system-of-systems context. Programs shall develop a Systems Engineering Plan (SEP) for Milestone Decision Authority (MDA) approval in conjunction with each Milestone review, and integrated with the Acquisition Strategy. This plan shall describe the program's overall technical approach, including processes, resources, metrics, and applicable performance incentives. It shall also detail the timing, conduct, and success criteria of technical reviews."**

**This is guidance for the DoD Program Office, not the contractor.**

Systems Engineering Plan (SEP)
Frequently Asked Questions (FAQs)
Updated: January 28, 2015
http://www.acq.osd.mil/se/pg/sepfaqs.html

# Questions (?) and Answers (!)

**Q: Why does my program need to write a SEP, the next milestone (MS) is not for many years? [This answer addresses the requirement for MS A, B, and C.]**

A: The SEP is required because it captures the program's overall technical approach and integration to program planning required to achieve the next MS. A good SEP captures and shares a roadmap of the technical execution of your program. Program personnel should use the SEP as a reference to access information relative to the program. The SEP should be continuously updated as plans are solidified or modified, activities move from plans to historical facts, known risks are mitigated or significantly change, new risks are identified, new tools and technologies are adopted, and as a myriad of other factors cause an adjustment to the way the program technical activities should best be managed.

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# Questions (?) and Answers (!)

## Q: How does the SEP benefit post-Milestone (MS) C programs?

A: Following MS C, the SEP should be maintained as a living document throughout the system life cycle. In accordance with DoDD 5000.01, the program manager, as the total life cycle systems manager, is responsible for effective and timely acquisition and sustainment of the system throughout its life cycle. Systems engineering continues through production, fielding, deployment, and sustainment. Manufacturers will propose changes through Engineering Change Proposals, and users will introduce new requirements that must be analyzed as part of the SE process. The program manager is responsible for providing the needed product support capability to maintain the readiness, sustainment, and operational capability of a system. Effective sustainment of a system during operations and support includes a multidisciplined effort to: collect and triage all service use information, analyze root causes of problems, assess suitability and effectiveness trends, develop solutions, and manage the fielded system configuration and associated processes. Thus, the need for technical planning to ensure the application of a disciplined systems engineering approach continues beyond MS C.

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# Questions (?) and Answers (!)

## Q: How often do we need to update and resubmit the SEP?

A. The Systems Engineering Plan (SEP) Outline, April 20, 2011, states, "SE planning is kept current throughout the acquisition lifecycle. For ACAT I programs, ODASD(SE) expects to approve SEP updates to support milestone reviews (e.g., Milestone (MS) A, B, and C) and program restructures; the PEO can approve SEP updates to support SE technical reviews and program changes that impact the technical strategy."

## Q: Why is the SEP a "living" document?

A: A good SEP provides a roadmap to the technical execution of a program. Program personnel should use the SEP as a reference to understand the overall technical approach to a program. A SEP should be continuously updated as plans are solidified or modified, activities move from plans to historical facts, known risks are mitigated or significantly changed, new risks are identified, new tools and technologies are adopted, and as a myriad of other factors cause an adjustment to the program's overall technical approach.

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# Questions (?) and Answers (!)

## Q: Do you have an example of a good SEP?

A: No. There are a number of SEPs that are candidate examples, but we feel that there are very strong reasons for not providing examples:
**Programs in different domains and different Services/Agencies will use different processes.

**Any given SEP is an operating plan for how that program will execute its systems engineering. How one program executes its systems engineering may differ greatly from how another program will execute its systems engineering. This could depend on many factors including the program's scope, acquisition strategy, risk, life cycle phase, etc. Without knowing these underlying influences, the technical planning in one SEP may or may not apply to another program.

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# Questions (?) and Answers (!)

**Q: Can we use existing related, relevant documentation rather than redeveloping or reformatting existing documentation?**

**A: Existing documentation can be used to the extent it captures relevant systems engineering technical planning. For example, the program may have a contractor's plan for technical planning. However, it generally does not include the Government program manager's plan for technical management of the program. We have also found that prime contractor's technical plans are often weak in flowing down systems engineering processes and requirements to subcontractors and vendors. Follow the guidelines provided in the question above regarding referencing other documents, as to proper referencing and maintaining the supporting information.**

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# Questions (?) and Answers (!)

**Q: What is the difference between the SEP and the SEMP?**

**A: In the USD(AT&L) systems engineering policy memorandum, dated Feb 20, 2004 and subsequent DoD 5000.02 update, we chose to call the document a "Systems Engineering Plan (SEP)." While the Systems Engineering Management Plan (SEMP) is a traditional term used previously in DoD and more common with industry, we have no preference regarding the title of your technical planning document. The important point to keep in mind is the content of the document, not the title of it.**

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# Questions (?) and Answers (!)

**Q: Do I need both a SEP and SEMP, or can they be combined into one document?**

**A: This question assumes the SEP is a "government" product and that the SEMP is a "contractor" document; however, this is not a valid distinction. That said, the decision on combining the program office's technical planning with the contractor's technical planning is an individual program decision based on resource limitations and other factors unique to the situation. If you choose to have one document, it must capture the technical planning for the entire program. If you choose to have two documents, for example, a "SEP" for the program office responsibilities and a "SEMP" for the contractor effort, the two documents must have a common systems engineering thread, linking the technical planning from the program office down to the lowest level supplier. The bottom line is that we expect a program to have a "shared vision" of the overall technical planning effort, regardless of how many documents contain that shared vision.**

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# Questions (?) and Answers (!)

**Q: Is the contractor SEMP adequate to meet the requirement?**

**A: A contractor's systems engineering plan is acceptable only if it addresses the overall program's systems engineering technical approach across the government, prime, and sub-contractor domains. Prime contractor systems engineering plans typically only address the technical planning associated with the prime contractor's effort, and do not necessarily encompass the entire technical effort associated with a program, such as requirements trade space for which the government retains authority, government furnished equipment, integrated developmental and operational test requirements and planning, etc. We have also found that prime contractor's documents do not adequately flow down the systems engineering process and requirements to subcontractors and vendors. However, if your program has an existing contractor systems engineering plan, you may cross reference that technical planning to the overall technical planning for the program described in the SEP.**

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# New SEP Outline Content and Purpose

| Key Sections | Rationale |
|---|---|
| **1. Introduction** | • Tracks revision control |
| **2. Program Technical Requirements**<br>2.1. Architectures and Interface Control<br>2.2. Technical Certifications | • Summarizes the expected architecture products, external interfaces, and links to common architectures<br>• Identifies required system-level certifications |
| **3. Engineering Resources and Management**<br>3.1. Technical Schedule and Schedule Risk Assessment<br>3.2. Engineering Resources and Cost/Schedule Reporting<br>3.3. Engineering and Integration and Risk Management<br>3.4. Technical Organization<br>3.5. Relationships with External Technical Organizations<br>3.6. Technical Performance Measures and Metrics | • Documents integrated, event-driven system development schedule including WBS and IMP/IMS<br>• Describes risk management process and organization; identifies system-level technical risks and opportunities<br>• Diagrams technical structure and staffing (e.g., IPTs, Working Groups, etc.)<br>• Identifies management of outside organizational interfaces<br>• Describes program's use of metrics to measure technical progress |
| **4. Technical Activities and Products**<br>4.1. Results of Previous Phase SE Activities<br>4.2. Planned SE Activities for Next Phase<br>4.3. Requirements Development and Change Process<br>4.4. Technical Reviews<br>4.5. Configuration and Change Management Process<br>4.6. Design Considerations<br>4.7. Engineering Tools | • Summarizes completed system-level technical reviews, independent reviews, and trade studies and analogous plans for the next phase<br>• Describes processes for requirements analysis, decomposition, and change management<br>• Summarizes technical review planning details and responsibilities<br>• Lists technical baseline artifacts and describes their management<br>• Identifies relevant design considerations and linkage to contracts<br>• Lists tools and required tool interfaces, if necessary |

# SEP: Mandated Tables and Figures

## Tables

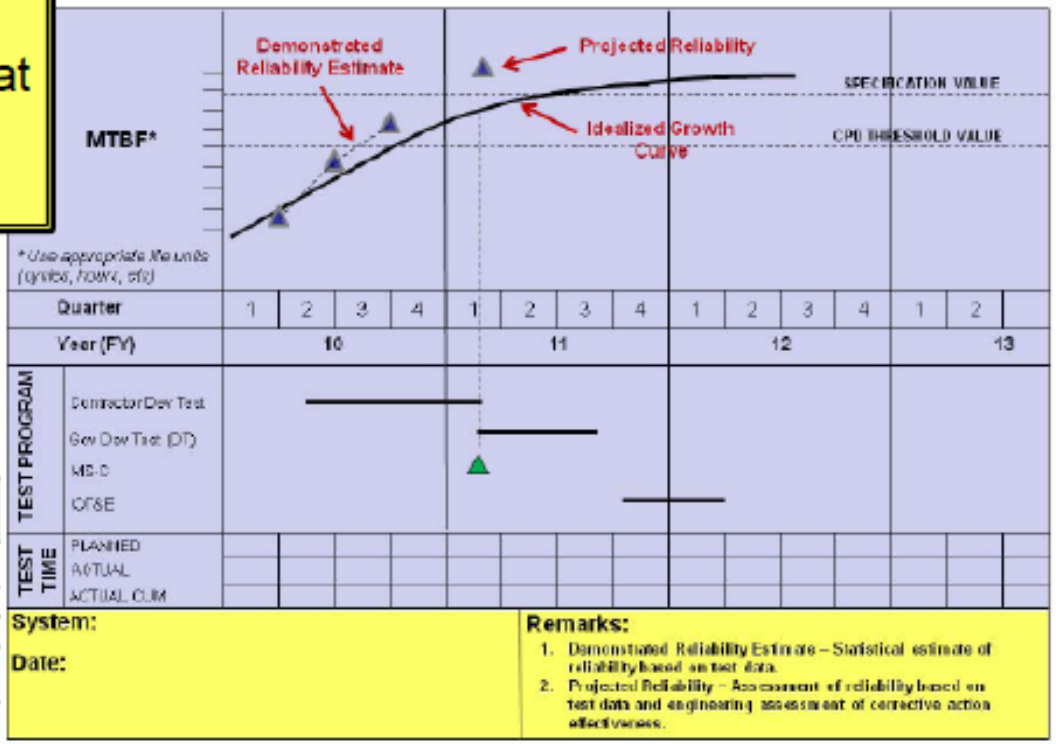
| | |
|---|---|
| Table 1.1-1 | SEP Update Record |
| Table 2.1-1 | Required Memoranda of Agreement **(NEW)** |
| Table 2.2-1 | Certification Requirements |
| Table 3.4.4-2 | IPT Team Details |
| Table 3.6-2 | Technical Performance Measures and Metrics **(NEW)** |
| Table 4.4-1-n | Technical Review Details |
| Table 4.6-1 | Design Considerations **(NEW)** |
| Table 4.6-2 | R&M Activity Planning and Timing **(NEW)** |
| Table 4.7-1 | Engineering Tools **(NEW)** |

## Figures

| | |
|---|---|
| Figure 3.1-1 | System Technical Schedule |
| Figure 3.3-1 | Technical Risk Cube |
| Figure 3.4.1-1 | Program Office Organization |
| Figure 3.4.2-1 | Program Technical Staffing |
| Figure 3.4.3-1 | Contractor Program Office Organization |
| Figure 3.4.3-2 | Contractor Technical Staffing **(NEW)** |
| Figure 3.4.4-1 | IPT/WG Team Hierarchy |
| Figure 3.6-1 | Reliability Growth Curve **(NEW)** |
| Figure 4.3.1-1 | Requirements Decomposition/Specification Tree/Baselines |
| Figure 4.5-1 | Configuration Management Process |

# New Reliability Reporting

Document the Reliability Growth Curve beginning at MS A, updated at each successive milestone, …




***Implementation of New Reliability Policy***

| R&M Engineering Activity | Planning and Timing |
|---|---|
| R&M Allocations | |
| R&M Block Diagrams | |
| R&M Predictions | |
| Failure Definitions and Scoring Criteria | |
| Failure Mode, Effects, and Criticality Analysis (FMECA) | |
| Maintainability and Built-in Test Demonstrations | |
| Reliability Growth Testing at the System and Subsystem Level | |
| Failure Reporting, Analysis, and Corrective Action System (FRACAS) | |

and report planning to generate R&M artifacts.

# DI-SESS-81785

- Supercedes DI-MGMT-81024
- The SEMP format shall be selected by the contractor. SEMP content may be tailored depending on the scope, purpose, and the acquisition phase of the program.
- The SEMP describes the contractor's technical approach and proposed plan for the conduct, management, and control of the integrated systems engineering effort.
- It shall be consistent with the government Systems Engineering Plan (SEP), if available.
- The contractor’s SEMP shall contain the annotated mapping between contractor and government SE processes. The government SE processes may be noted in the SEP. The SEMP shall also show alignment of contractor and subcontractor SE processes.

# Summary

- Systems Engineering is an essential component of the management of today's complex systems.
- Successful Systems Engineering requires planning, execution, monitoring and updating.
- The government program office must convey to the contractor their needs and expectations relative to technical management of the program.
- Utilizing their internal SE processes, contractors must also plan, execute, monitor, and modify the use of those processes in support of the government program office.
- The SEP and the SEMP must be consistent and may be the same document.
- Plans are worthless; planning is invaluable. Gen Eisenhower.