USAF T&E Community Views on T&E/SE Interactions

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Overview

- Rules of Engagement
- Bottom Line Upfront
- T&E/SE Interactions Today
- The Way Ahead
- Conclusions & Recommendations

Rules of Engagement

- Limited to US Air Force (DT&E and AFOTEC) Only
- Importance of Lexicon: What Do We Mean By T&E?
- Who Conducts T&E?
- T&E Often Used Simultaneously—But…
- DT&E: “Verification” (System Work As Designed?)
- OT&E: “Validation” (Is System Effective?)

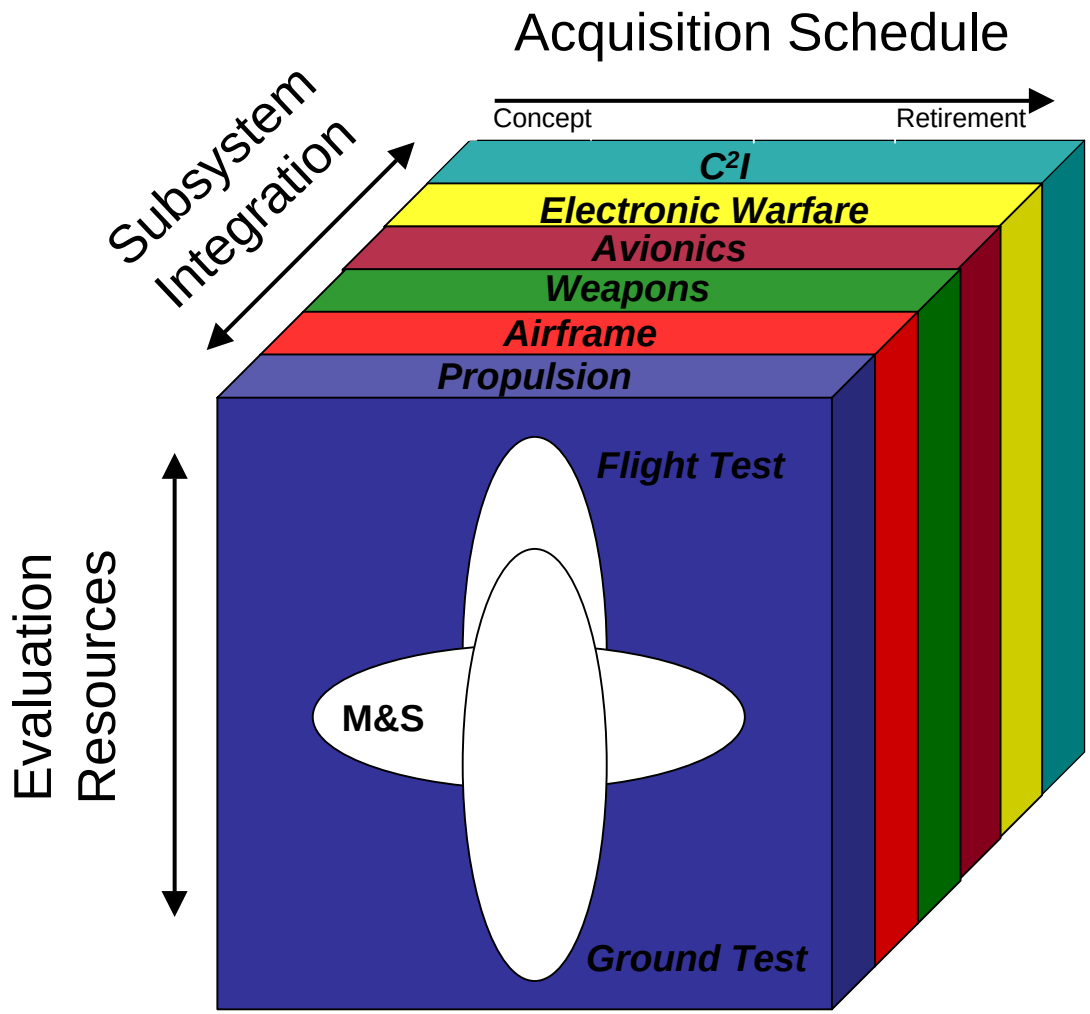
GOAL: THOUGHT-PROVOKING/PROVOCATIVE DISCUSSIONS

Bottom Line Upfront

- T&E is an Enabler for Program Success
- SE Process Used Throughout T&E Processes
- T&E/SE Should Be Inseparable But…
  - Independent governmental DT&E eroded
  - Concerns with SoS/FoS Integration
- Early involvement getting better but could be better
  - OT&E—Yes / DT&E (Gov't) —No
- Integrated DT/OT and Early, Independent, Persistent and Continuous Governmental Test and Evaluation required to effectively and efficiently verify and validate weapon systems

T&E Role in Weapon System SE

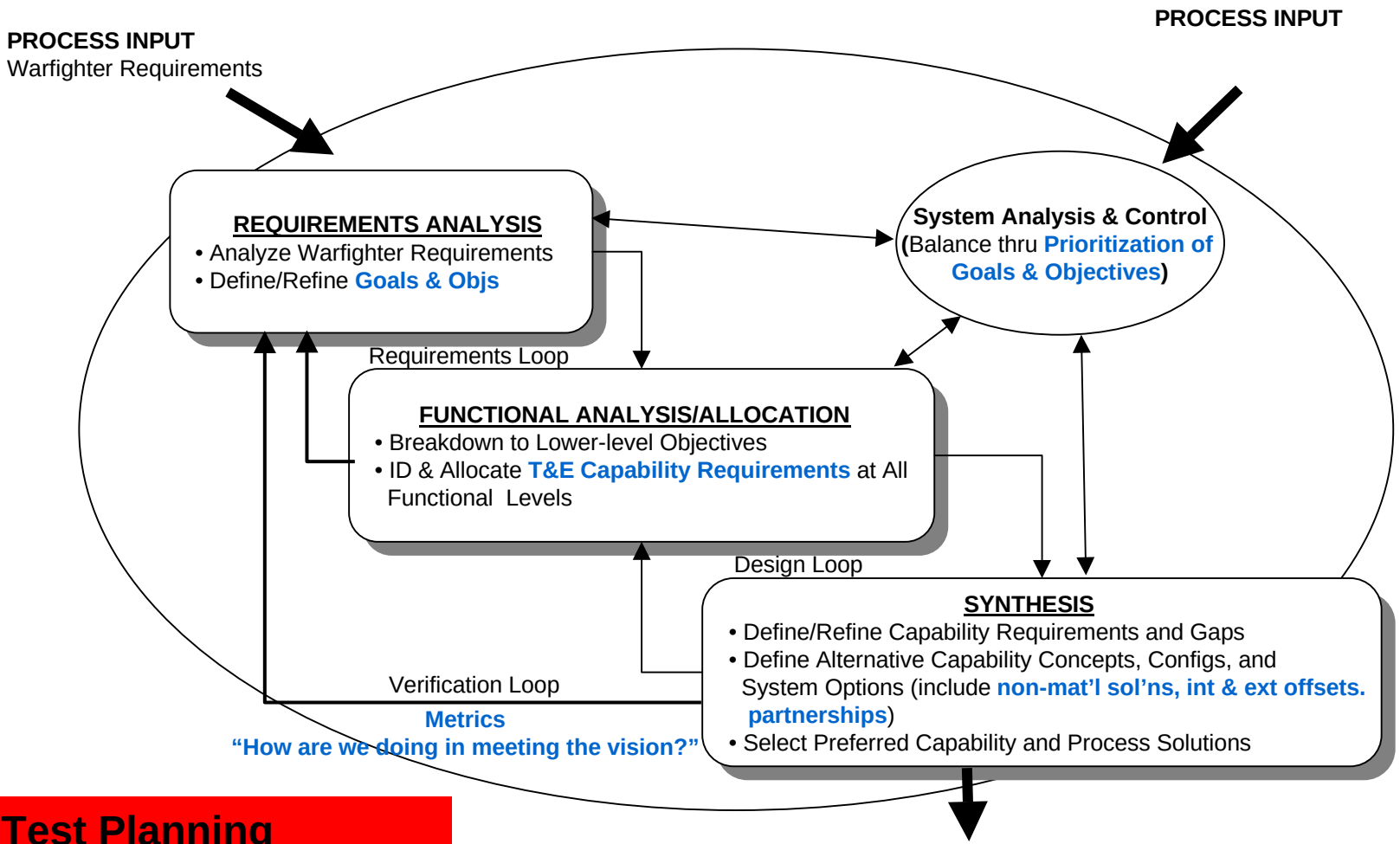
(ala Ed Kraft & Glen Lazalier)



- Integrate evaluation resources
- Integrate sub-systems ASAP and AWAP
- Reduce acquisition cycle time

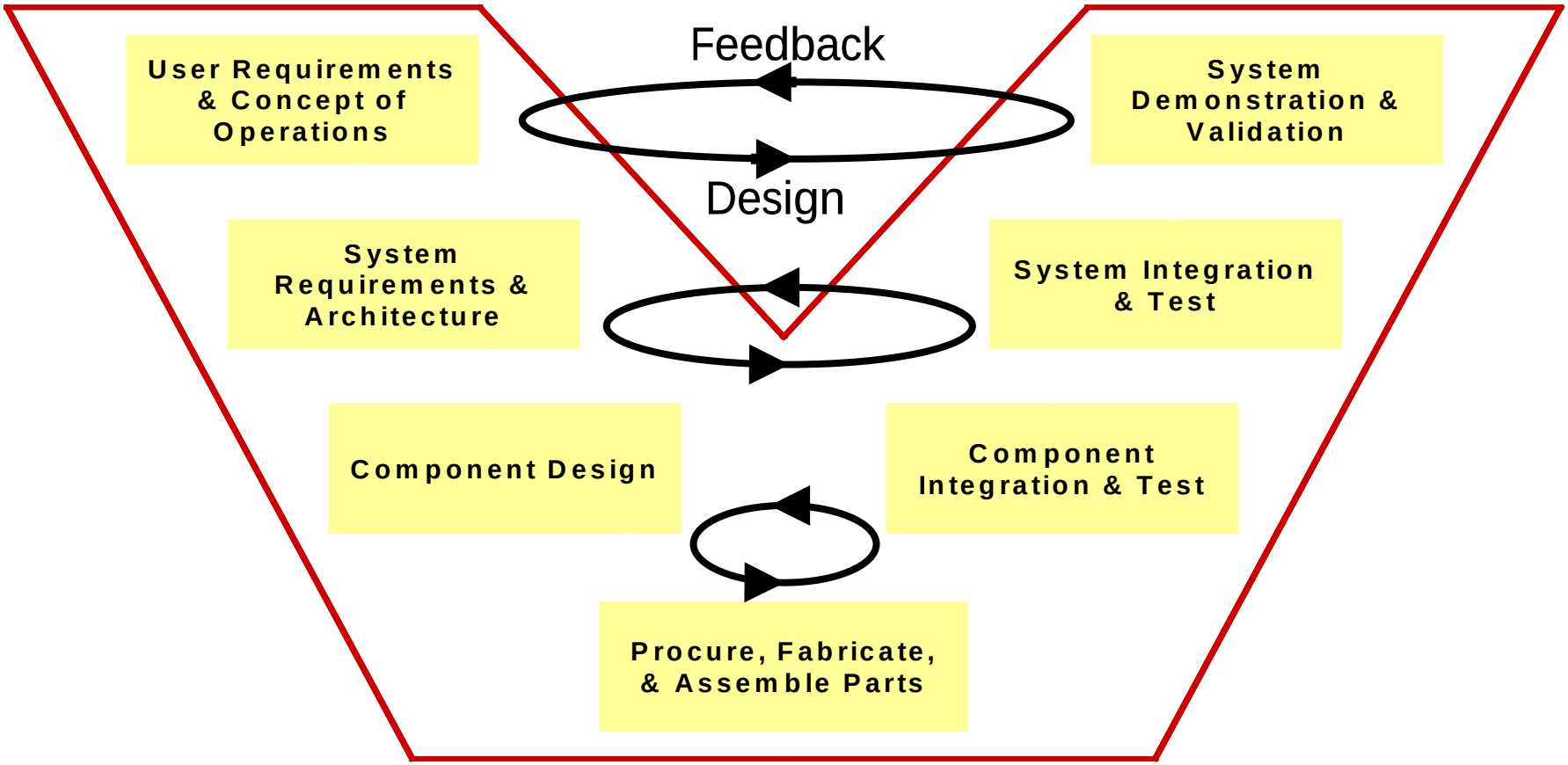
T&E IS AN ENABLER FOR PROGRAM SUCCESS

SE Role in T&E Processes



Test Planning
Safety Review Process
Roadmapping
Improvement & Modernization

T&E/SE Should Be Inseparable…



Source: International Council on Systems Engineering,1999 and Jim Hollenbach, 2004

T&E/SE THROUGHOUT ENTIRE LIFE CYCLE

…But Are They?

- Independent governmental DT&E (particularly evaluation) has eroded
  - Weakened verification step in SE Process
  - Large number of systems not certified ready for OT
- Governmental DT&E concern with SoS/FoS
  - Inherently governmental function to get past proprietary firewalls

What Can We Conclude Today?

- SE fully integrated within T&E processes
- T&E not fully integrated within SE process
  - Independent verification
- “SE Community has recognized the need to embrace T&E throughout the system life cycle; policy and implementation are works in progress”
  - SAF/AQRE

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Way Ahead

Air Force Transformation

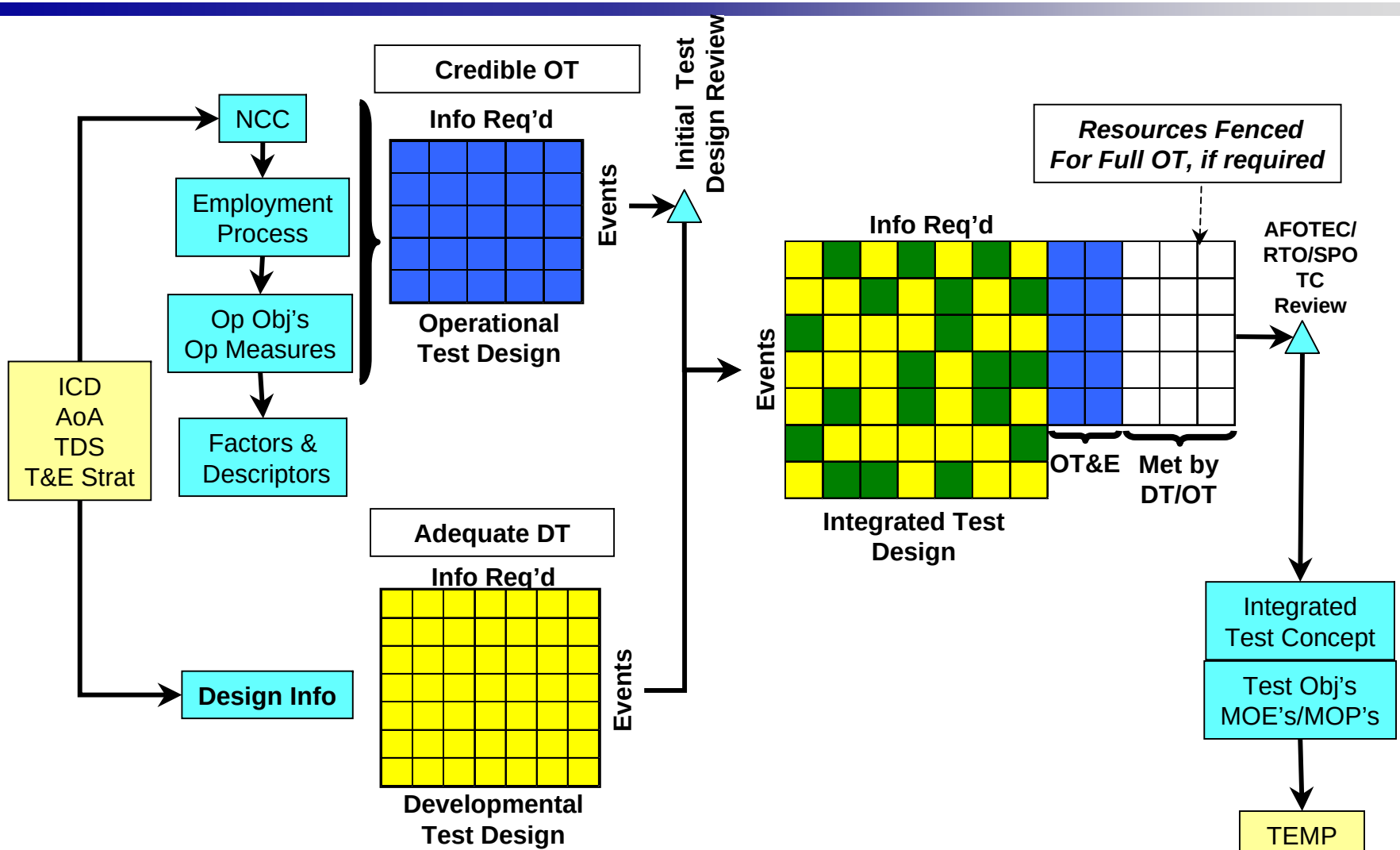
- Capabilities Based Requirements
  - In the past, requirements were written in terms of specifications
    - "Radar must see 2000 km"
  - Requirements are now written in terms of capabilities
    - "Radar must see target with sufficient distance to successfully engage and defeat"
- Evolutionary Acquisition
  - Capability not delivered all at once
  - Capability delivered incrementally as the system matures

Approach To Testing

- Early Involvement is absolutely critical!
- Operational testing with
  - PRODUCTION-REPRESENTATIVE SYSTEMS
  - STABILIZED PERFORMANCE
  - OPERATIONAL ENVIRONMENT
- Always conduct Effectiveness & Suitability testing
- Always perform Operational Impact Assessments

Integrated DT/OT

Steps to the Integrated Test Concept

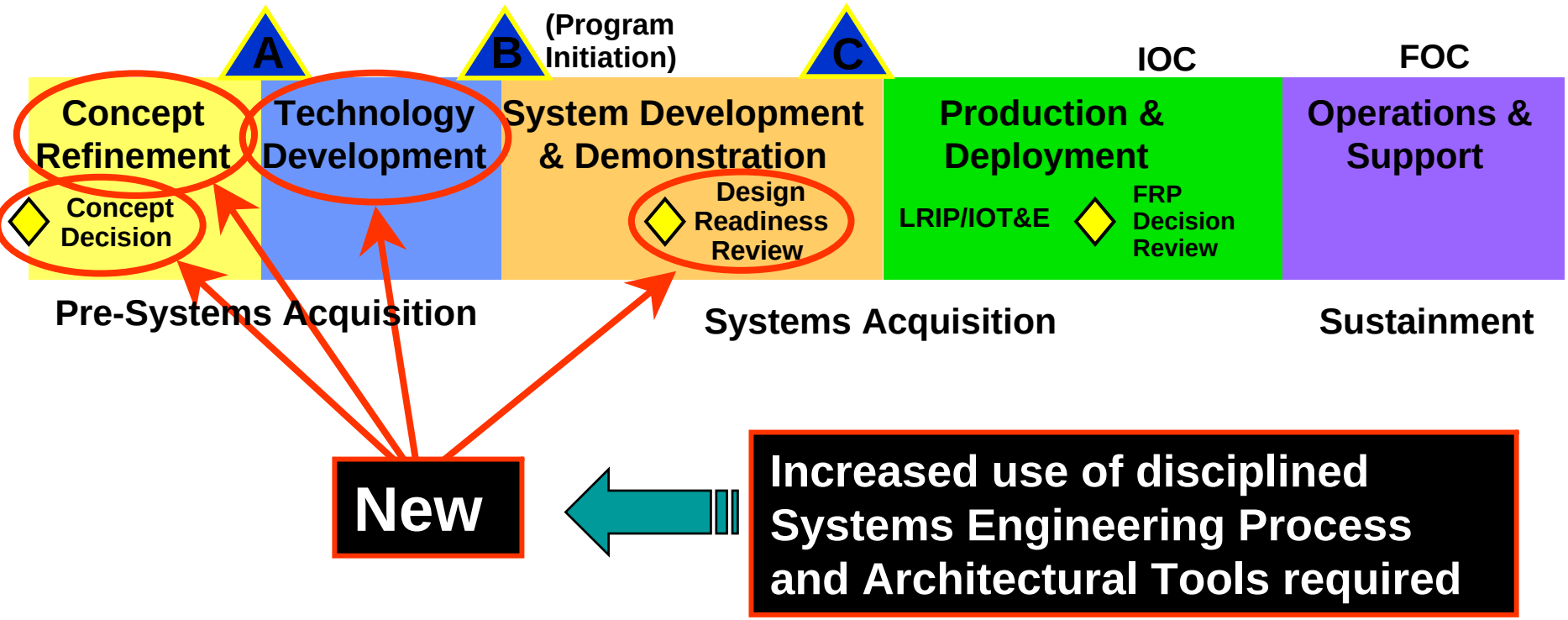


ROLE OF THE INTEGRATED TEST TEAM (ITT)

SAQ/AQ Working Definition for Systems Engineering

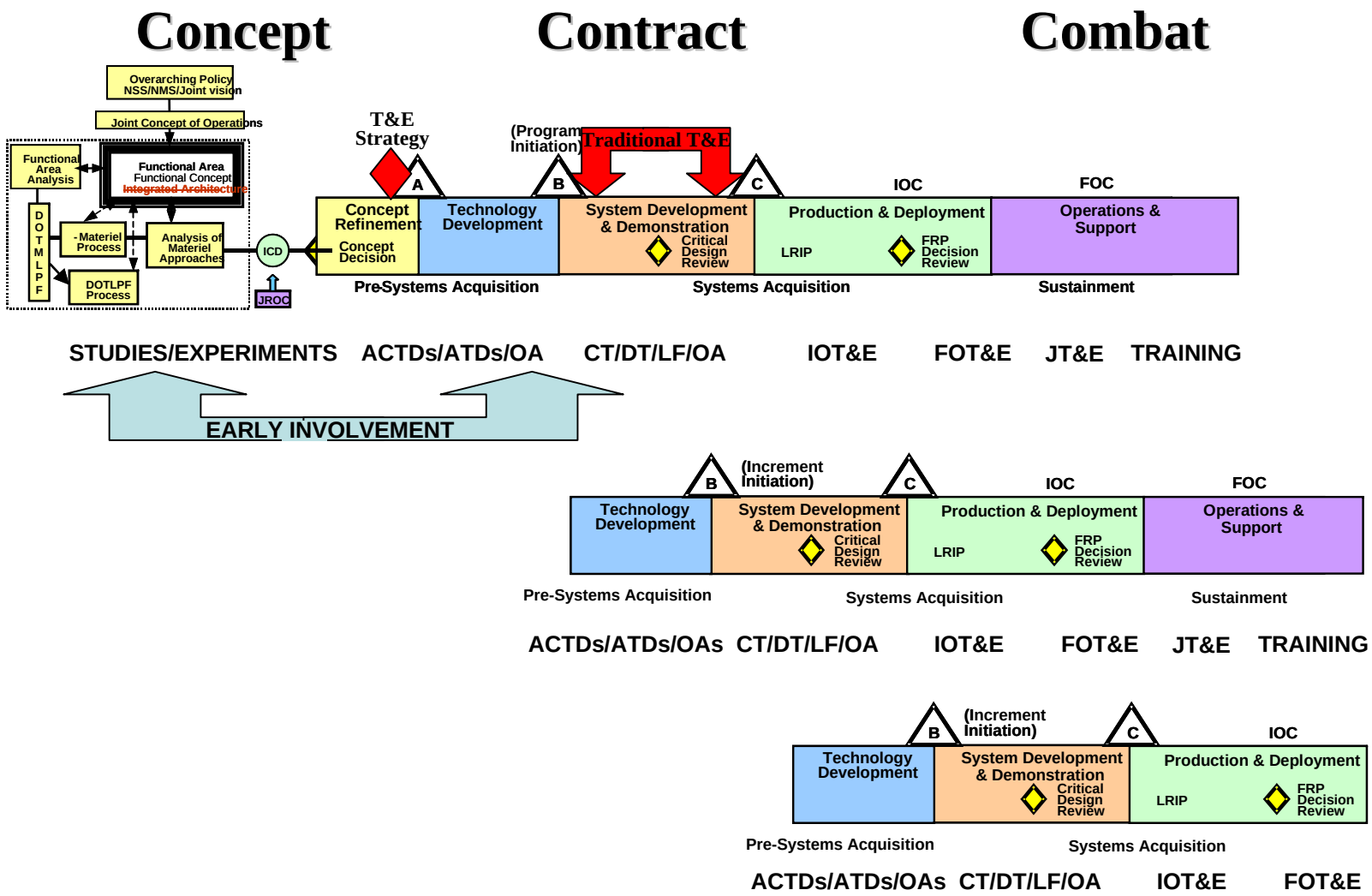
- Systems Engineering means developing systems/system-of-systems that are
  - Capable of adapting to changes in mission and requirements
  - Expandable/scaleable, and designed to accommodate growth in capability
  - Able to reliably function given changes in threats and environment
  - Effectively/affordably sustainable over their lifecycle
  - Developed using products designed for use in various platforms and systems
  - Easily modified to leverage new technologies

SE and Defense Acquisition Management Framework



DoD 5000 Series changes predominantly in upfront planning (Pre-Systems Acquisition)

Scope of Test & Evaluation
(Concept to Combat)



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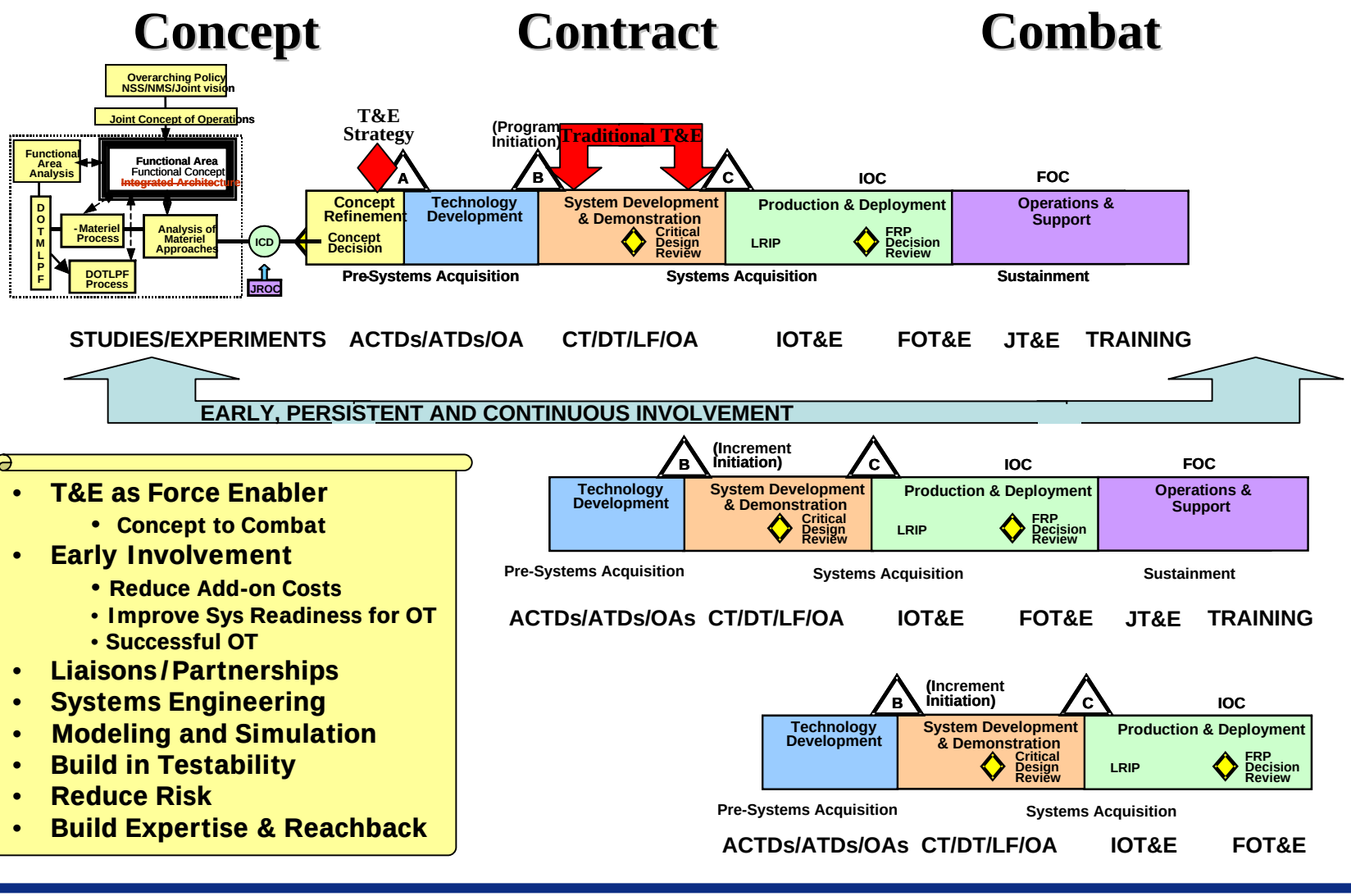

- **T&E as Force Enabler**
  - **Concept to Combat**
- **Early Involvement**
  - **Reduce Add-on Costs**
  - **Improve Sys Readiness for OT**
  - **Successful OT**
- **Liaisons/Partnerships**
- **Systems Engineering**
- **Modeling and Simulation**
- **Build in Testability**
- **Reduce Risk**
- **Build Expertise & Reachback**

Conclusions

- Systems Engineering (SE) is ingrained in key T&E processes
- Current short comings in independent governmental evaluation (verification)
  - When good systems engineering practices are not used, that quickly becomes apparent during testing (if testing is done at all)
- Consistent Early Involvement as a policy makes sense
  - OT&E—Good DT&E—Poor
  - Another tough issue is funding
- Early, Independent, Persistent and Continuous Governmental Test and Evaluation required to effectively and efficiently verify and validate weapon systems designed to rapidly deliver war-winning capabilities

Recommendations

- If USAF T&E community conclusions are consistent across Services…
  - T&E/SE Summit should address these issues
  - Possibly stand up Joint T&E Tiger Team if Summit leaves insufficient time
- Provide AT&L with recommended policy changes

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Questions

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Back Up Slides

SAF/AC: SE Refocus Objectives

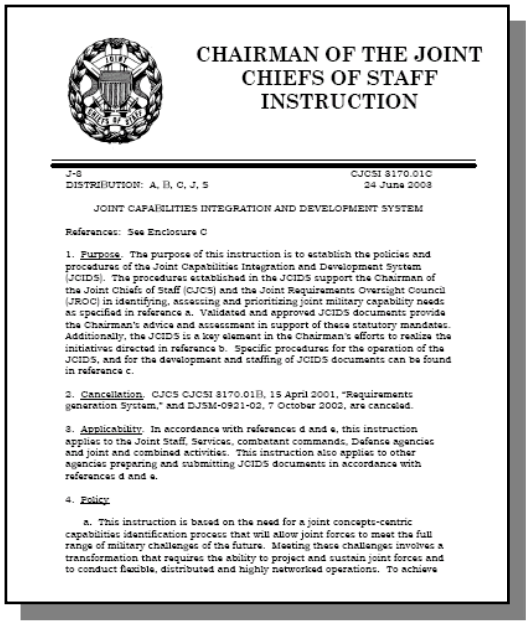
- Establish an environment founded on SE principles that delivers products that exhibit attributes of robustness:
  - Deliver promised capabilities within budget and schedule
  - Are easily scalable/expandable to meet future capability needs
  - Are desensitized to expected variabilities in manufacture and use
- Reintroduce and elevate key elements of SE as principal considerations in solicitation, award, and execution processes
- Provide sample leading indicators for proactive SE that:
  - Are measurable
  - Map to incentive strategies
  - Minimize surprises

Refocusing of AF SE Policy & Practice!

SAF/AQ: Governing Philosophy

- Change in Government SE roles
  - More emphasis in early stages of acquisition
    - Requirements for “robust” systems engineering
    - Evaluation criteria to emphasize SE in source selection
    - Selection of key items for incentive strategies
  - Insight through leading indicators (early warnings), not lagging data that capture consequences
  - Select, interpret, understand, manage
- Change in industry SE roles
  - More emphasis on design and development processes to ensure they reflect “robust” systems engineering practices
    - Design flexibility/scalability to accommodate future change
    - Insensitivity to variability in design/manufacturing/repair processes
  - Responsibility, discipline, and accountability

SE guidance in JCIDS Capability Based Requirements



CHAIRMAN OF THE JOINT CHIEFS OF STAFF INSTRUCTION

J-8 CJCSI 3170.01C
DISTRIBUTION: A, B, C, J, S 24 June 2008

JOINT CAPABILITIES INTEGRATION AND DEVELOPMENT SYSTEM

References: See Enclosure C

1. Purpose. The purpose of this instruction is to establish the policies and procedures of the Joint Capabilities Integration and Development System (JCIDS). The procedures established in the JCIDS support the Chairman of the Joint Chiefs of Staff (CJCS) and the Joint Requirements Oversight Council (JROC) in identifying, assessing and prioritizing joint military capability needs as specified in reference a. Validated and approved JCIDS documents provide the Chairman's advice and assessment in support of these statutory mandates. Additionally, the JCIDS is a key element in the Chairman's efforts to realize the initiatives directed in reference b. Specific procedures for the operation of the JCIDS, and for the development and staffing of JCIDS documents can be found in reference c.

2. Cancellation. CJCS CJCSI 3170.01B, 15 April 2001, "Requirements generation System," and DJSM-0921-02, 7 October 2002, are canceled.

3. Applicability. In accordance with references d and e, this instruction applies to the Joint Staff, Services, combatant commands, Defense agencies and joint and combined activities. This instruction also applies to other agencies preparing and submitting JCIDS documents in accordance with references d and e.

4. Policy

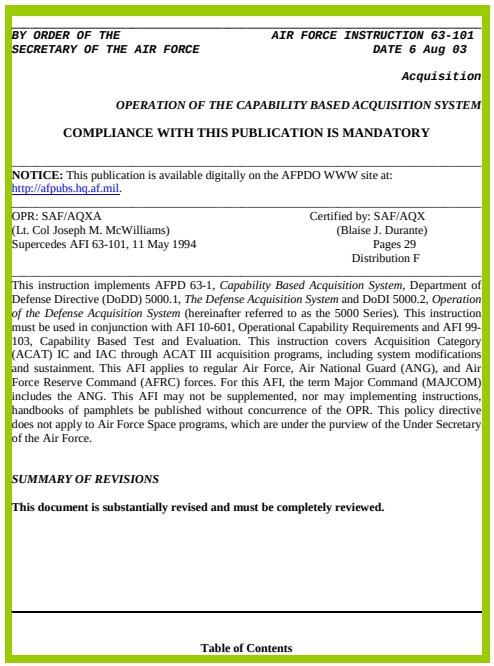
a. This instruction is based on the need for a joint concepts-centric capabilities identification process that will allow joint forces to meet the full range of military challenges of the future. Meeting these challenges involves a transformation that requires the ability to project and sustain joint forces and to conduct flexible, distributed and highly networked operations. To achieve

CJCSI 3170.01/ CJCSM 3170.01C

- **Indirect reference to** Systems Engineering
  - ***"For each attribute, provide a threshold and an objective value. Expressing capabilities in this manner*** *enables the systems engineering process* ***to develop an optimal product."***
- ***"This document does set the stage for the transition to a process founded on joint concepts and*** *integrated architectures.* ***Future revisions will complete this transition."***

Opportunities exist for increased emphasis on Systems Engineering throughout this document!

SE guidance in AFI 63-101
Operation of the Capability Based Acquisition System



BY ORDER OF THE SECRETARY OF THE AIR FORCE

AIR FORCE INSTRUCTION 63-101
DATE 6 Aug 03

Acquisition

OPERATION OF THE CAPABILITY BASED ACQUISITION SYSTEM

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

NOTICE: This publication is available digitally on the AFPDO WWW site at: http://afpubs.hq.af.mil.

OPR: SAF/AQXA
(Lt. Col Joseph M. McWilliams)
Supercedes AFI 63-101, 11 May 1994

Certified by: SAF/AQX
(Blaise J. Durante)
Pages 29
Distribution F

This instruction implements AFPD 63-1, *Capability Based Acquisition System*, Department of Defense Directive (DoDD) 5000.1, *The Defense Acquisition System* and DoDI 5000.2, *Operation of the Defense Acquisition System* (hereinafter referred to as the 5000 Series). This instruction must be used in conjunction with AFI 10-601, Operational Capability Requirements and AFI 99-103, Capability Based Test and Evaluation. This instruction covers Acquisition Category (ACAT) IC and IAC through ACAT III acquisition programs, including system modifications and sustainment. This AFI applies to regular Air Force, Air National Guard (ANG), and Air Force Reserve Command (AFRC) forces. For this AFI, the term Major Command (MAJCOM) includes the ANG. This AFI may not be supplemented, nor may implementing instructions, handbooks of pamphlets be published without concurrence of the OPR. This policy directive does not apply to Air Force Space programs, which are under the purview of the Under Secretary of the Air Force.

SUMMARY OF REVISIONS

This document is substantially revised and must be completely reviewed.

Table of Contents

AFI 63-101

7.2 Systems Engineering (SE). Robust systems engineering is essential to the success of any program. Failure to apply SE ***early on in a program*** *will inevitably result in cost, schedule, and performance problems…..*

Where appropriate, the *selection of a contractor should include an evaluation of (SE) past performance* ***as well as*** *linking (SE) performance to the contract award fee or incentive fee structure.*

*7.4 Risk Management (SE). …****The PM shall prepare and*** *maintain a current Risk Management Plan* ***for his program….***

One area of focus should be on the contractor's engineering process---…*It is imperative that the PM communicates the "true" program risks to the leadership.*

7.5 Contractor Planning and Execution. ***Detailed planning by the contractor is a key ingredient in executing the program… to promote*** *both the discipline and comprehensiveness that is essential to avoid surprises and miscommunication.*

Good Start at strengthening Systems Engineering emphasis.
Need added focus on requirement stability, cost/schedule estimates, key health indicators, and robust design attributes

“Robust” & “Robustness” in USAF SE parlance …

- These terms encompass design and process flexibility to rapidly and affordably accommodate change.
- Some areas in which change is inevitable are:
  - Increasing definition of initially ambiguous requirements
  - Evolutionary acquisition strategies
  - Underpinning technological advancements
  - Inherent variability of the design, test, production, and sustainment sub-processes embedded in SE
- For example, a term that is used in the world of networks system engineering is “scalability.”
  - There is not much value in designing, producing, and fielding a network that can only connect to 100 users when you eventually plan to accommodate millions of operators … the network must be scalable.