Systems Engineering Performance Measures

22 Oct 08

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Director of Engineering
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Sustainment Environment

727th Aircraft Sustainment Wing

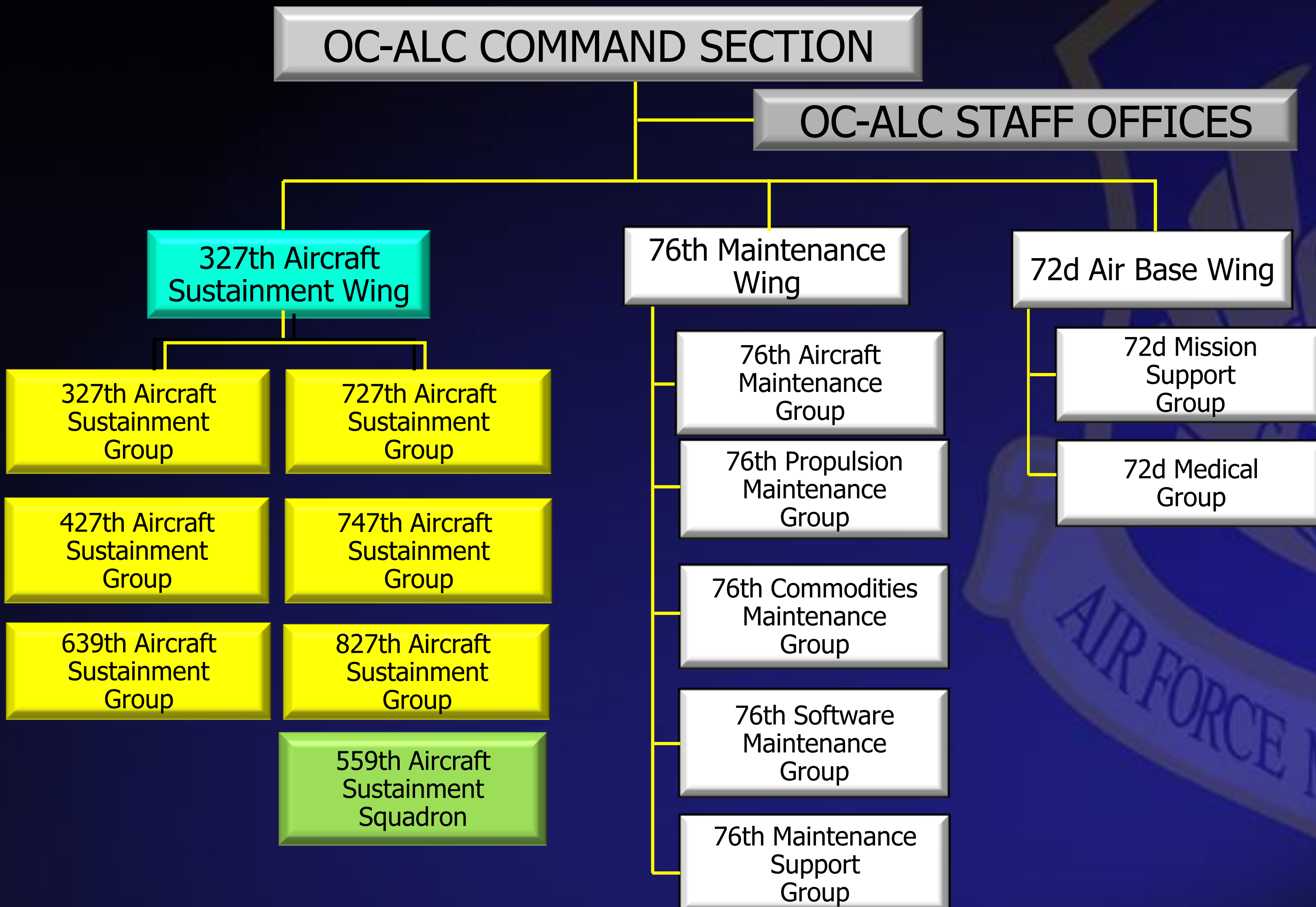
Col. Paul Waugh
Commander

Mr. Bob Valdez
Deputy Director

Mr. James Miller
Director of Engineering

PROVIDING EFFECTIVE & EFFICIENT WEAPON SYSTEM SUPPORT

OC-ALC Wing Structure



327th Aircraft Sustainment Wing

327th Aircraft Sustainment Wing
Col Paul Waugh, 736-5865
Bob Valdez, 736-5865
Jim Miller, 736-4101

Wing Group Sqdn Div

327 ACSG B-52
Col Benjamin Coffey 736-5641
Laura Culberson 736-5641

- **540 A/C Sust Sq** (B-52 Mods/Sust) — Maj Christopher Parry 734-5892; Marsha Smith 736-5211
- **541 A/C Sust Sq** (Proposed) — Edward Rua 734-5751; Ron Sandhop 7364-5938
- **Engineering Div** — Jerold Smith 736-7815
- **Contracting Div** — James Celcer 622-7263
- **Financial Mgmt Div** — Jeff Jilek, 734-6905

427 ACSG B-1
Col Michael Pelletier 736-2001
Sam Malone 736-2001

- **553 A/C Sust Sq** (B-1 Production Support) — Karen Hagar 736-2332
- **554 A/C Sust Sq** (B-1 Combat Support) — Bill Barnes 736-7578; Maj Richard Buckley 736-7578
- **555 A/C Sust Sq** (B-1 Modification) — Sherry Murphy 736-7577
- **Engineering Div** — Jeffrey Vaughn
- **Contracting Div** — Tommy Nicholson 739-2815

639 ACSG Propulsion
Greg Hughes 736-2863
LtCol Charles Darnell 736-2863

- **536 A/C Sust Sq** (F100/TF33) — Wendy Walden 734-4318; Shannon Custard 734-8729
- **537 A/C Sust Sq** (F101/108/110/118) — Lt Col Mary Cooley 736-5652; Dave Horn 736-7217
- **538 A/C Sust Sq** (TF39/TF56/Specialty) — Linda Olivarez 736-2828; Sheri Lucas (Actg) 736-2021
- **539 A/C Sust Sq** (Int'l Engines) — Lois Lum 739-2080
- **Engineering Div** — Grizelda Loy-Kraft 734-4173
- **Contracting Div** — Paula Maggard 734-8250

727 ACSG CLS
Col James Fulton 736-7995
Jerri Hulme 736-7996

- **544 A/C Sust Sq** (Tanker/Airlift) — Karl Turner 739-2985
- **545 A/C Sust Sq** (VIP/SAM) — Erik Michelsen 736-3233
- **546 A/C Sust Sq** (Special Duty) — Lt Col John Newberry 734-0362
- **547 A/C Sust Sq** (HF Communications) — Zane Boatright 734-2300
- **Engineering Div**
- **Contracting Div** — Mary Wade 739-2216

747 ACSG Combat Sys
Col Keith Weyenberg 739-3448

- **556 A/C Sust Sq** (B-2 Bomber) — Col Mark Hays 739-4260; Vacant 739-4260
- **557 A/C Sust Sq** (E-3 Command & Control) — Michael Fronkier 736-2374; Maj Scott Pukay 736-2371
- **558 A/C Sust Sq** (ATCALS) — Maj JonDavid Duvall; Carl Lippe 734-7722
- **Contracting Div** — Tommy Nicholson 739-2815

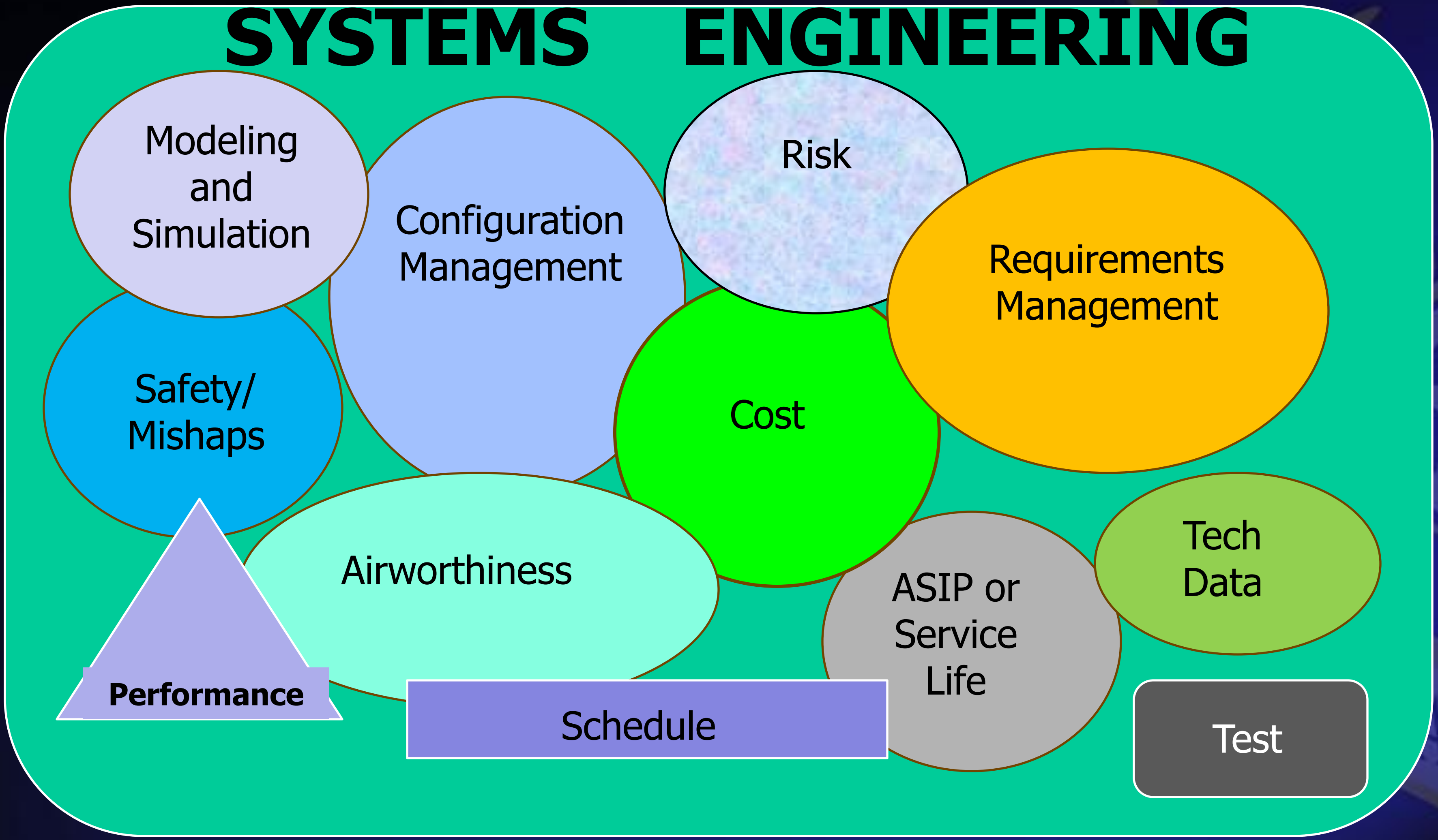
827 ACSG C/KC-135
Col James Nally 736-7755
Ralph Garcia 736-7755

- **550 A/C Sust Sq** (Combat Support) — Edward Durell 736-5391
- **551 A/C Sust Sq** (Modification) — Sherie Donahay 736-5188; Maj Jason Englund 739-8357
- **552 A/C Sust Sq** (PDM Support) — Walt Spicer 736-3284; Maj Gary Lyles 736-4446
- **Int'l Programs Div** — Norm Gibson 736-2727
- **Engineering Div** — Gaddis Gann 736-7755
- **Contracting Div** — Carl Atkison 739-5438
- **Financial Advisor** — Crystal Boston 736-7275

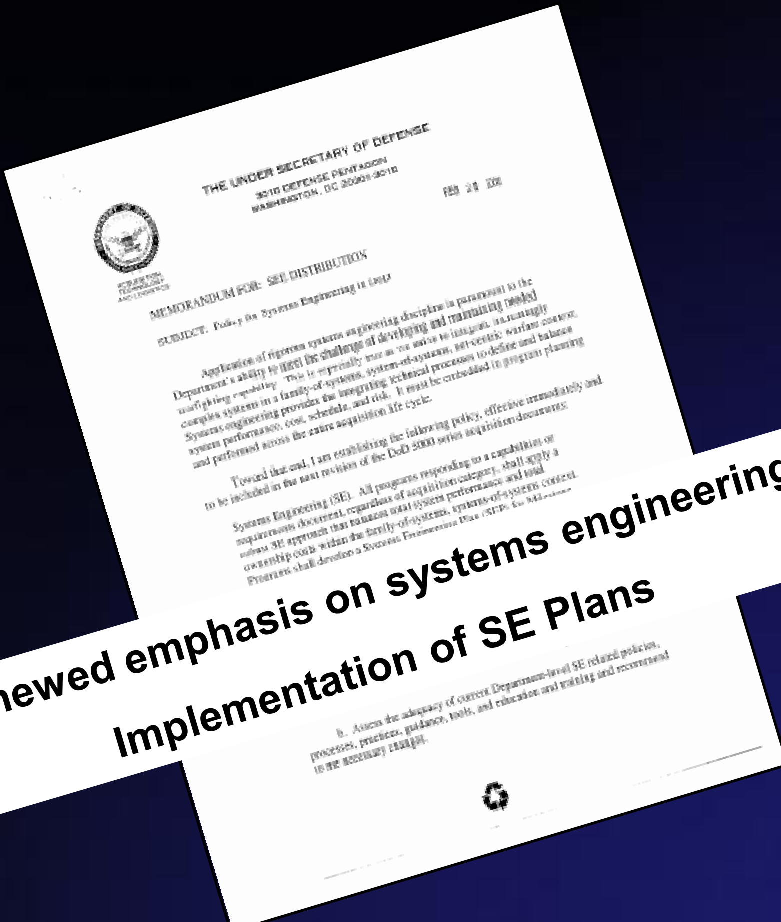
327th ASW Responsibilities

So What is System Engineering?

…Everything Can Be System Engineering



AF and DoD Sys Eng Policy



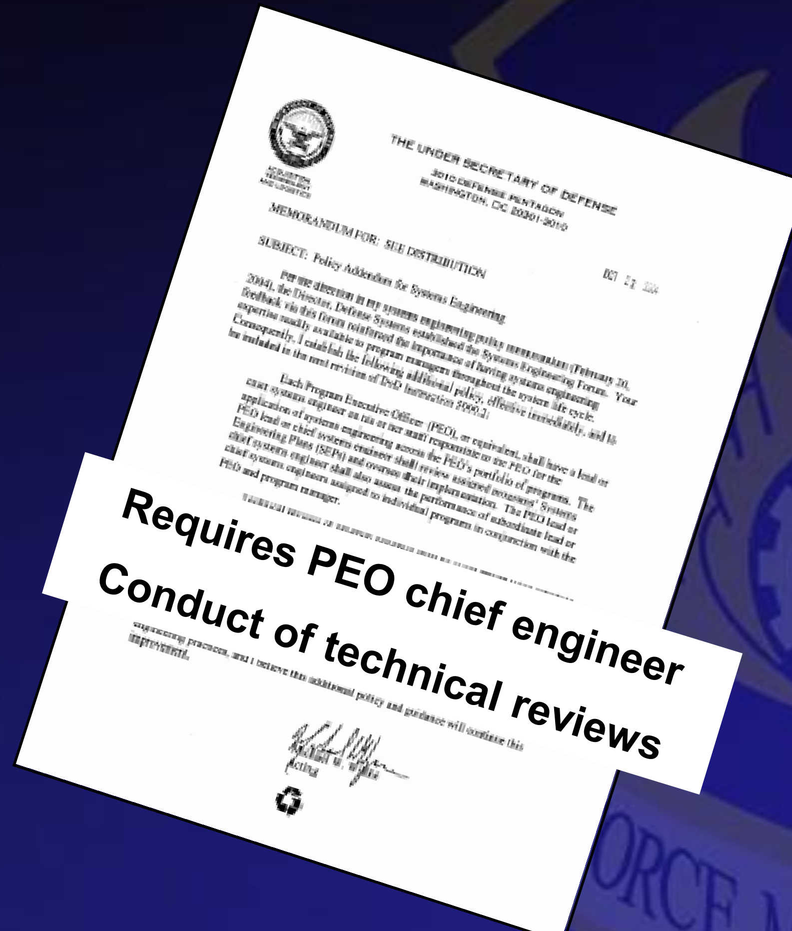
THE UNDER SECRETARY OF DEFENSE
3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

MEMORANDUM FOR: SEE DISTRIBUTION

SUBJECT: Policy for Systems Engineering in DoD

Renewed emphasis on systems engineering

Implementation of SE Plans



THE UNDER SECRETARY OF DEFENSE
3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

MEMORANDUM FOR: SEE DISTRIBUTION

SUBJECT: Policy Addendum for Systems Engineering

Requires PEO chief engineer

Conduct of technical reviews

SE Policy Addendum

Signed by the Marvin R. Sambour, Asst. SecAF (Acquisition) Apr 03 & Jan 04

- **Policy Memo 03A-005, 9 Apr 03**
  - Subj: Incentivizing contractors for Better Systems Engineering
  - "An immediate transformation imperative for all our programs is to focus more attention on the application of Systems Engineering principles…"
  - Directing the following:
    - A. Assess ability to incentivize contractors to perform robust SE
    - B. Develop SE performance incentives
    - C. Include SE processes/practices during all program reviews
- **Policy Memo 04A-001, 7 Jan 04**
  - Subj: Revitalizing Air Force and Industry Systems Engineering (SE) – Increment 2
  - "…intended to institionalize key attributes of an acceptable SE approach and outcome…"
  - "…must focus on an end state…"

Systems Engineering Policy in DoD

Signed by the Honorable Mike Wynne, USD(AT&L) (Acting) Feb 20, 2004

- All programs, regardless of ACAT shall:
  - Apply an SE approach
  - Develop a Systems Engineering Plan (SEP)
    - Describe technical approach, including processes, resources, and metrics
    - Detail timing and conduct of SE technical reviews
- Director, DS tasked to provide SEP guidance for DoDI 5000.2
  - Recommend changes in Defense SE
  - Establish a senior-level SE forum
  - Assess SEP and program readiness to proceed before each DAB and other USD(AT&L)-led acquisition reviews

So What is the Problem?

- High-level policy is there, But …
  - How do you know if you are doing it?
  - How do you measure so you drive the behavior?
- Sys Eng scope can be huge, So …
  - What tenets should be measured?
  - What are the key characteristics?
  - How can it apply across different programs and organizations?
- Sys Eng is important, Yet …
  - No accepted, standard metrics
  - No measure of sys eng current status
  - No metrics for both PM and upper management

Why Measure Systems Engineering?

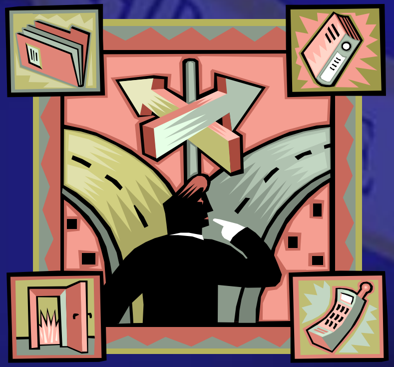
- When performance is measured … performance improves
- When performance is measured and reported … the rate of performance improves
- When performance is measured, reported, and compared … the rate of performance continues to improve

Sys Eng Metrics Key Characteristics

- Must Measure Major Components of Sys Eng
- Must Be Few in Number
- Must Avoid Extensive Data Collection Efforts
- Must Describe Current Status, Not Lagging
- Must Be Targeted for Management
- Must Allow For Comparison Between Programs, Organizations, and Time
- Must Be Cumulative (Ability to Roll-Up)

What Was Our Approach?

- Defined first 5 Sys Eng Tenets
- Step-by-step implemented systems engineering throughout the organization
- Is a tangible approach that is:
  - Aimed at the working level
  - Affects all phases of a program's lifecycle
  - Applicable throughout entire organization
  - Accounts for organization's progress through metrics
- Documented clearly in Operating Instructions (OIs)



What Each OI Has

- Brief and to the point
- Pictorially defined process flow
- Specific instructions for each process step aimed at working level
- Clearly outlines approval levels
- Defines specific metrics
- States when/where show to upper management

Tenets of Sys Eng

- Our first-cut tenet selection of Systems Engineering:
  - Requirements Management
  - Risk Management
  - Test Management
  - Airworthiness
  - Training

Tenets of Sys Eng

- **Our first-cut tenet selection of Systems Engineering:**
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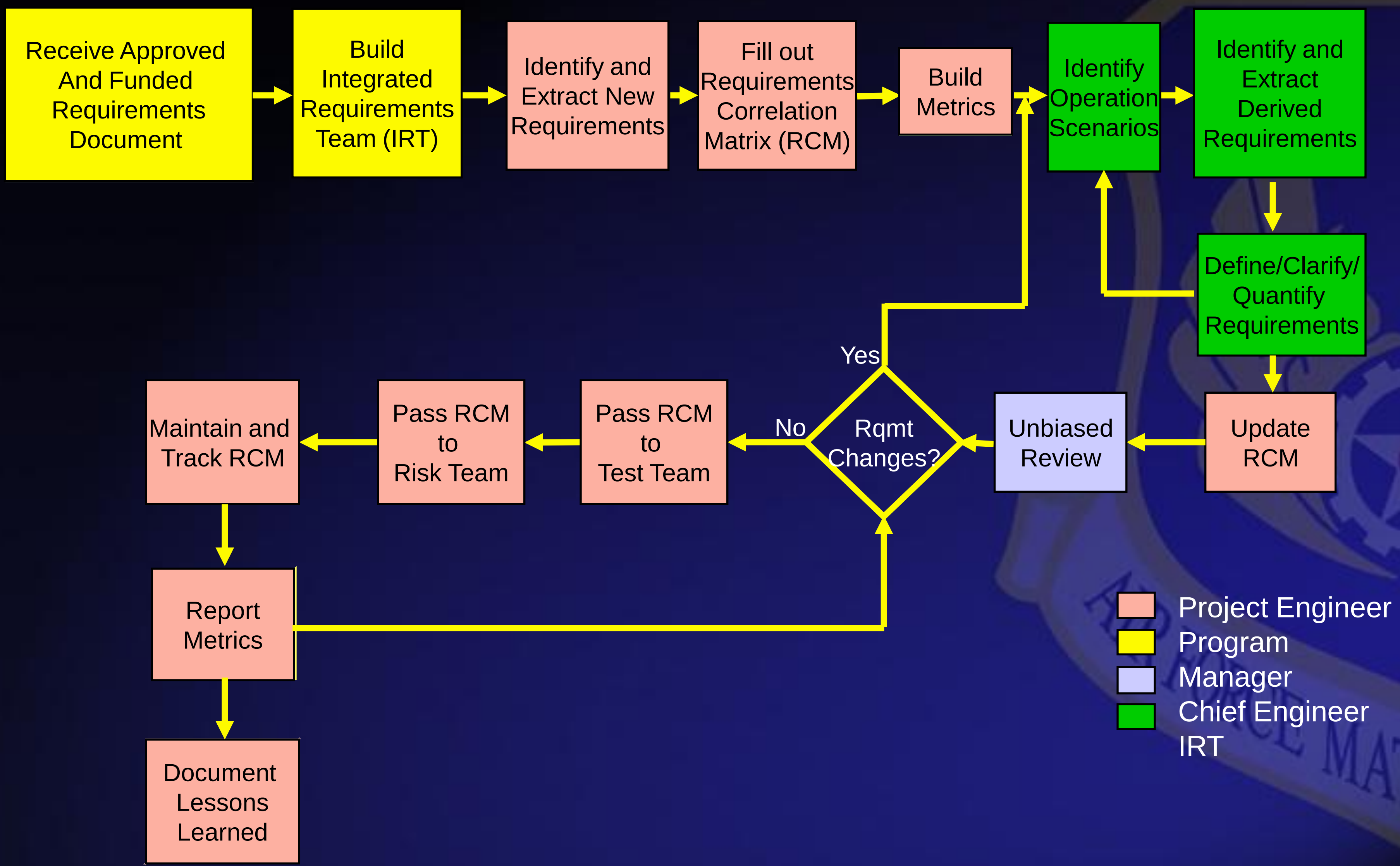
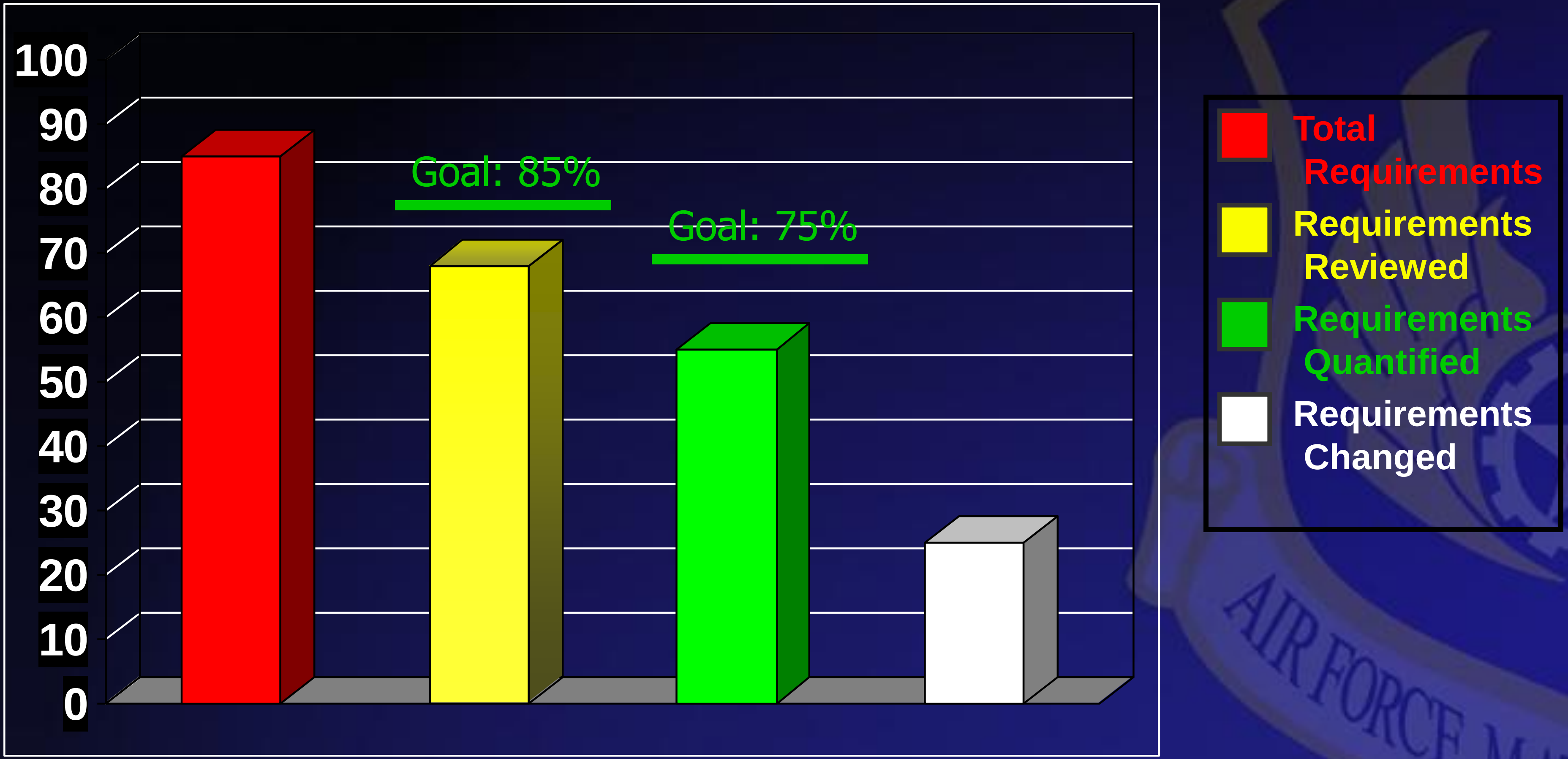
Requirements Mngt Process Flowchart

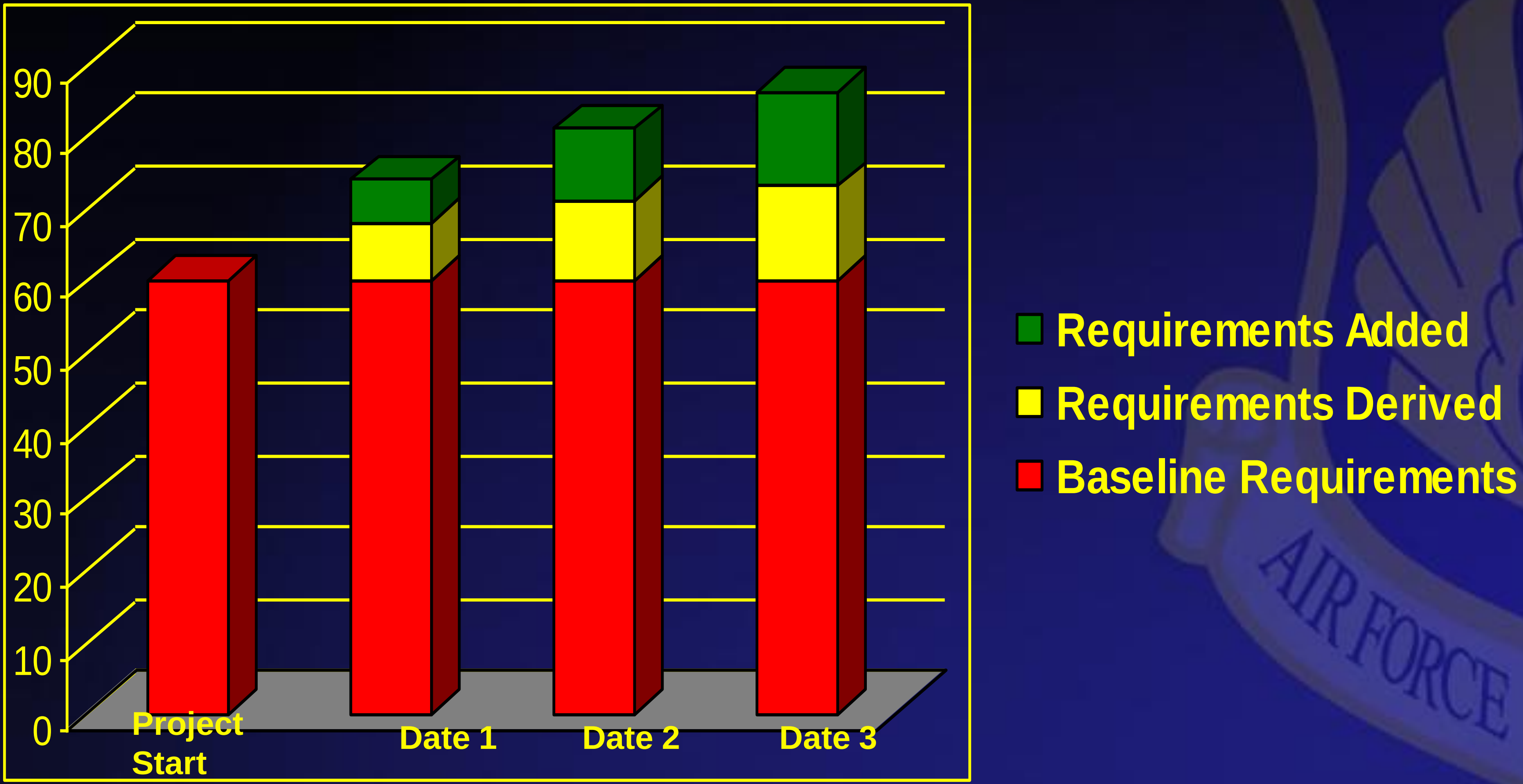


Requirements Management Metric



Total Requirements = Stated Requirements + Derived Requirements

Requirements Growth Metric



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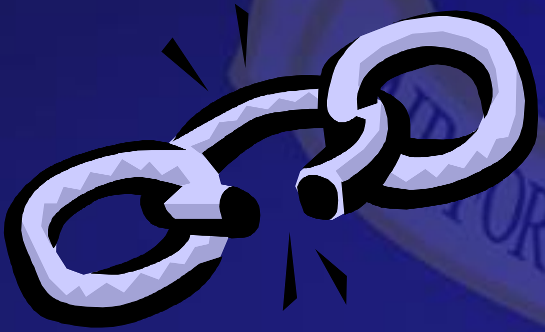


Risk Management Process Flowchart

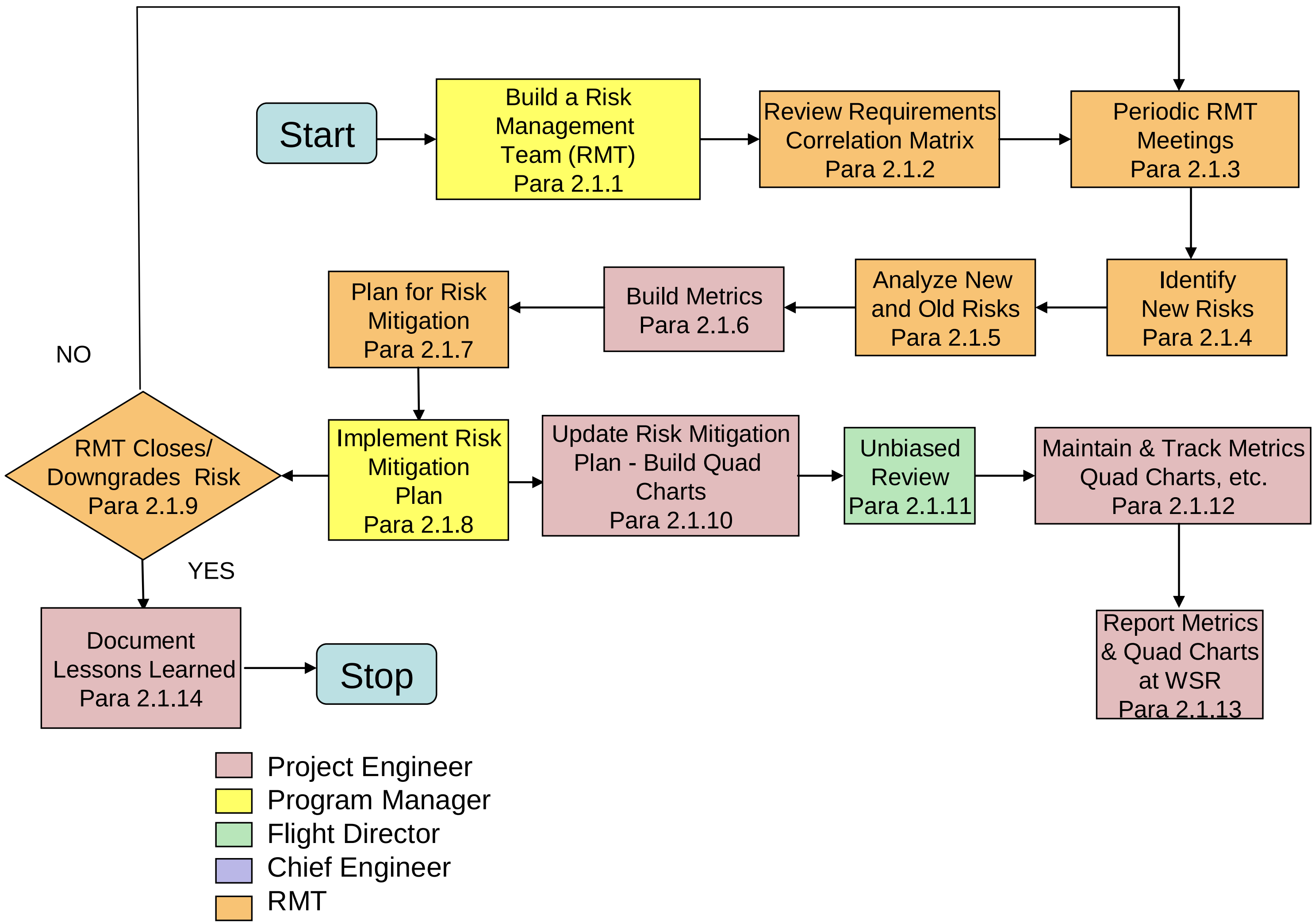
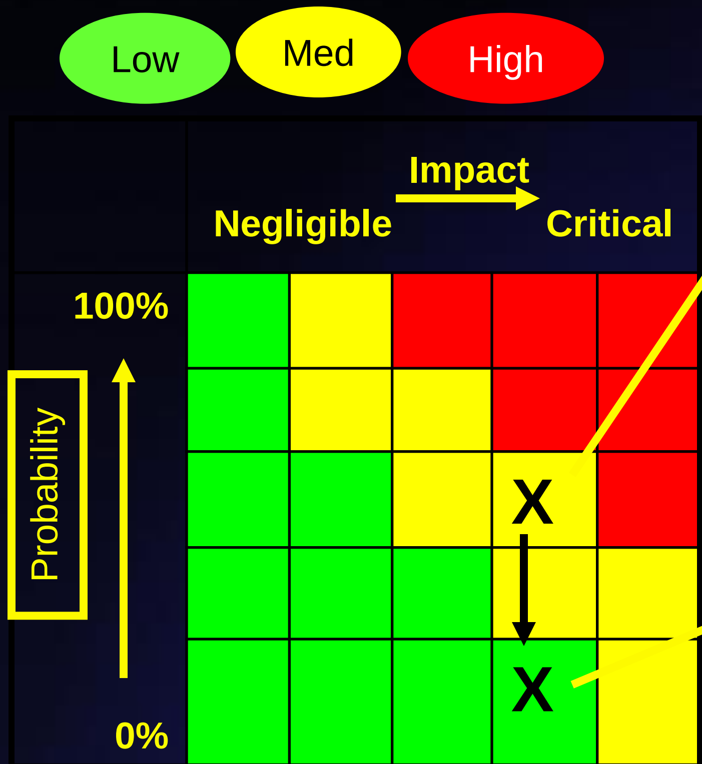


Figure 1. Flowchart for Risk Management Process

Risk #1 Assessment Matrix



Risk Workshop Completed – 14 Mar 07

Technical Risk: If software complexity increases on MCS then failure of modifications could result.

Mitigation Plan:

- Contractor is currently Capabilities Maturity Model Integration (CMMI) software level 3 certified and has plan to reach level 5 by contract award
- Government will ensure contractor will work with ground agencies to ensure software is interoperable
- Government will follow disciplined requirement matrix process outlined in 727 ACSG Operating Instruction (O.I.) to prevent unplanned requirements/complexity increases & track via established metrics

Risk Quad Chart

Risk Title

Risk Tracking Number

G

Risk Color Code

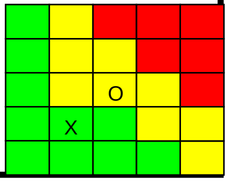
Background

Description of prob

- **Item 1**
- **Item 2**
- **Item 3**

Risk Mitigation Plan

- **Proposed solution for implementation and risk mitigation.**



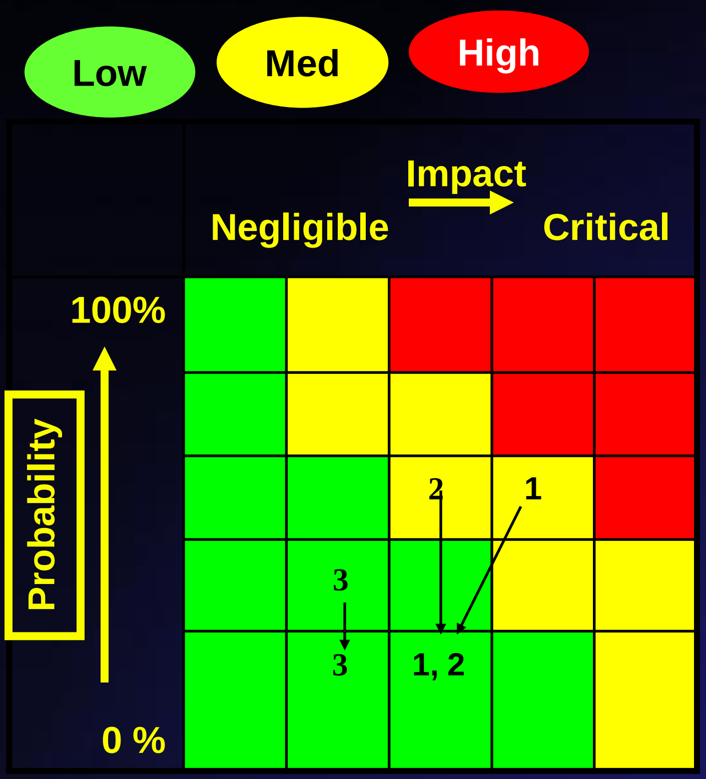
Actions to Date

	Date
• **Established Risk Assessment**	**Date 1**
• **Completed Mitigation Plan**	**Date 2**
• **Completed details of mitigation incorporation with contractor**	**Date 3**
• **Received effort impact (cost and schedule)**	**Date 4**

Future Action

	Proj.Date
• **Contract Award for implementation**	**Date 1**
• **Mitigation Plan Completion (or any significant milestones)**	**Date 2**
• **Etc…**	

Technical Risk Summary



OVERALL TECHNICAL RISK IS LOW

Risk Workshop Completed – 14 Mar 07

Tenets of Sys Eng

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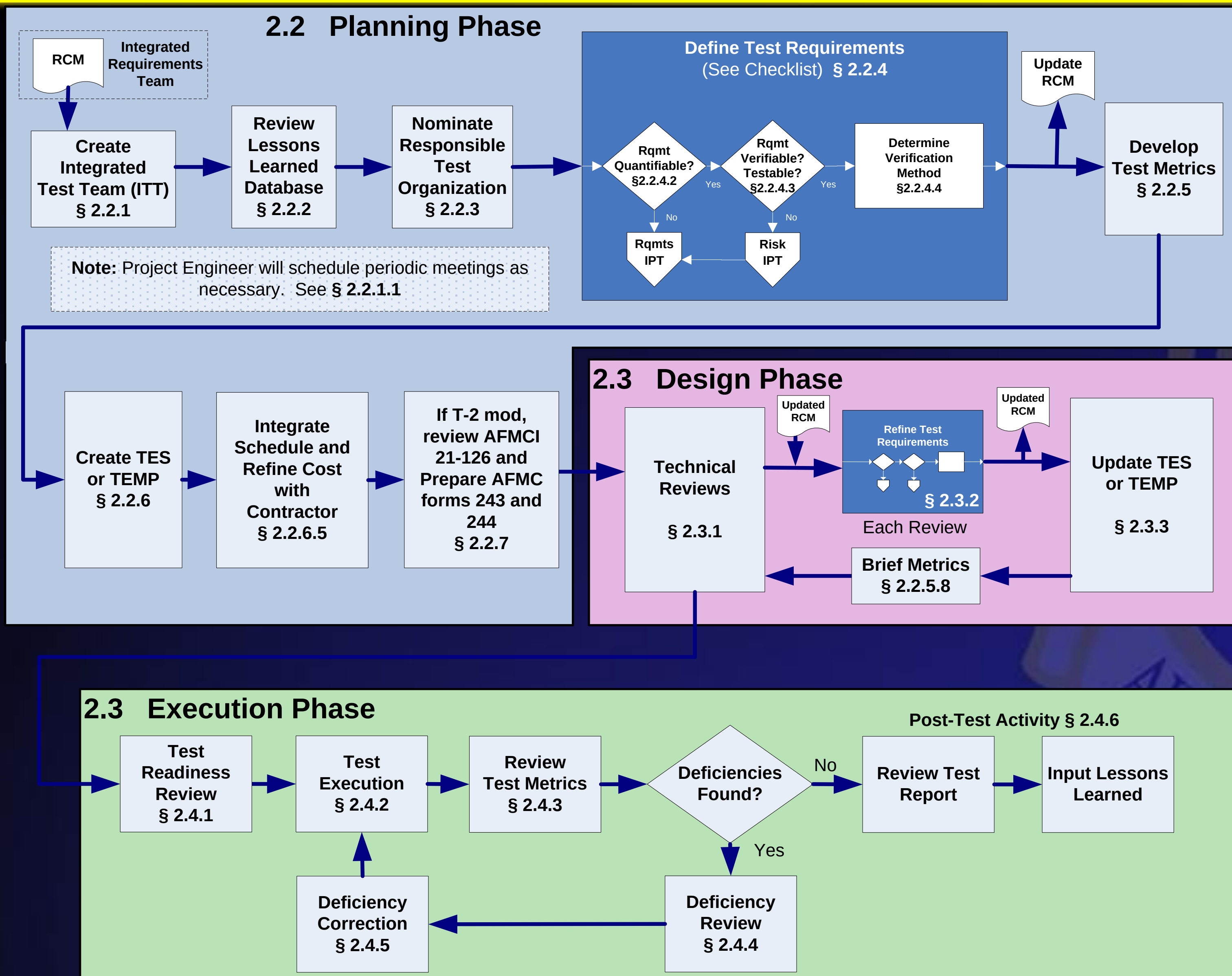
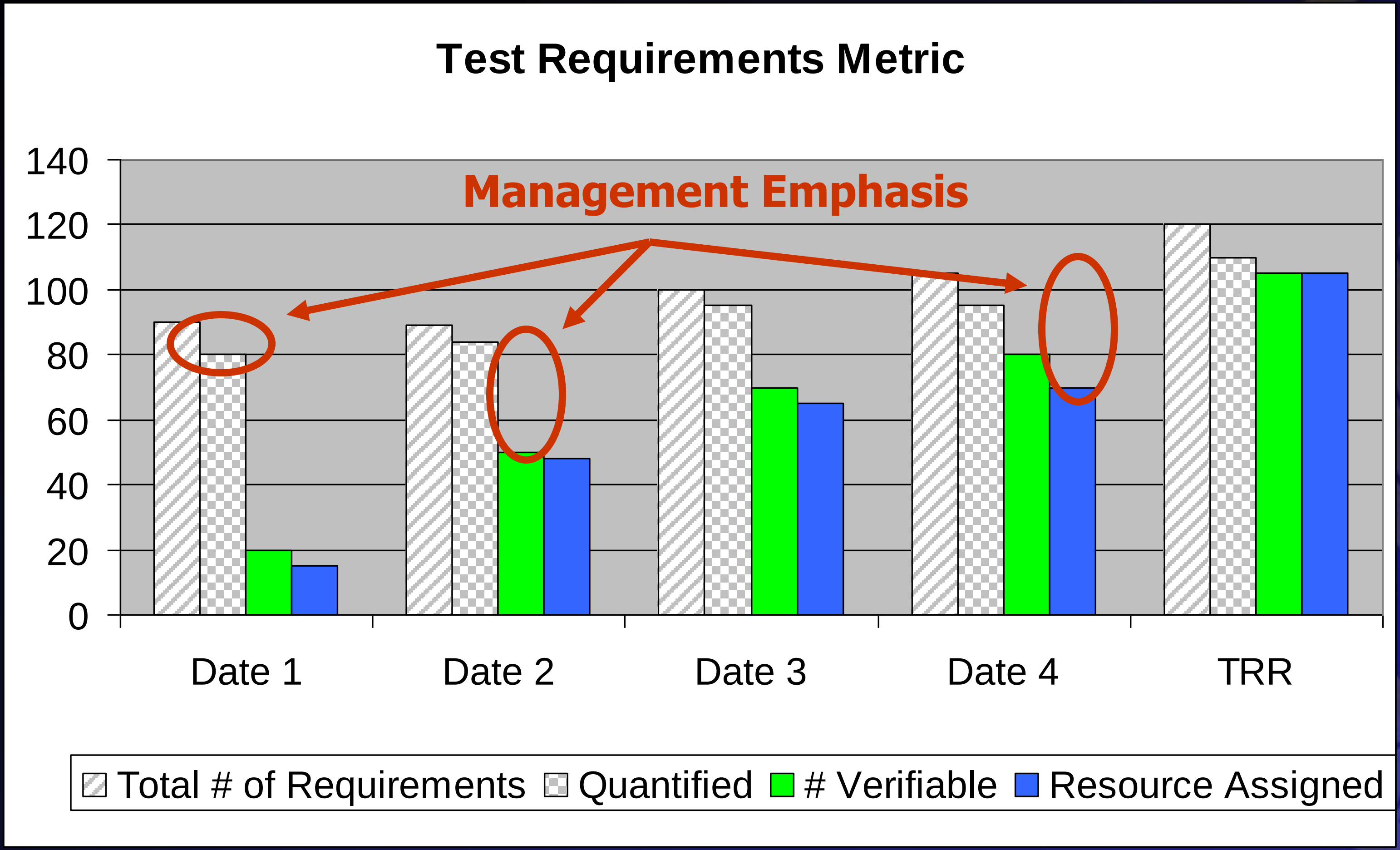
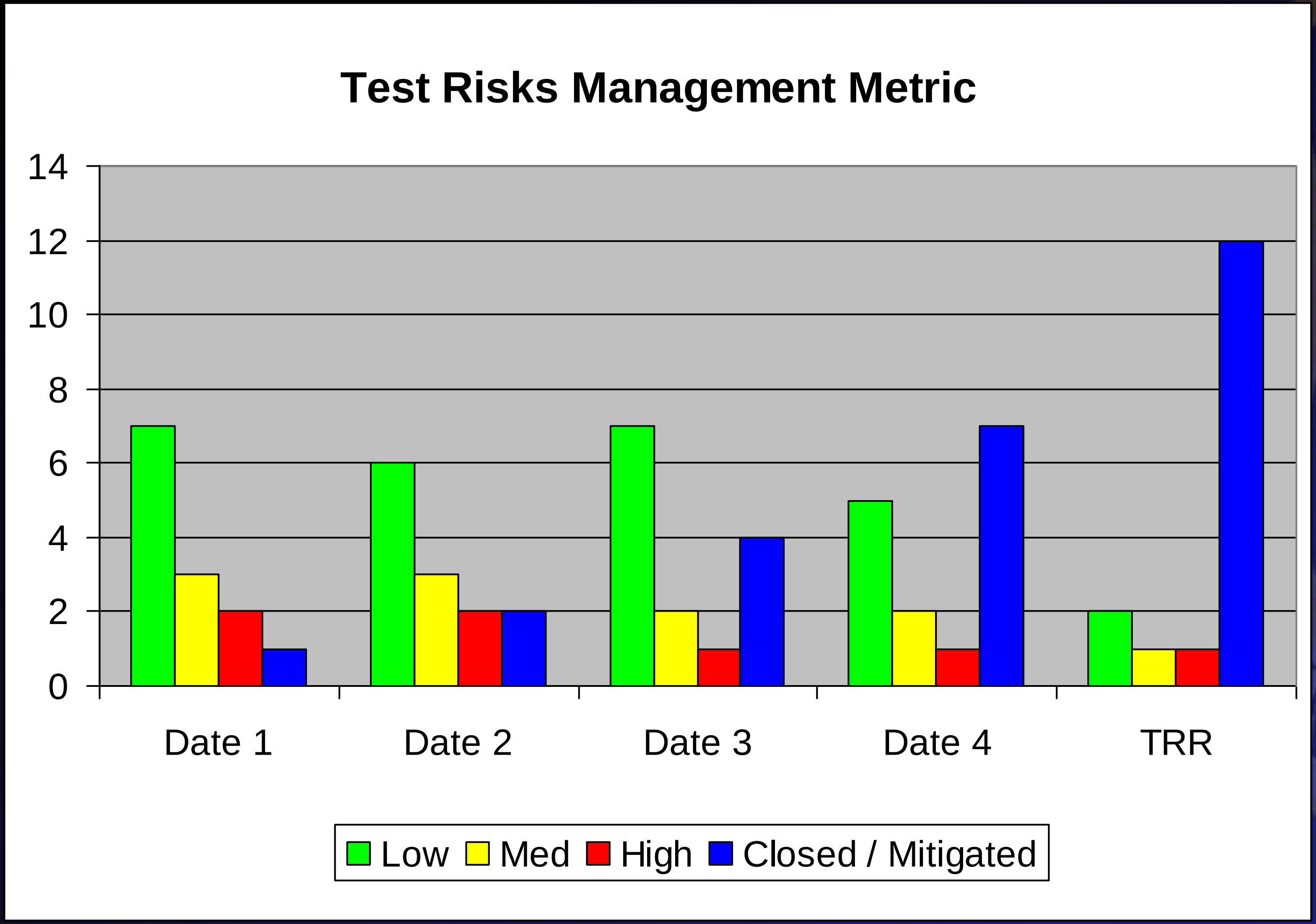
Test Management Process Flowchart



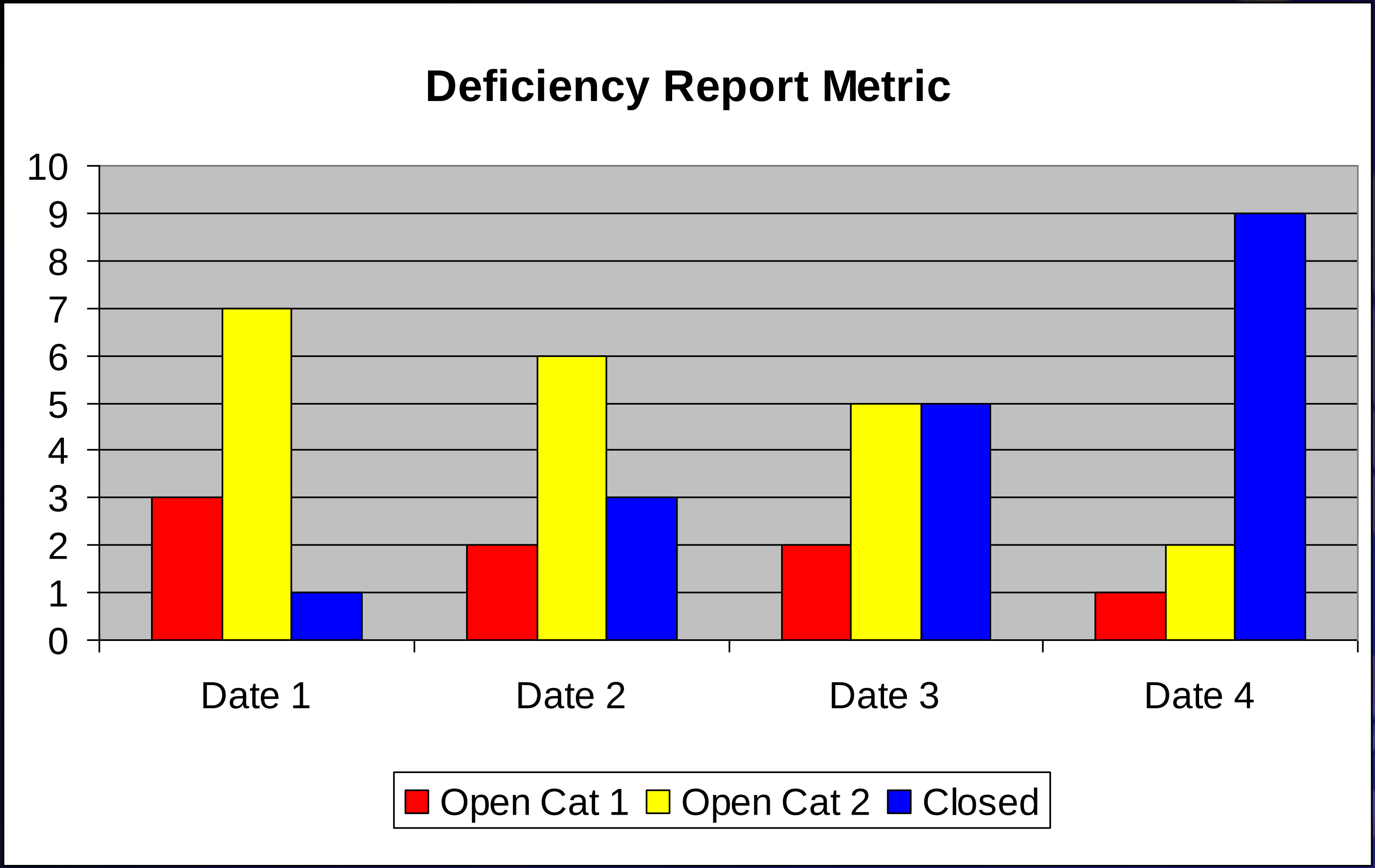
Test Requirements Metric



Test Risks Management Metric



Deficiency Metric Report



Tenets of Sys Eng

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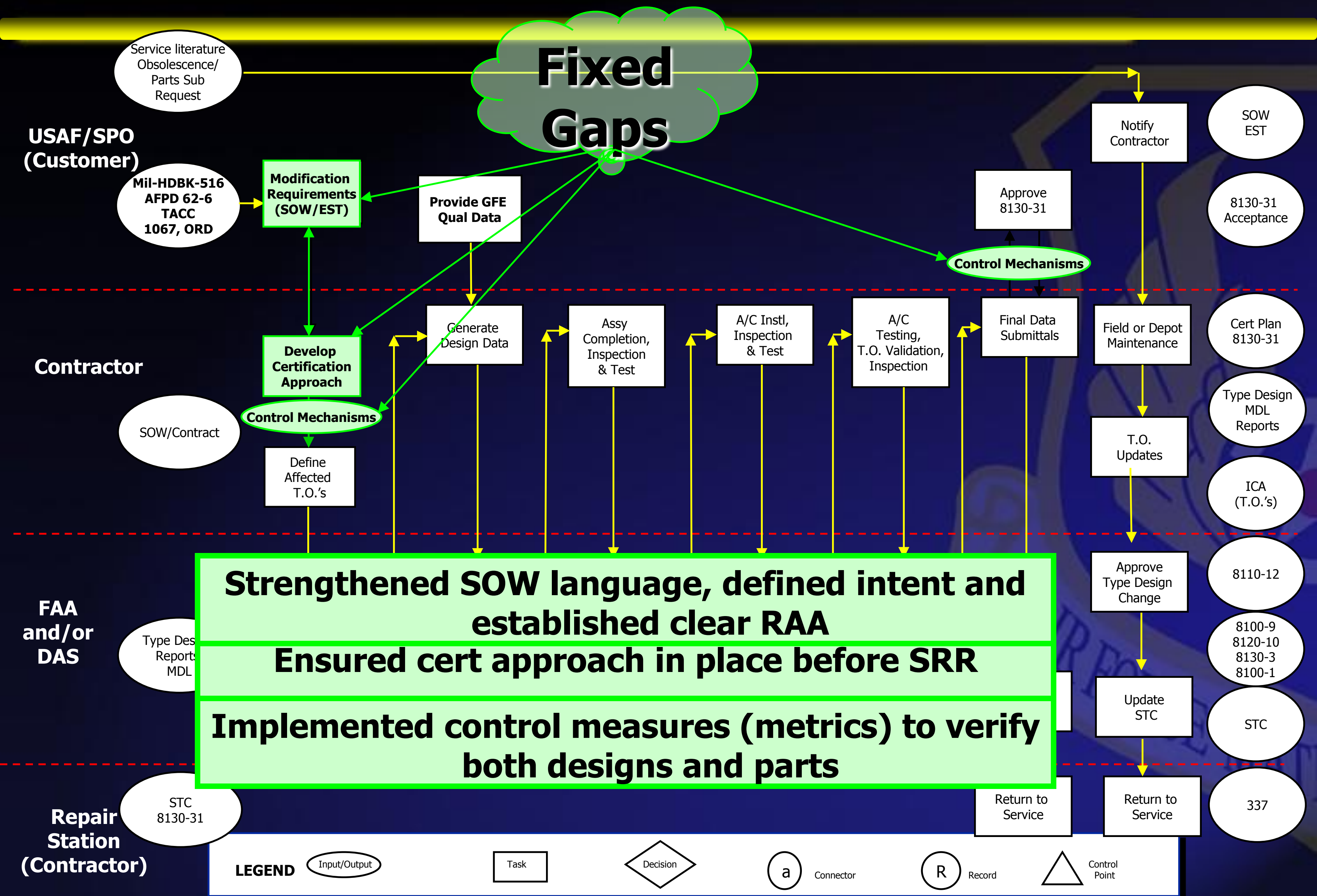
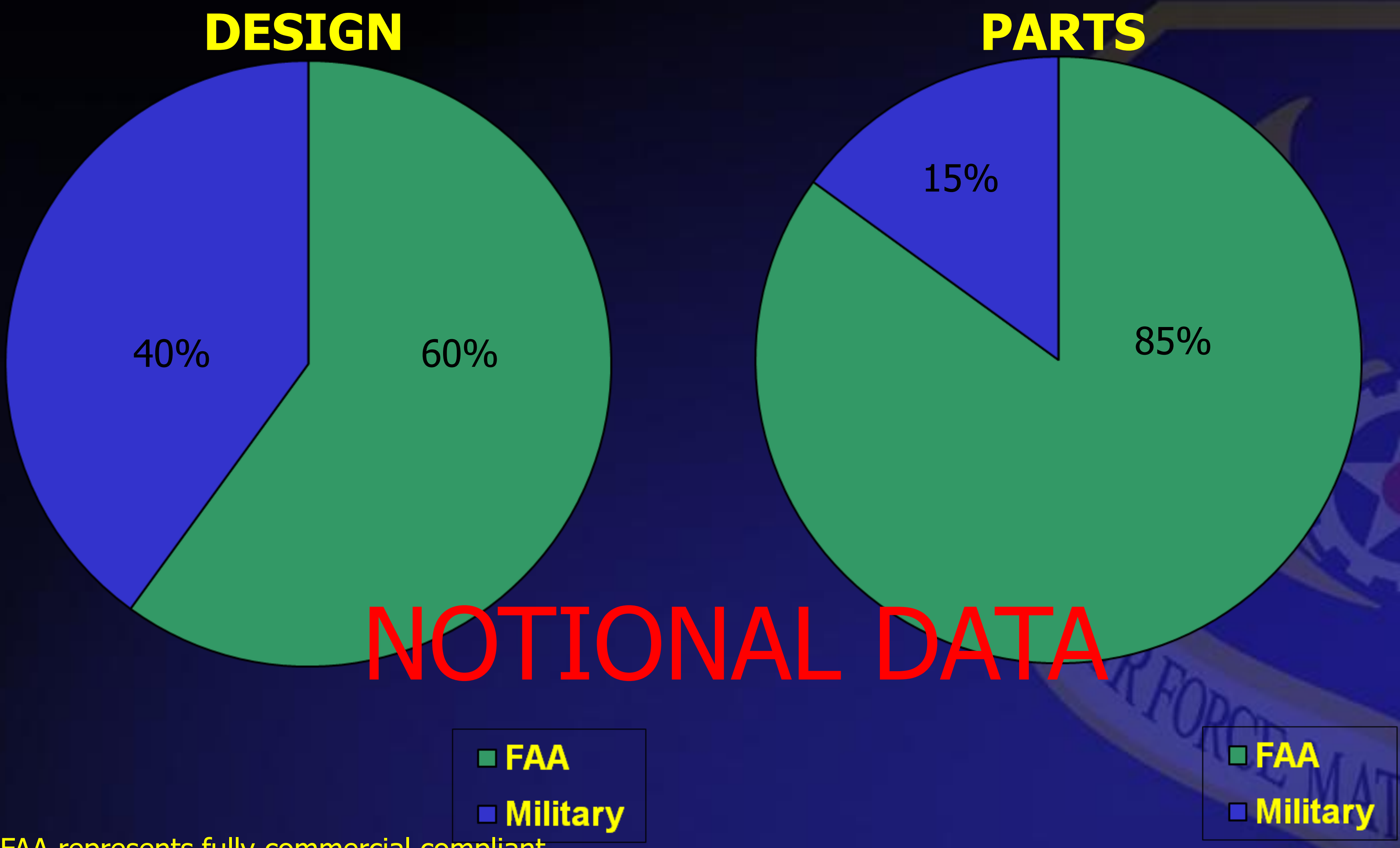
New Process to Ensure Airworthiness

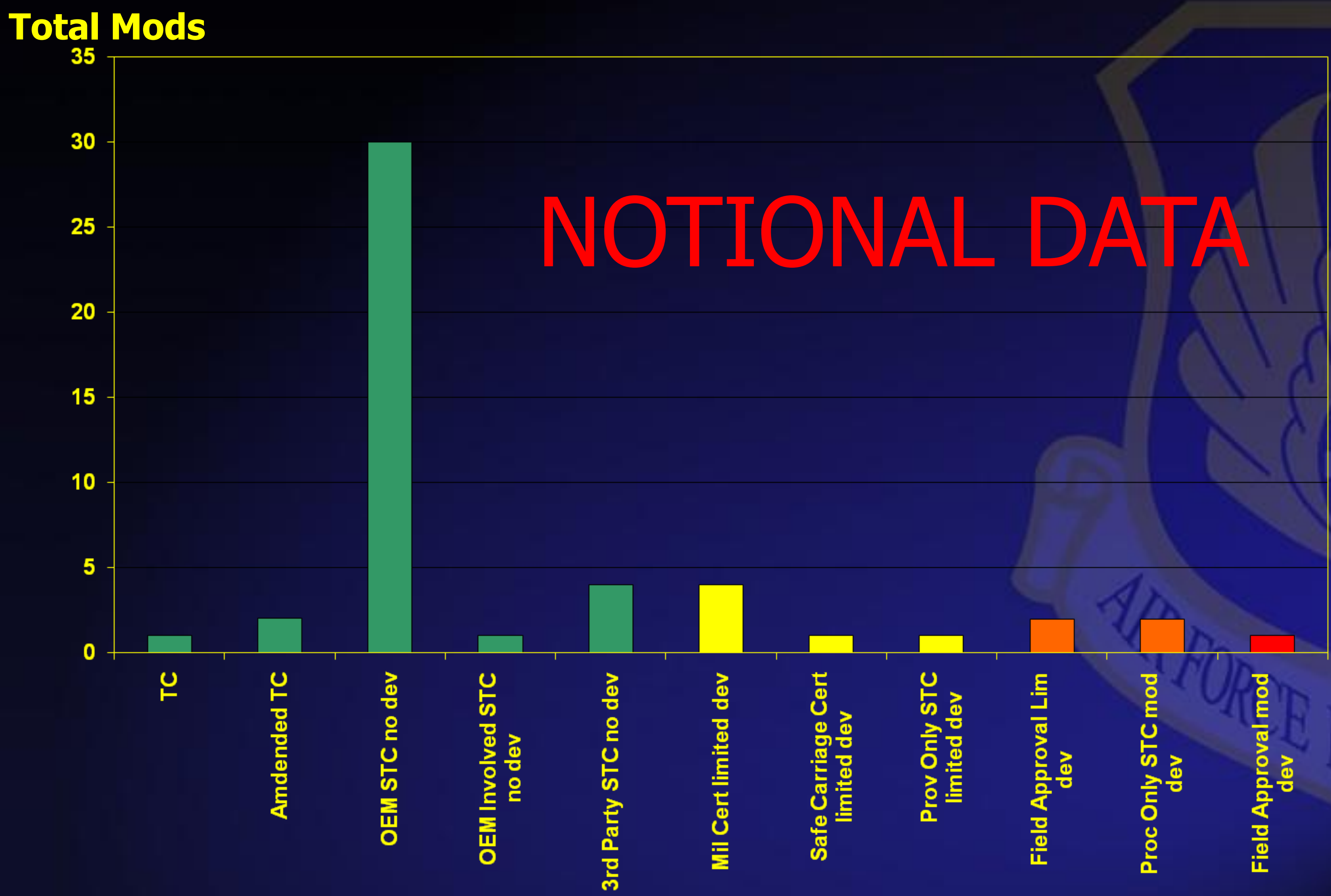


Design/Part Certification Method

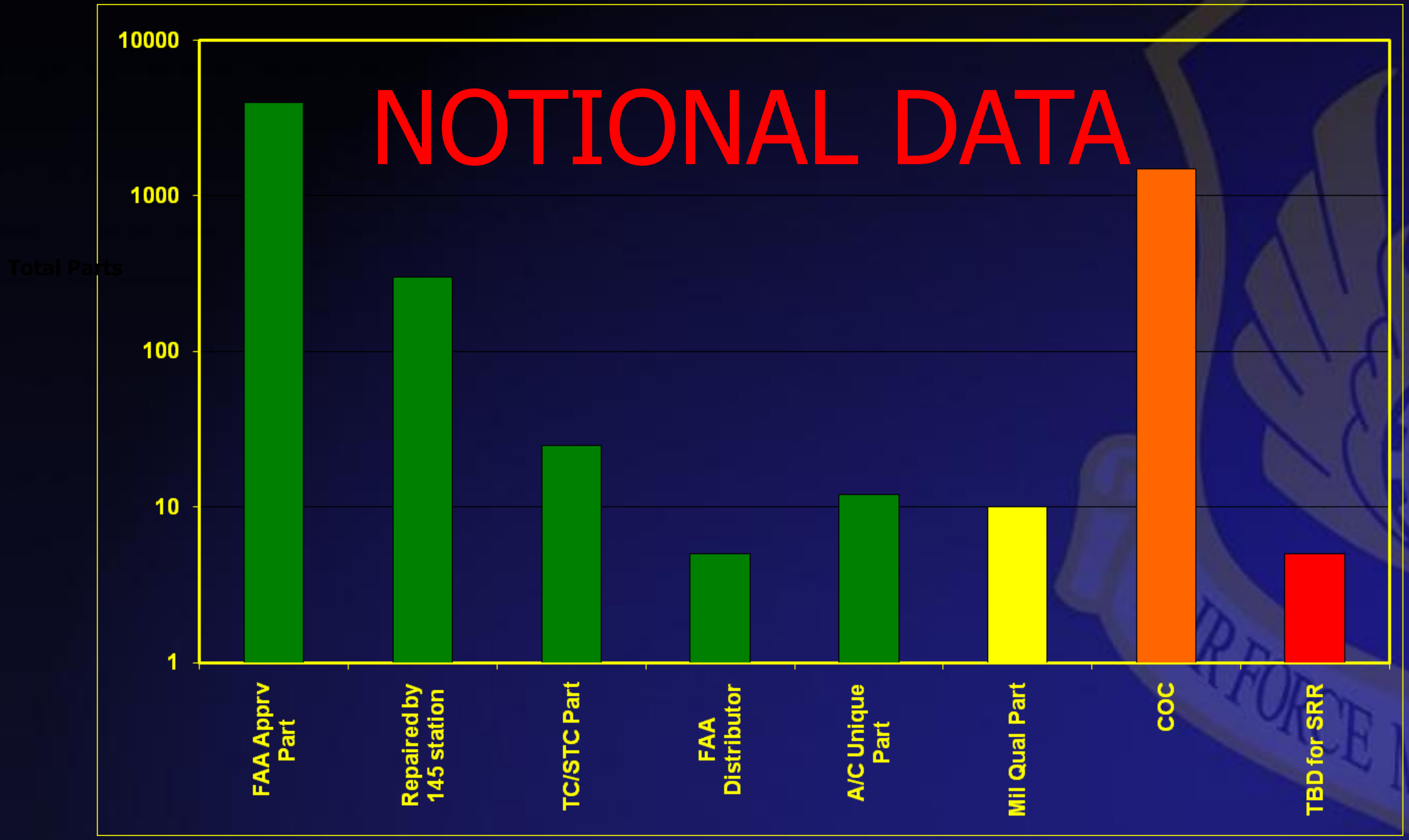


- FAA represents fully commercial compliant
- Military is anything but fully commercial compliant

Design Certification Breakout



Part Certification Breakout



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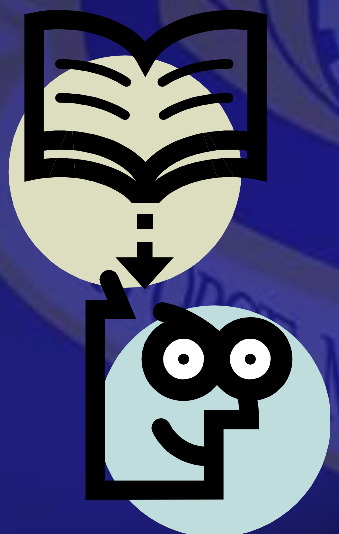
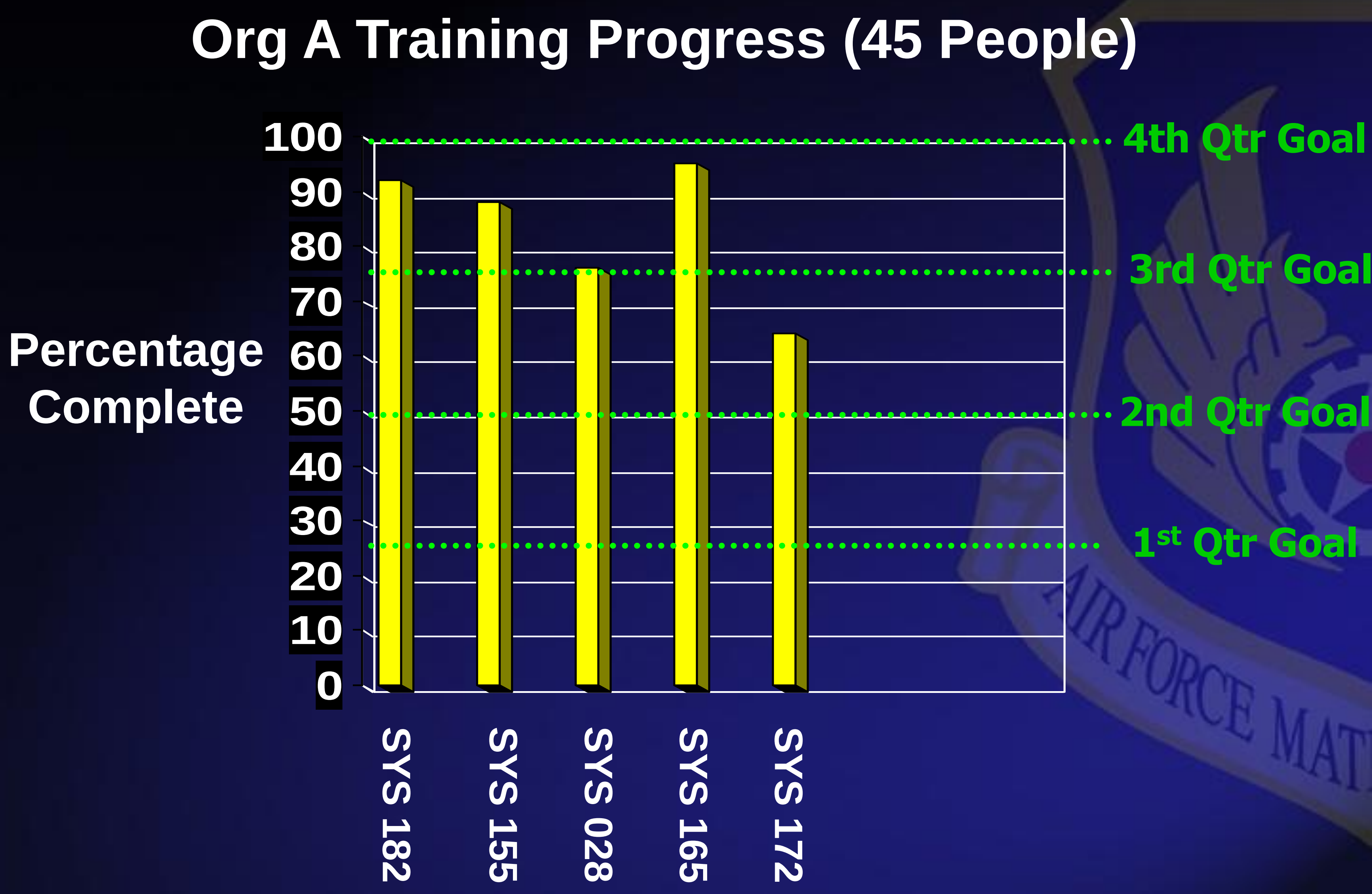


Workforce Training Metric



What's Next

- Aircraft Structural Integrity Program (ASIP)
- Configuration Control
- Service Life
- Mishaps
- Obsolescence
- Safety
- Incentivizing contractors

Summary

- Measuring systems engineering can be a daunting task
- 327th ASW developed a means to do this:
  - Broke up sys eng into its components
  - Devised metrics for each component
  - Institutionalized by codifying in OIs
  - Regularly brief to upper management
- Driving behavior, but takes time
- Have plans to do more…

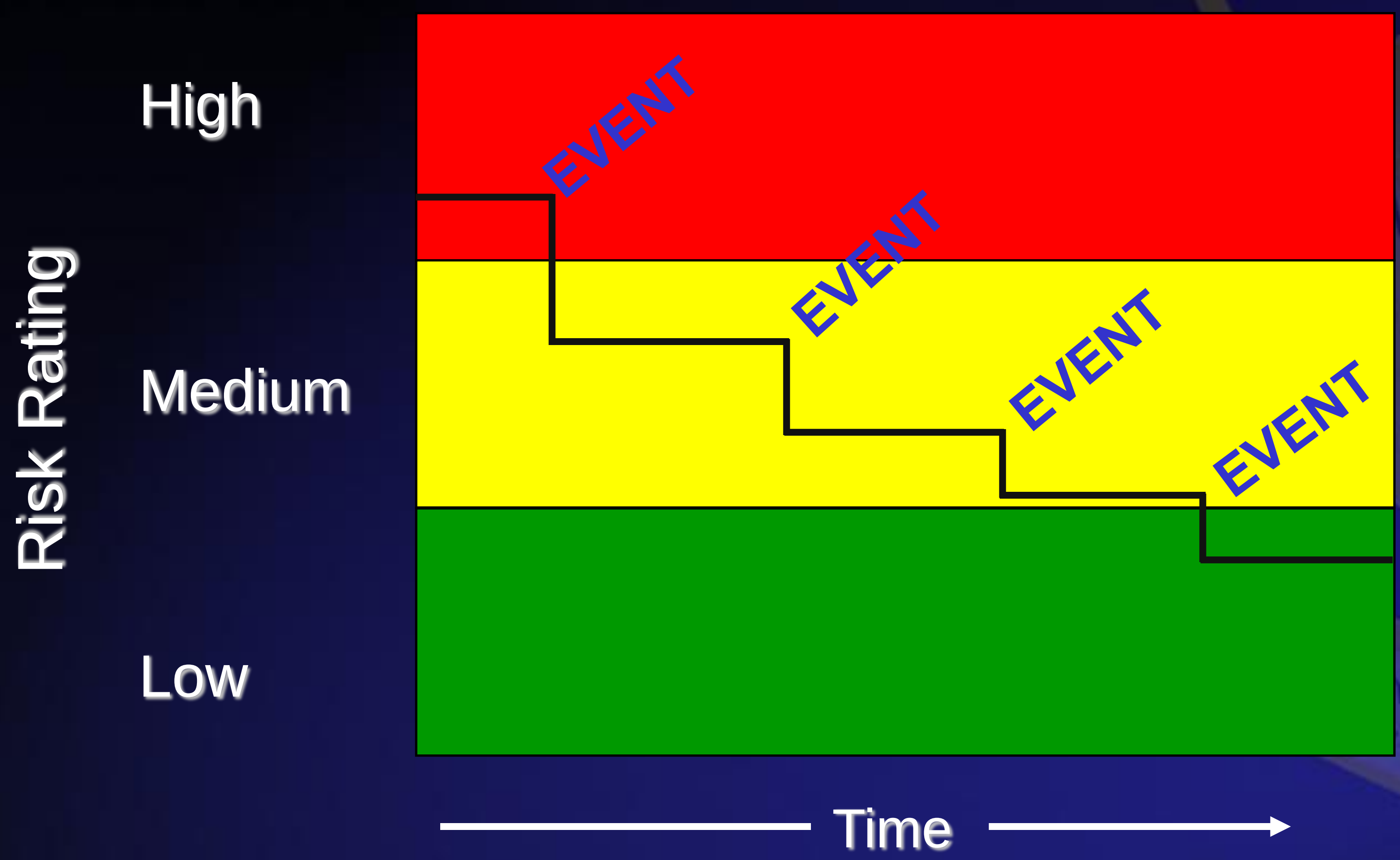
Performance measures are being implemented, driving behavior AND making a difference

Questions ?

Incentivizing Contractors Metric

% of Contracts with Sys Eng Incentives

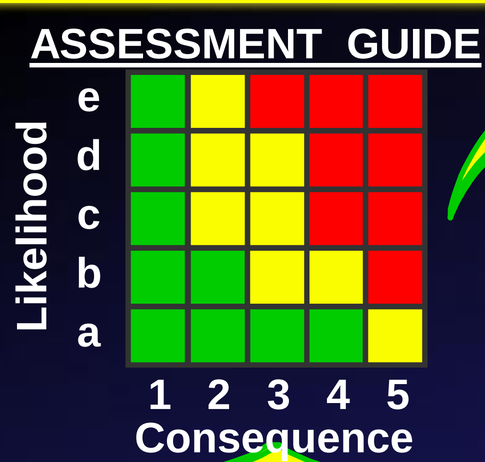
Risk Handling Plan - “Waterfall”



Sample: 5 - Level Risk Rating Chart

LIKELIHOOD:

Level	What Is The Likelihood The Risk Will Happen?
a	Remote
b	Unlikely
c	Likely
d	Highly Likely
e	Near Certainty



RISK ASSESSMENT

HIGH - Unacceptable. Major disruption likely. Different approach required. Priority management attention required.

MODERATE - Some disruption. Different approach may be required. Additional management attention may be needed.

LOW - Minimum impact. Minimum oversight needed to ensure risk remains low.

CONSEQUENCE:
Given The Risk Event is Realized, What is the Magnitude of the Impact?

Level	Technical Performance	and/or	Schedule	and/or	Cost	and/or	Impact on Other Teams
1	Minimal or no impact		Minimal or no impact		Minimal or no impact		None
2	Acceptable with some reduction in margin		Additional resources required; able to meet need dates		< 5%		Some impact
3	Acceptable with significant reduction in margin		Minor slip in key milestone; not able to meet need dates		5 - 7%		Moderate impact
4	Acceptable, no remaining margin		Major slip in key milestone or critical path impacted		> 7 - 10%		Major impact
5	Unacceptable		Can't achieve key team or major program milestone		> 10%		Unacceptable

Major Modification Programs

17 Current Programs

Y	KC-10 AMP – ASC Lead (ACAT II)	$1.03B
G	KC-10 Dual 406 MHz ELT Upgrade (ACAT III)*	$2.4M
G	KC-10 Iridium Phone (ACAT III)*	$2.7M
G	KC-10 UHF SATCOM Antenna (ACAT III)*	$2.6M
G	VC-25 Forward Lower Lobe (FLL) Cooling (ACAT III)	$14.4M
G	VC-25 Presidential Data System (PDS) (ACAT III)*	$223.3M
G	VC-25 CNS/ATM (ACAT III)*	$41.8M
G	C-20 Gulfstream Test Vehicle (GTV) (ACAT III)*	$8.7M
G	E-9 Telemetry Sys Upgrade (ACAT III)*	$5.9M
G	E-4B Mod Block I (ACAT II) *	$421.4M
G	E-4B 256 Kbps High Speed Data via INMARSAT (ACAT III)*	$8.4M
R	C-12 EFIS (ACAT III)	$77.7M
Y	HFGCS Network Control Station – West (ACAT III)*	$23.2M
Y	HFGCS AFSPC Test Range HF Modernization (ACAT III)*	$3.9M
G	HFGCS Network Optimization – Spiral II (ACAT III)*	$7.1M
G	HFGCS Navy Consolidation (ACAT III)*	$6.4M
G	HFGCS Audit Log Upgrade (ACAT III)*	$189K

*Program is fully funded