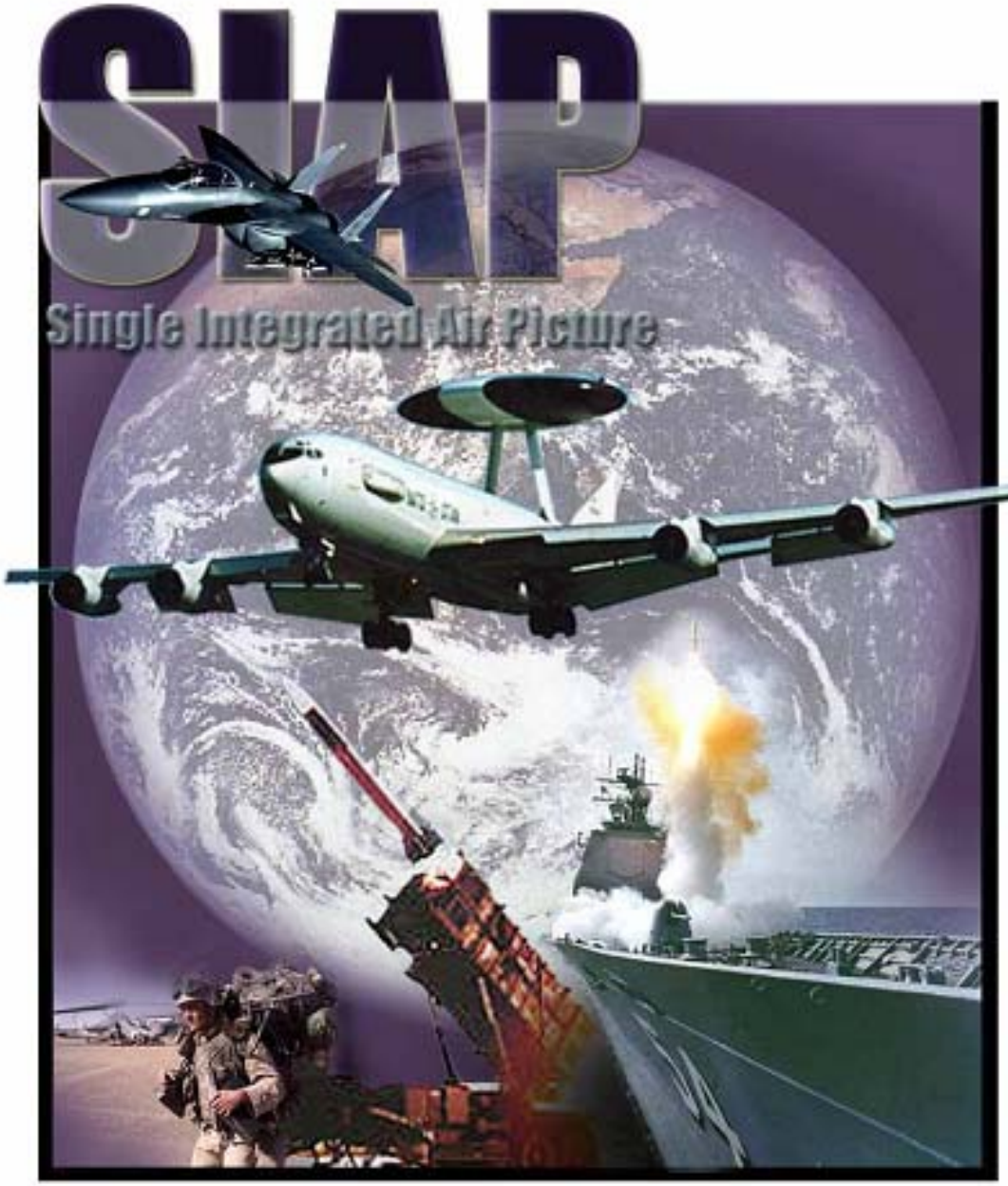


Joint SIAP System Engineering Organization (JSSEO)

Implementing the JBMC2 Roadmap A JSSEO Perspective

23 March 2005

Col Harry Dutchyshyn, USAF
Deputy Director, JSSEO

JSSEO a Strategy for DoD Convergence

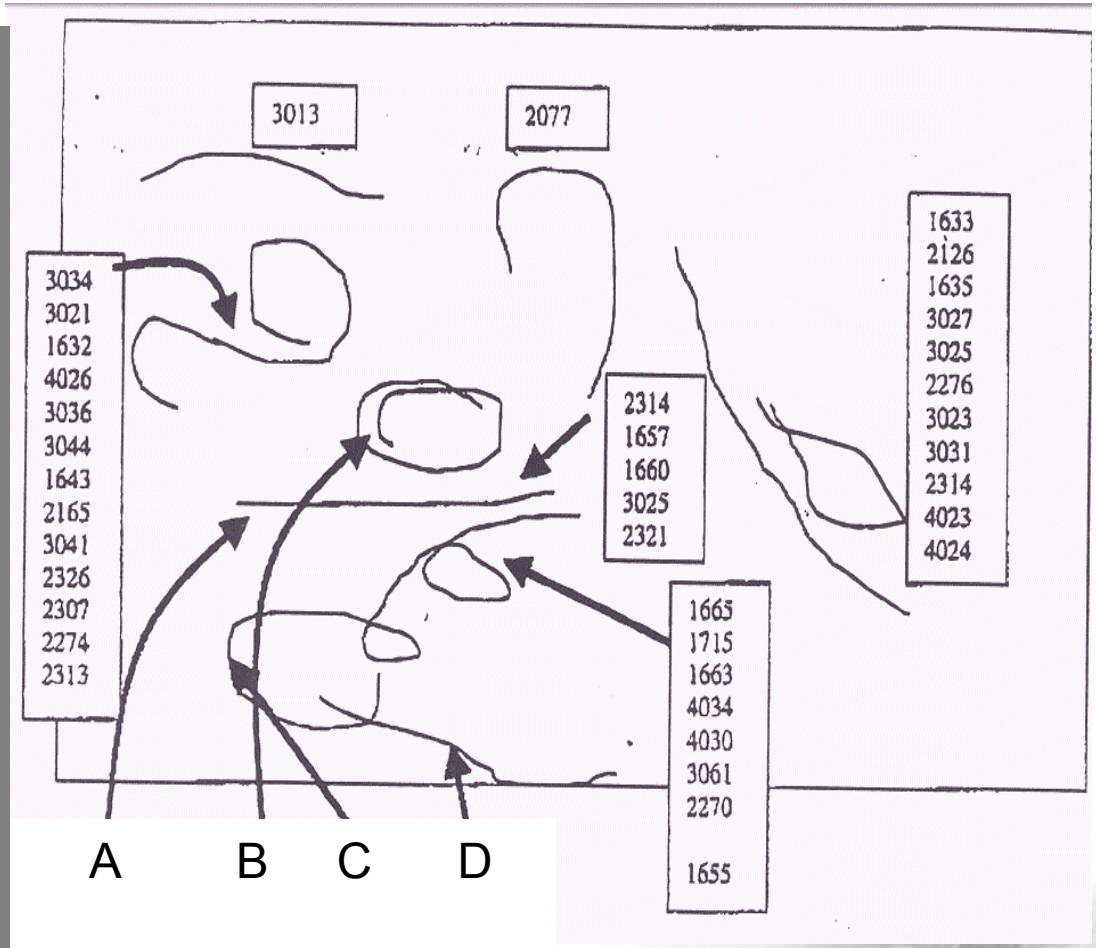
Connecting the dots:

The problem

The strategy & commitments

The challenges

Today's Warfighting Challenge



Today's approach does not satisfy operational objectives

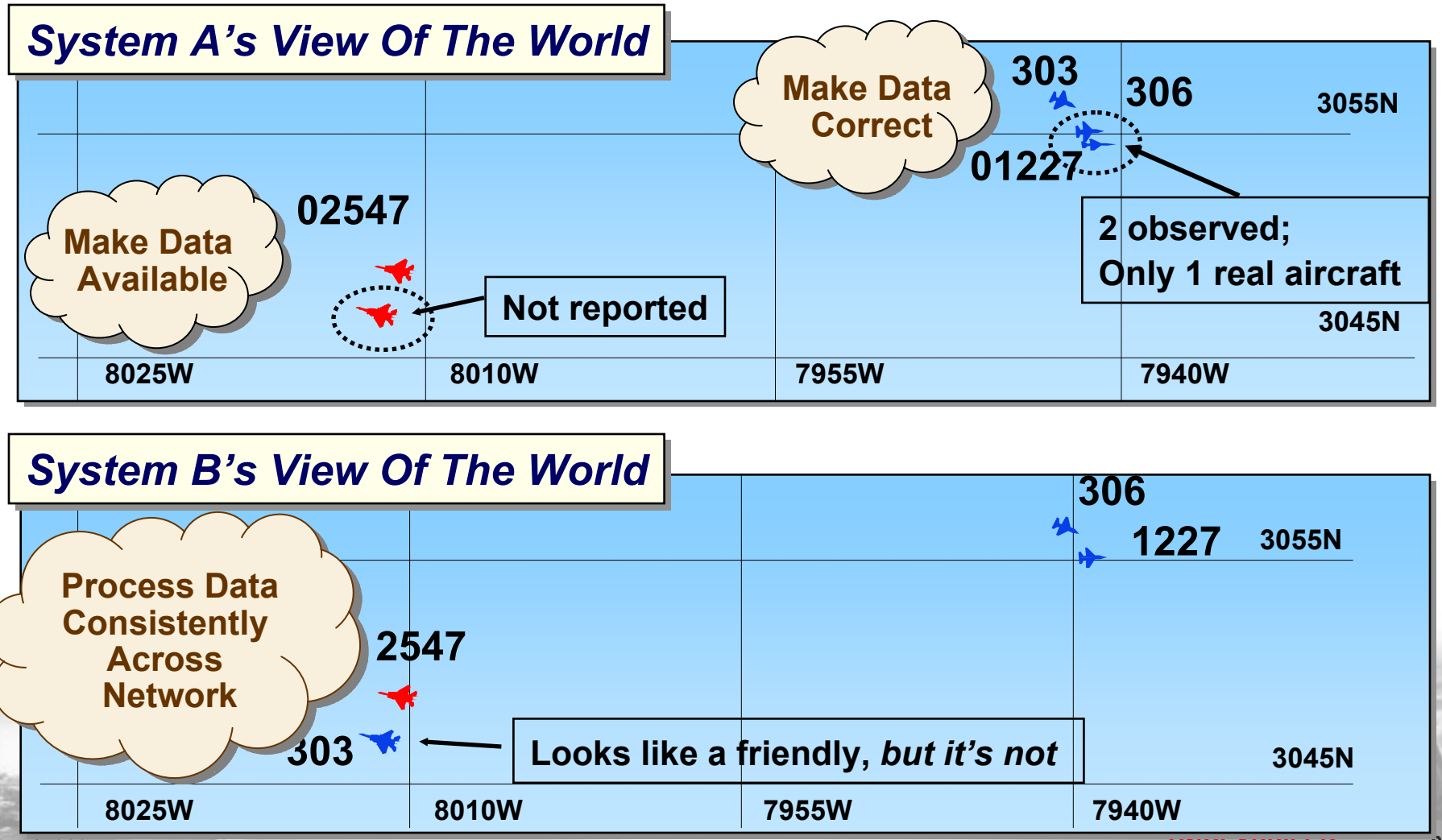
What are the "Deadly Sins"?

- **Time:** Lack of a common time standard
- **Nav:** INS/GPS integration factors
- **Tracking:** Poor tracking performance & inaccurate Track Quality calculations
- **Connectivity:** BLOS relay requirements & throughput limits
- **Gridlock:** Failure to achieve common geodetic coordinate frame
- **ID:** Automated ID processing differences
- **Message standard implementation**
- **JTTP shortfalls**
- **Network design/management shortfalls**

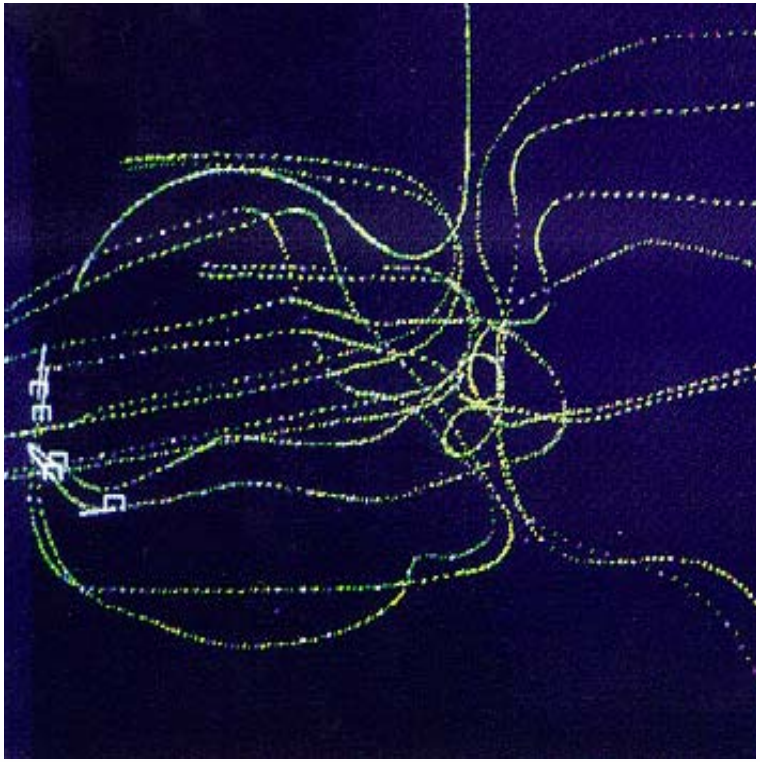
"Deadly Sins" inhibit interoperability

Strategy—the Objective

Getting everyone on the same sheet of music…



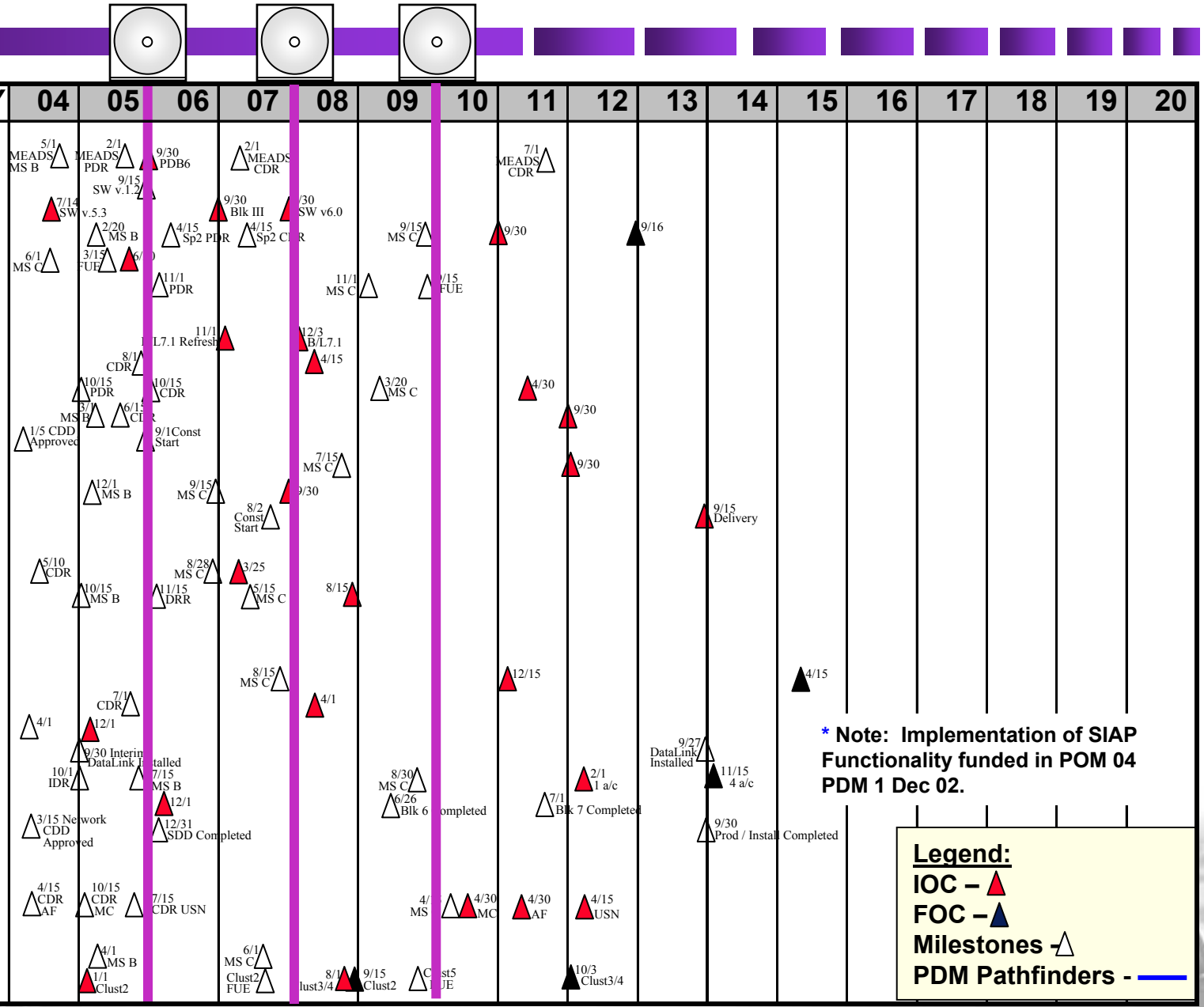
SIAP Attributes—What 'Good' Looks Like



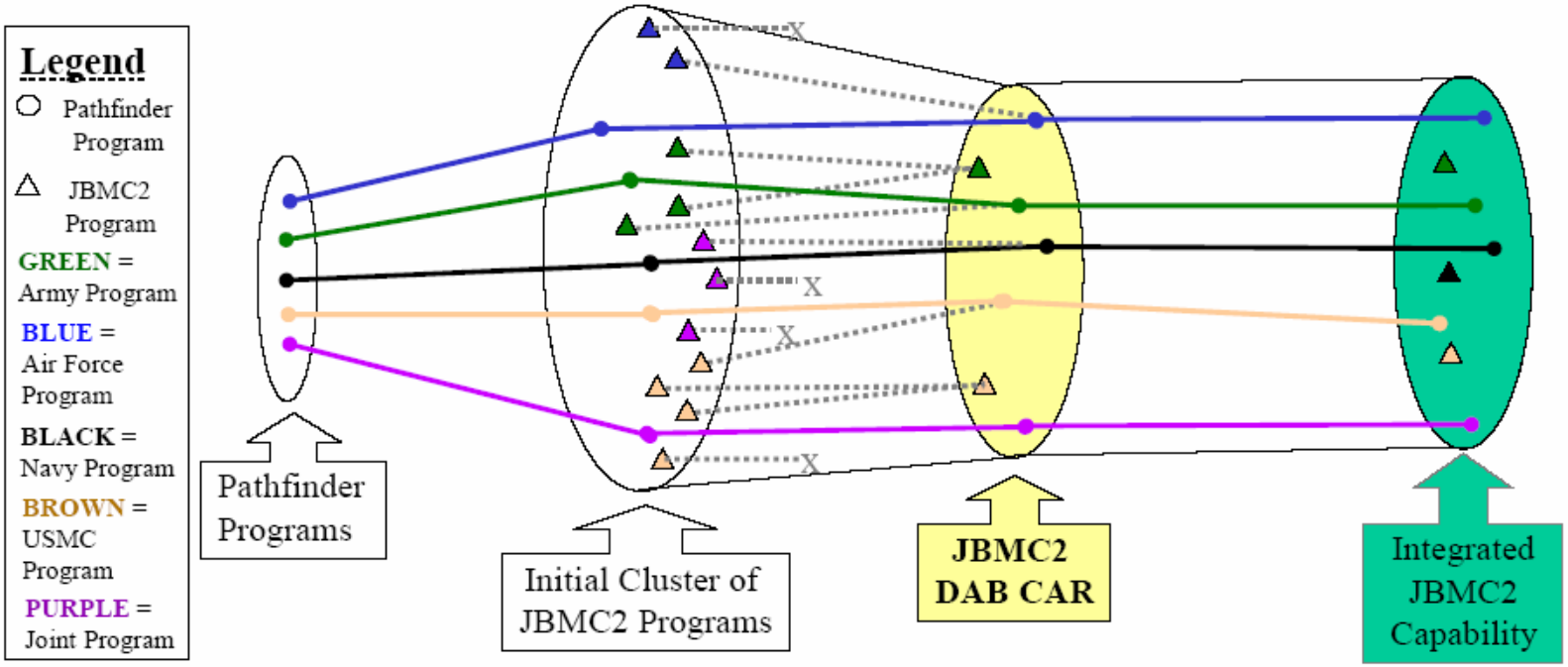
JROC Approved Requirements

- Completeness: The air picture is complete when all objects are detected, tracked and reported
- Clarity: The air picture is clear when it does not include ambiguous or spurious tracks
- Continuity: The air picture is continuous when the tracks are long lived and stable
- Kinematic Accuracy: The air picture is kinematically accurate when the position and velocity of a track agrees with the position and velocity of the associated object
- ID Completeness: The ID is complete when all tracked objects are labeled in a state other than unknown
- ID Accuracy: The ID is accurate when all traced objects are labeled correctly
- ID Clarity: The ID is ambiguous when a tracked object has two or more conflicting ID states
- Commonality: The air picture is common when the tracks held by each participant have the same track number, position and ID

Built At a Pace & Level We Can Afford



JBMC2 Capability Area Review



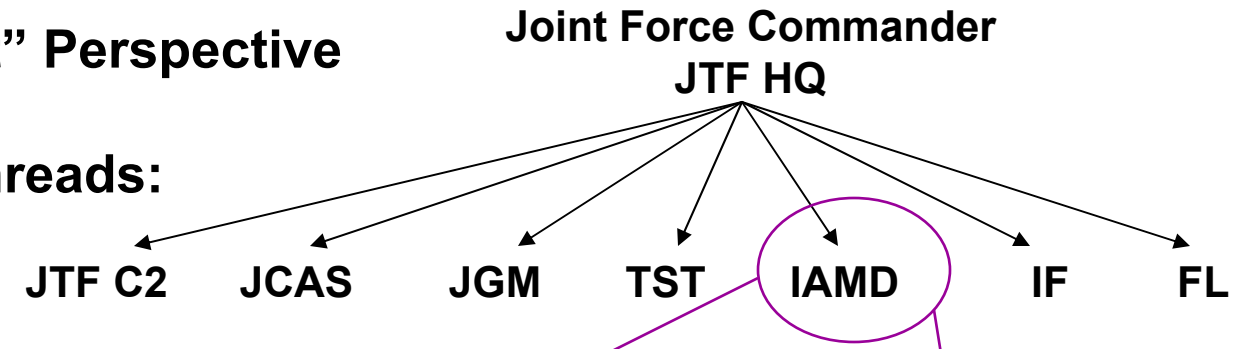
- **Cluster of JBMC2 programs essential to end-to-end performance**
- **Anchored by JBMC2 Pathfinder programs**
- **DAB CARs used to assess progress in developing integrated JBMC2 capabilities**
- **Legacy program phase out and convergence plan approved at DAB CAR**

JBMC2 Architectural Relationship

JBMC2 Architecture:

"Command Post" Perspective

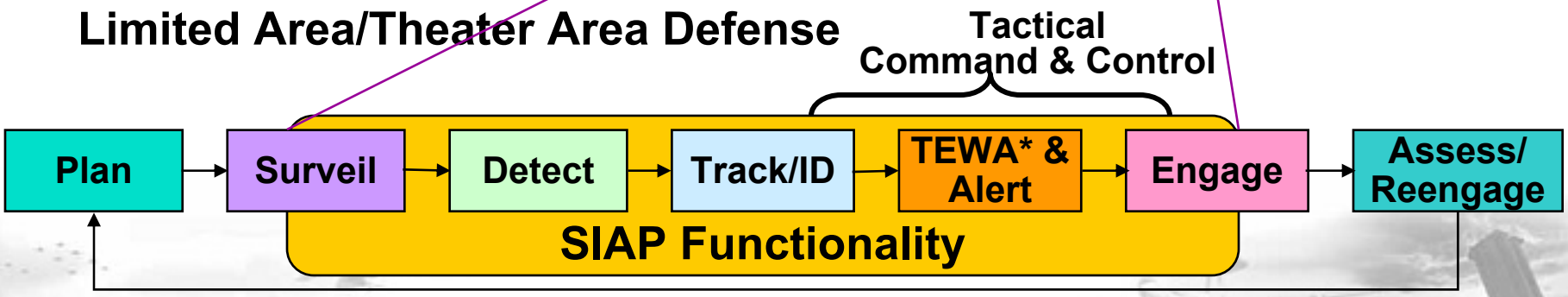
Joint Mission Threads:



IAMD Architecture:

Mission Oriented (functional view):

Limited Area/Theater Area Defense



*Threat Evaluation and Weapons Assignment

Strategy for achieving SIAP capability

Capability achieved through:

1. **Architectural requirements/directives**
   - A computerized spec

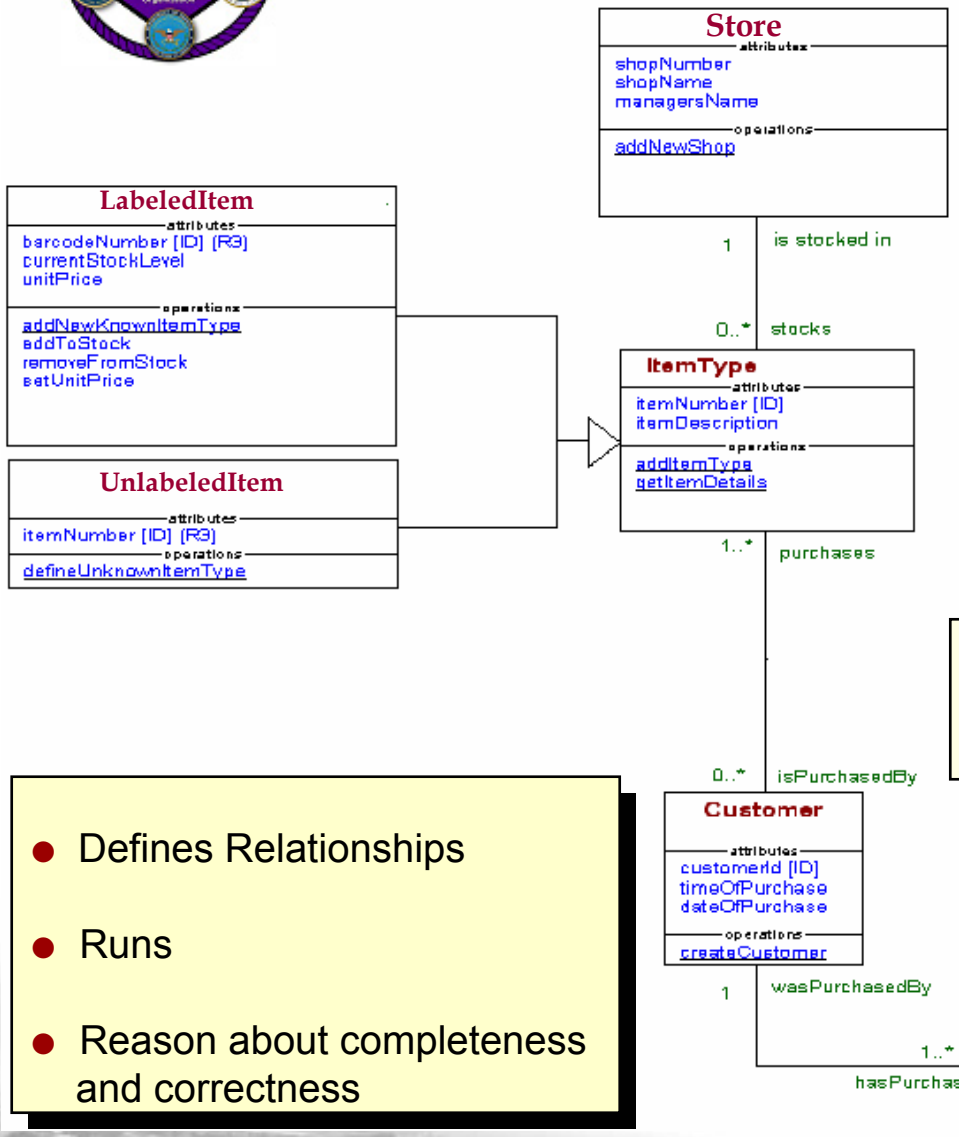
2. **Application of Net-Ready Requirer**
   - A software Jig

3. **Service implementation and architecture enforcement through JITC**
   - A conformance tool

AMD Capability Area Reviews and JCIDS Process

Using Model Driven Architecture and industrial standards to reduce acquisition costs & provide conformance criteria

Executable UML—A Computerized Spec



- Industry standard approach - Object Management Group
- Separate functionality and implementation
- Stabilize design as implementation technologies evolve and improve (platform independent)

The IABM and "Executable Architecture"

- Defines Relationships
- Runs
- Reason about completeness and correctness

IABM - A Stepping Stone to Service Implementation—A Software Jig

System A
Requirements
Standards

System B
Requirements
Standards

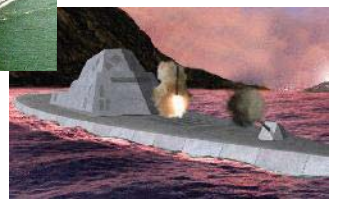
System C
Requirements
Standards

Joint Specification
Requirements
Standards

for (i=0;9; i++)
{a * =sin(i * PI);}

for (i=0;9; i++)
{a * =sin(i * PI);}

for (i=0;9; i++)
{a * =sin(i * PI);}



TDL

Peer-peer

TDL

Function
Track Mgmt
Distributed Resource Mgmt
Data Dissemination Mgmt
Joint C2
Common Services
System Interfaces

JSSEO

Service

An Architecture Conformance Tool

- **IABM runs…testable in a distributed simulation**
- **Known scripts…controls & expected outputs**
- **Standards conformance…MOA signed Mar 05**
  - MOA with JITC to support testing of the IABM as developed by JSSEO and Service implementations of the IABM in combat systems

Provides a mechanism for validating data correctness, data availability and consistent data processing for architecture threads—validates Net-Ready requirement

IABM & Progress

- Services fielding Link 16 correlation & ID fixes
- New strength track reporting ICP (4 Feb 05)
- Created Joint metrics defining SIAP performance
- Shaped Joint Net Ready KPP on data
- Introduced IABM – Executable arch. paradigm
- Released 21 incremental IABM TimeBoxes
- Standardized test planning, executing, & reporting
- Built new tools for enterprise analysis/distributed testing
- Engaged industry in risk reduction contracts to integrate IABM into SIAP pathfinders

Industrial Strategy

- **Broad participation in Joint system engineering**
- **Focused risk reduction with Service Primes**
  - Service risk reduction contracts: BCS, AWACS, LHA
  - JSSEO Industry Risk Reduction--DMEA contract
  - Industry Assessment Team
- **Promote competition with open design & Government maintains control of the specification**
  - Terms of use agreement & classified facility
  - Linkage to industrial standards

Challenges & Risk Reduction

- **Industry Exposure and Risk Reduction**
  - –Objective: Reduce implementation risk by giving industry partners an early peek at PIM to PSM translation, and automated code generation.
  - –May – Oct 04
- **Industry Assessment Team**
  - –Objective: Assess JSSEO Model Driven Architecture approach
  - –2 Aug – 3 Sep 04
  - –Six-man on-site team at JSSEO

Industry Partners

F-15

MC2A

AWACS

NORTHROP GRUMMAN

E-2C

F-18

BOEING

PAC 2 PAC 3

DDG

CG

RC-135

MCE/TAOC

LOCKHEED MARTIN

Patriot ECS

Raytheon

ThalesRaytheonSystems

CAC2S

BCS

LHA/CNI

GENERAL DYNAMICS
Strength on Your Side™

IABM Risk Reduction on contract

Industry Exposure & Risk Reduction

- **Translation worked for each system environment**
  - Clear learning curve for each instance
  - Major dependence on model documentation
  - Insufficient “calibration” data for the exercise
  - Model compiler critical to quality of emitted code
- **Must strengthen industrial standards for MDA tools**
- **Must re-think workforce skill sets & training**
- **Continue to mature test, verification and validation concepts along with Configuration Management**
- **Insufficient insight to validate cost, rates & factors**
  - Limited scope…not integrated into weapon system

Industry Assessment Team Findings

- ***Finding 1:*** Insufficient time devoted to resolving defects and keeping IABM documentation current

✓***Action Taken:*** Bug Top-10, Introduced documentation metric for model development, Added fidelity for Configuration 05 Description Document, IABM TEMP, and IABM User's Guide

- ***Finding 2:*** Code reviews were not always performed.

✓***Action Taken:*** Quality gates in place between each development phase

- ***Finding 3:*** Significant fixed overhead for each TimeBox

✓***Action Taken:*** New 6-week TimeBox developed. Introduced testing automation. Phased integration process reduces troubleshooting overhead.

Industry Assessment Team Findings *cont.*

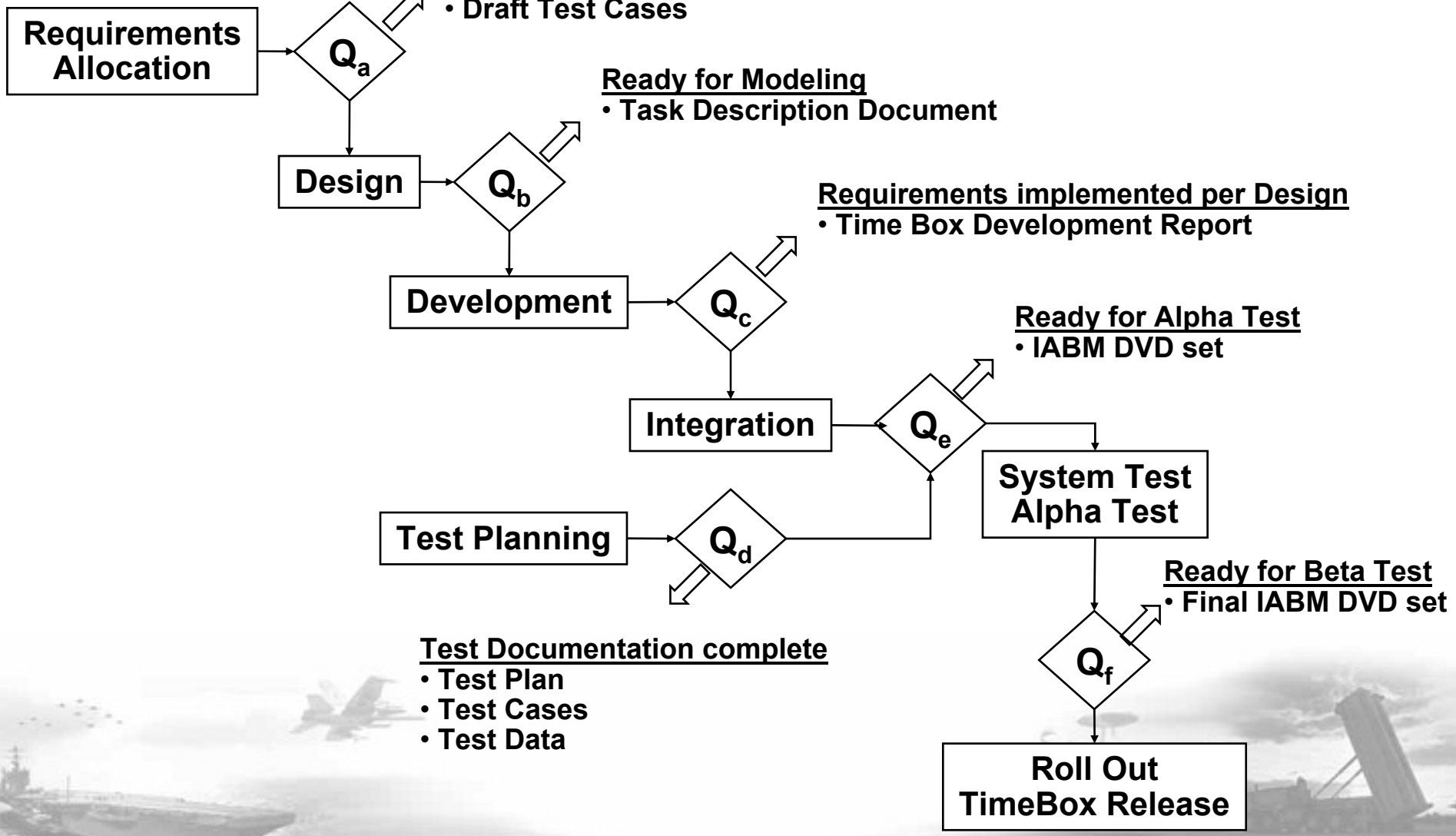
- ***Finding 4:*** TimeBoxes were delivered to beta sites at the same time they went to QA.

✓**Action Taken:** Alpha test sites identified; TimeBoxes released to Beta sites after Alpha testing is complete

- ***Finding 5:*** IABM requirements were not fully traceable to the operational requirements.

✓**Action Taken:** Requirements database created in DOORS and trace developed to lower level requirements, architecture, and IABM.

Implementing Industry's Advice



Industry Assessment Conclusions

- **SIAP is highly innovative and bold project**
  - Application of MDA practices
  - Acquisition model
- **SIAP IABM is an extensive application of MDA**
- **SIAP is applying MDA standards and can influence the evolution of the standards**
- **The JSSEO team is highly motivated, skilled, and open minded**
- **JSSEO is experiencing the natural learning curve**
- **SIAP MDA approach offers significant potential to achieve its objectives for interoperable and maintainable systems**

From SIAP Concept to Capability

- Combat scenarios, operational concepts and mission area ICDs drive the IAMD architecture and define mission threads
- Net-Ready KPP links Service systems to the IAMD architecture
- A computerized spec (the IABM) captures the behavior of the IAMD architecture and provides an executable template for what “good” looks like
- Services use this model/template as a software jig to create computer programs that conform to the IAMD architecture
- Service OTAs and JITC compare system performance to computerized spec (IABM) to validate architectural conformance and certify satisfaction of Net Ready KPP requirements

It’s about engineering the ensemble…

Using the IABM

It's about the data

- Make it correct
- Make it available
- Process it consistently

"Net Ready" Requirement

Behavior Model is our strategy

- Interoperability improvements
- Life-cycle cost avoidance
- Reduced time to field new and modified capability

…and improving our decision making processes…

To improve Joint warfighting

What the Warfighter Gets:

- Confidence in Tracking Targets & Friends
- Flexibility to Engage on Our Terms
- Robustness for Reacting to Change

To Achieve What Effects:

- Exploit our weapons at their full kinematic range
- Reduce the risk of fratricide
- Counter emerging threats

…to field Joint warfighting capabilities implemented by the Services at a pace and level we can afford