Harnessing Technology for C4ISTAR Operations

Capability & Architecture-Based Improvement Process

Dr David Sundstrom
Senior Technical Fellow
Network Centric Systems
24 September 2002

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
23 AUG 2004	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Harnessing Technology for C4ISTAR Operations Capability & Architecture-Based Improvement Process	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Network Centric Systems**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADM001711 Meeting C4ISTAR Requirements: Implementing and Exploiting Technology Solutions., The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**21**	

Sharing Insights About Improving C4ISTAR Operations

Warfighting Experience: Powerful Solutions, Often Process-Oriented, Put Quickly Into Place; Solutions Tend to be Specific & Not Institutionalized

Experimentation: Excellent, But Expensive; Improvement Injected Without Formal Controls

Capability-Based Architecture: The 'Right Way' , But Very Hard, & Results May be Long in Coming

Under-explored

Process Focus: Pick an Information Thread, Discover & Drive Out Waste

This Brief Starts With Capabilities & Architectures & Closes With a Lean Information Process Focus

Capability … Everyone's Talking About It

CAPABILITIES-BASED REVIEWS BEGIN TO BEAR FRUIT, ROCHE SAYS …

The Capabilities Review and Risk Assessment process aims to let capabilities, not specific weapons systems, drive how the Air Force spends its money. *

*** INSIDE THE AIR FORCE, August 30, 2002**

Capability … Everyone's Talking About It

"How is it that we can tie capabilities to the budget process? Right now, they're kind of divorced because my CONOPS looks at problems, effects and capabilities and my POM looks at programs and systems." **

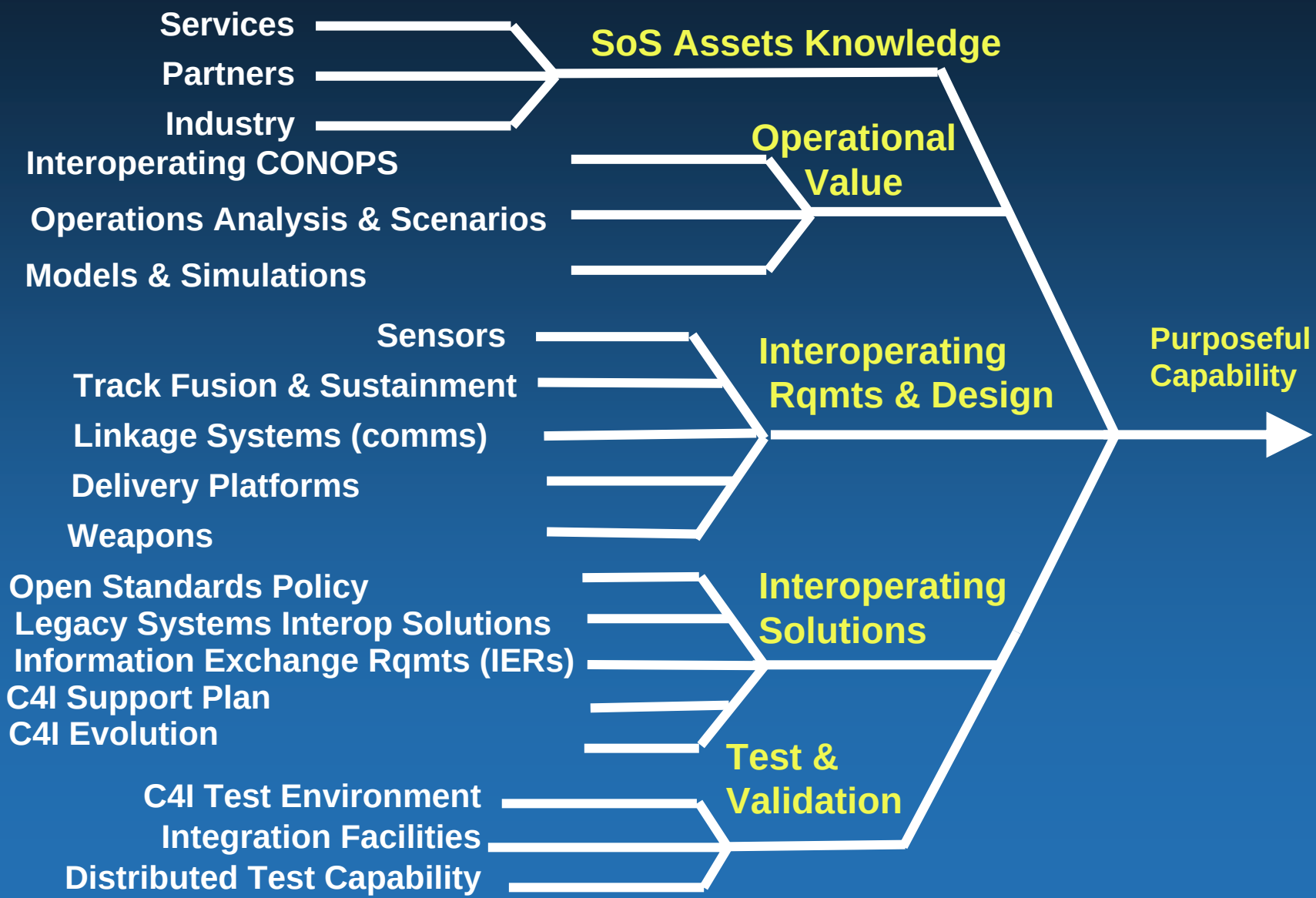
**** Col. Gary Crowder, chief of strategy, concepts, and doctrine at Air Combat Command; quoted in INSIDE THE AIR FORCE, September 6, 2002b**

Alignment…

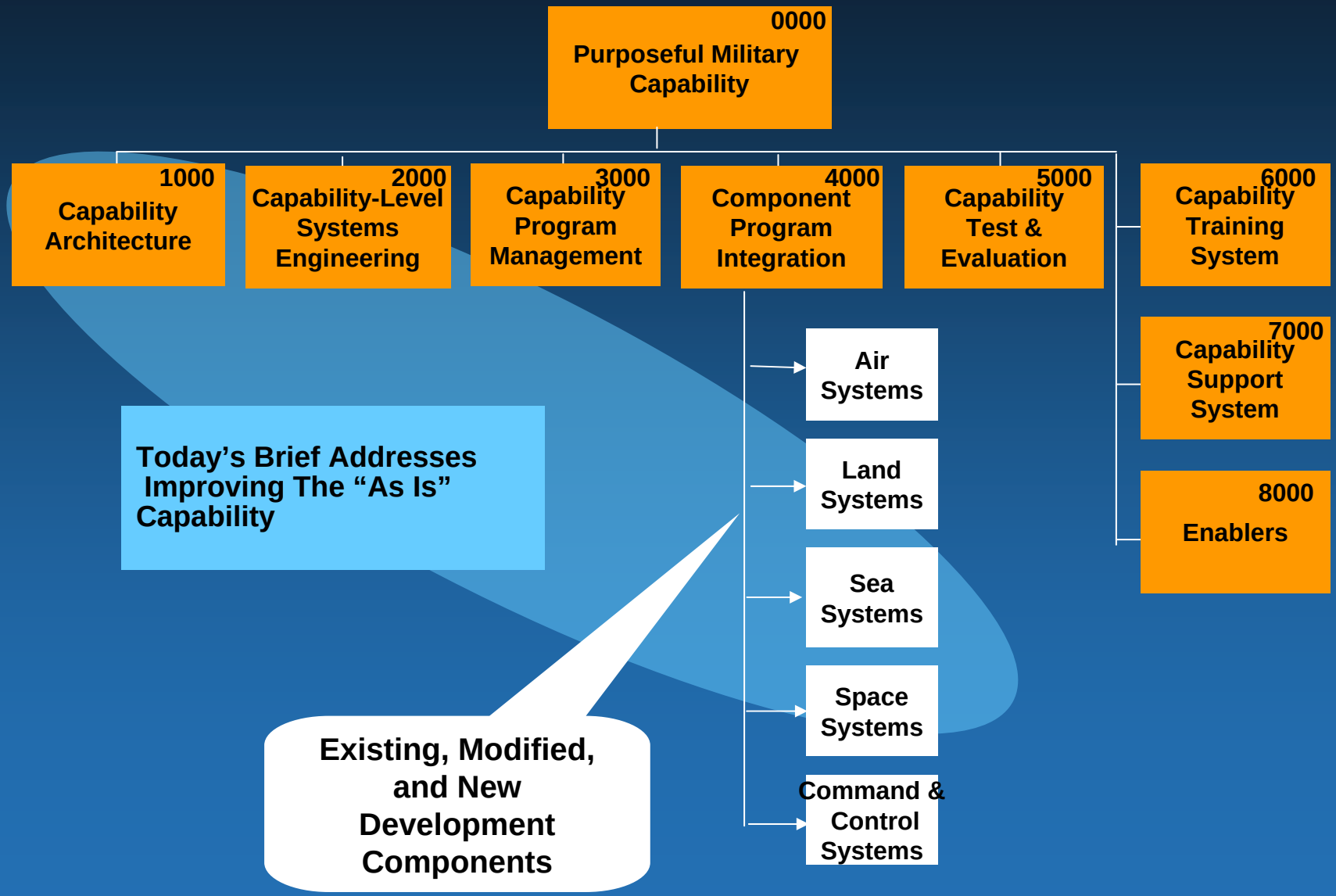
- ***Capability*** **for This Presentation Means…**
  - **Improved Effectiveness of Locating Mines in Surf**
  - **Effective Attack Against Time Critical Targets**
  - **…**
- **A *Capability* is Characterized By…**
  - **An Operational Architecture…Commander's Intent**
  - **Process Architecture…Who Does What When**
  - **An Information Architecture… Supports The Process**
  - **Conforming Components…The Implementing Agents & Actors**
- ***Capability Solutions*** **Are Threads Linking Conforming Components Into an Operational Whole**

Multiple Solutions Are A Characteristic of Capabilities

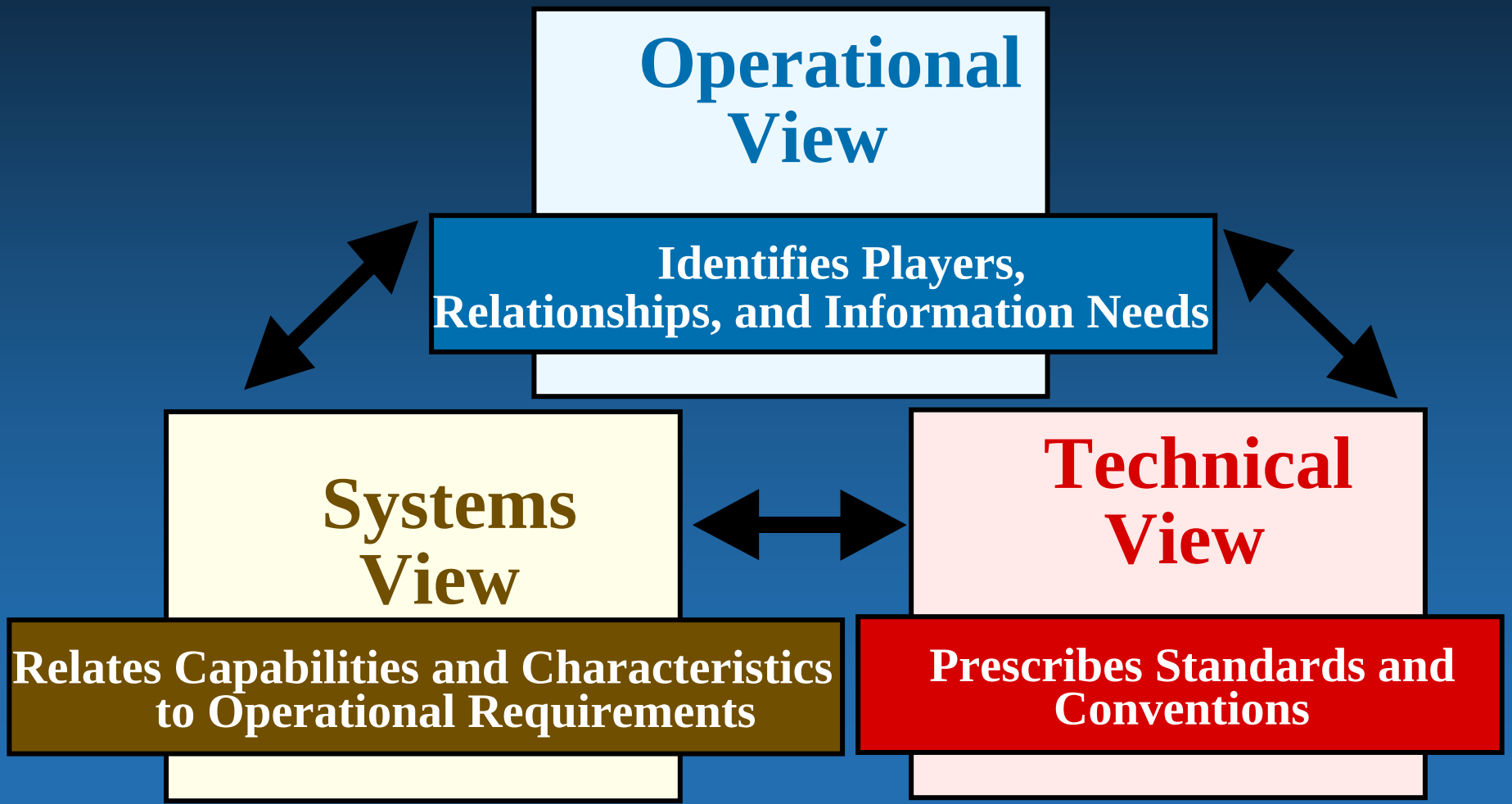
Components of a Capability



Work Breakdown Template for a Capability Program

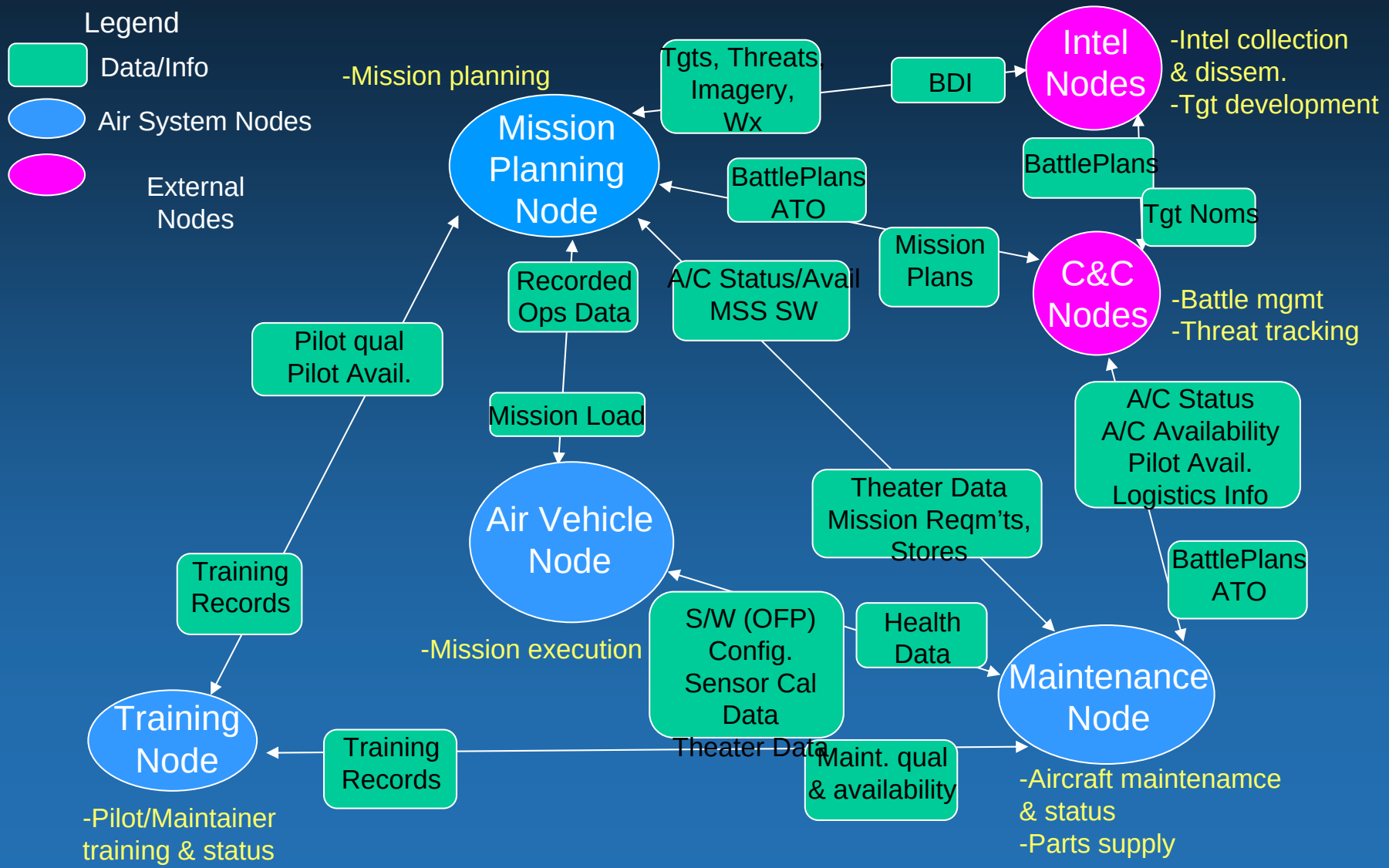


Architecture … Everyone's Talking About It ..



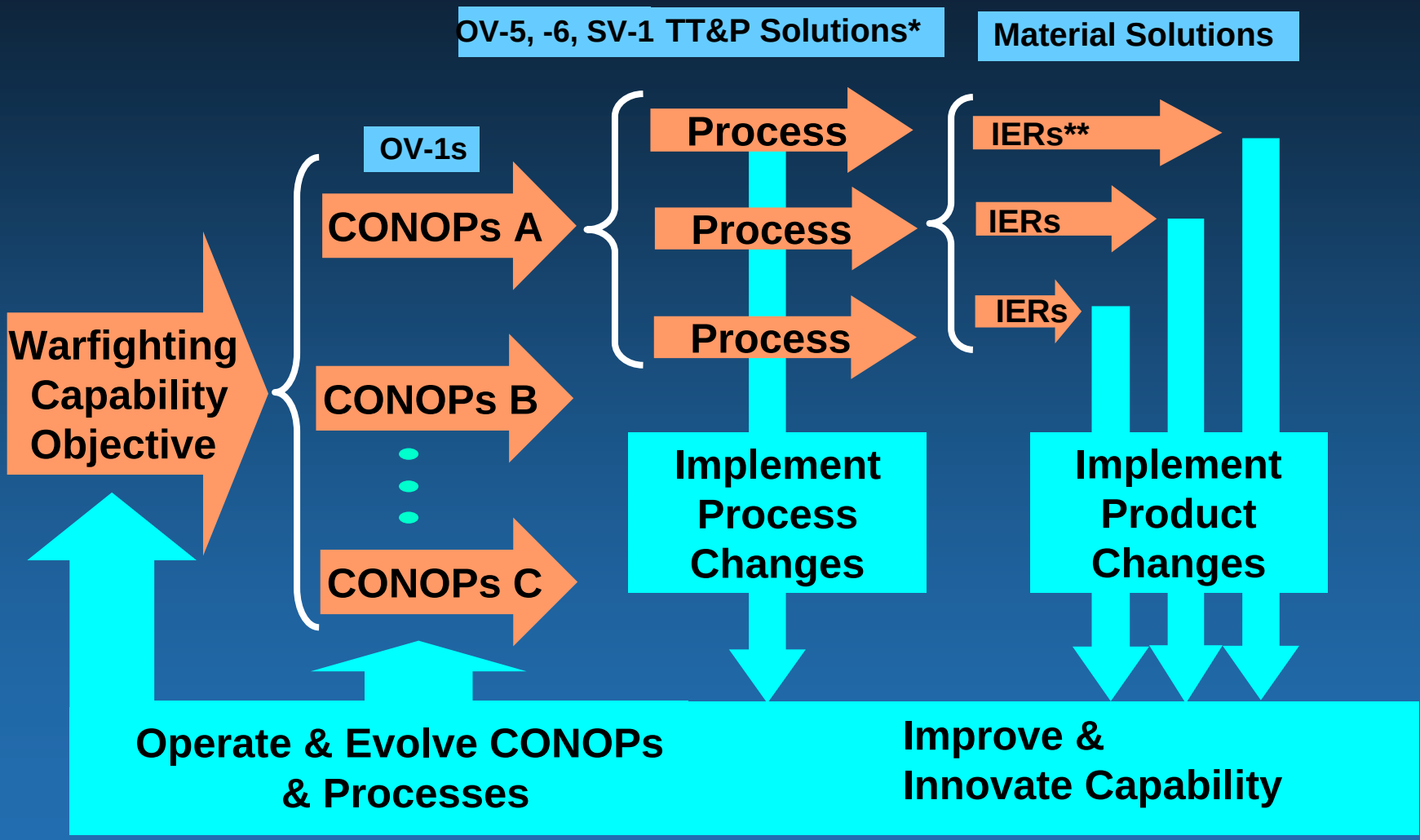
Example: Aircraft Ground Turn-around Thread

Operational View - 2 (Operational Node Connectivity Diagram)



Using Architecture-based Capability Descriptions to Identify C4ISTAR Operations Improvements

Improvements Opportunities Emerge At Several Levels



*TT&P: Tactics, Techniques & Procedures

**IERs: Information Exchange Requirements

Observations on Architecture & Implementation

- **Focus of Acquisition Is Nodes & Entities**
  - Well-documented Requirements
  - Managed Change Processes
- **Focus of Joint Operations Requires Nodes and Entities to Purposefully Interoperate**
  - Within The Context of a Process (Conops)
  - Tactics, Training & Procedures Reflect Process Specifics
- **Operational Performance Today Often Constrained by Process & Interoperability**
  - Process Fulfillment Time Often the Dominant Factor

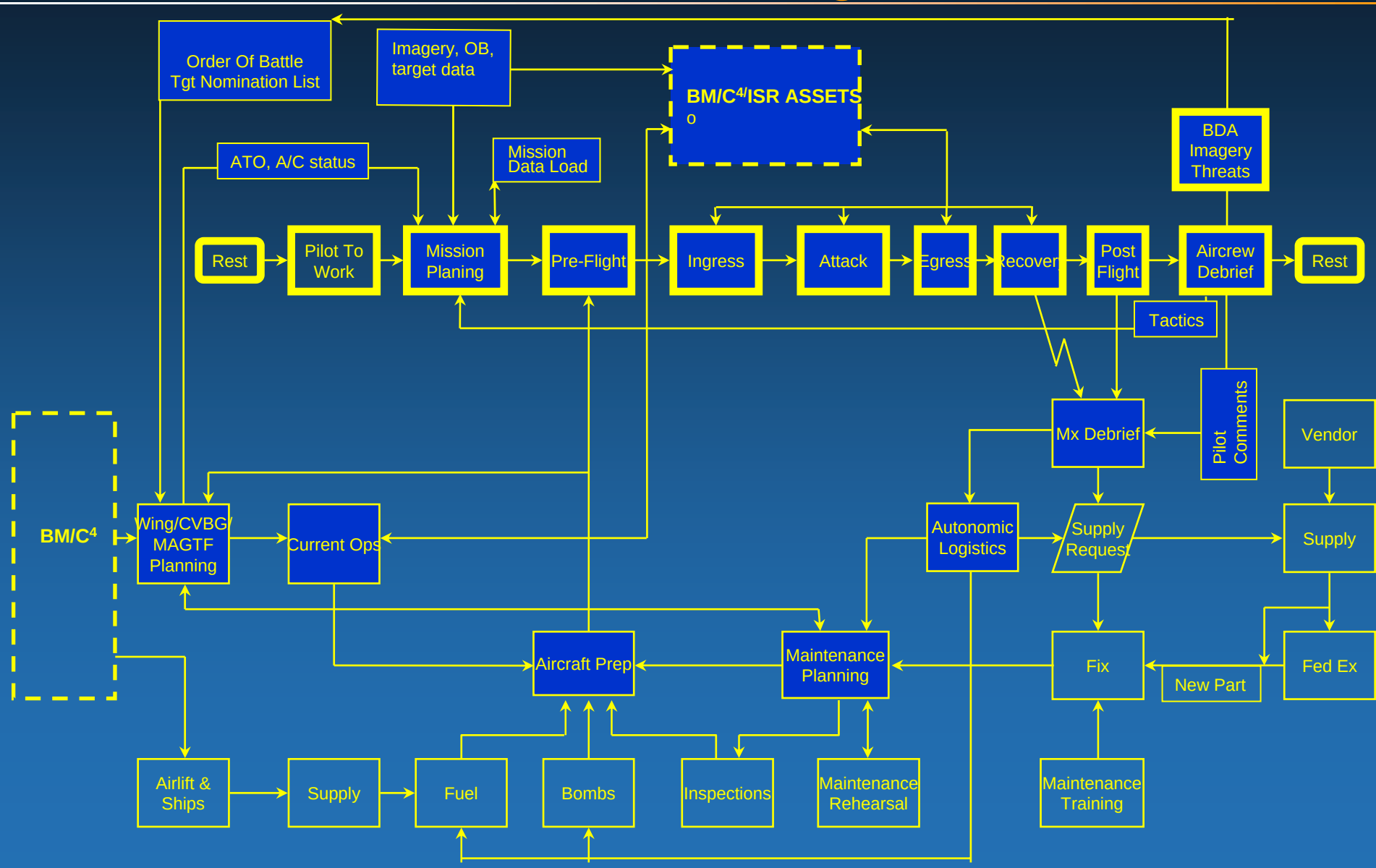
Even New-Wave Architectures Will Be Strongly Constrained by Legacy Force Elements

So How Do We Improve C4ISTAR Operations??

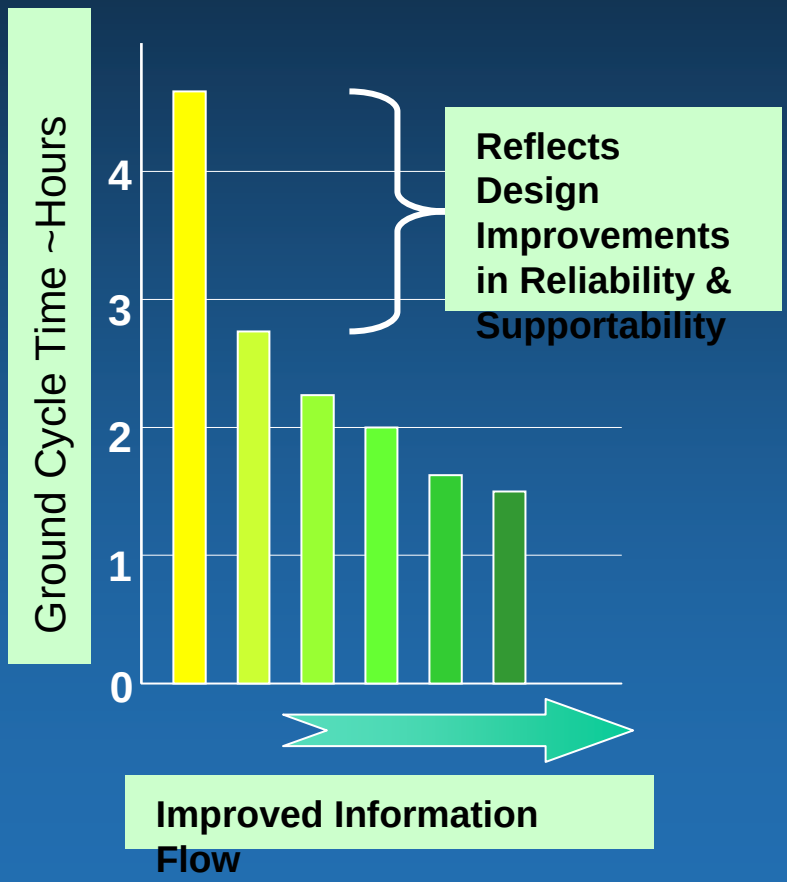
During JEFX wargaming, the time-critical targeting process was reduced to “less than thirty minutes” …. Key to this reduction was the existence of enhanced machine-to-machine interfaces among applications in the CAOC… Greater integration of all applications … cuts down on the use of the so-called “sneaker-net,” …. when “an operator has to …create a database on one machine, save it to a floppy disk, go over to another machine and pop the floppy disk in.” *

*INSIDE THE AIR FORCE, September 6, 2002

Closing the Execution Loop in A Combat Air Mission Setting



Improved Information Flow Reduces Ground Cycle Time



- Legacy Fighter, Legacy IA
- Next Gen Fighter with Legacy IA
- + pre/post-flight data transfers, routine acts, missioniz'g, load'g
- + reliability, abort freq'y/repair, Mx frequency, Mx actions
- + a/c disposition decisions, maintenance-data transfers
- + parts delays

IA--Information Architecture

Lean Thinking (Womack and Jones)

- Precisely specify value by specific ~~product~~ capability
- Identify the value stream for each ~~product~~ capability
- Make value flow without interruptions
- Let the customer pull value from the producer
- Pursue perfection

Example Today: Improving Sortie Generation Through Improved Maintenance Information Flows

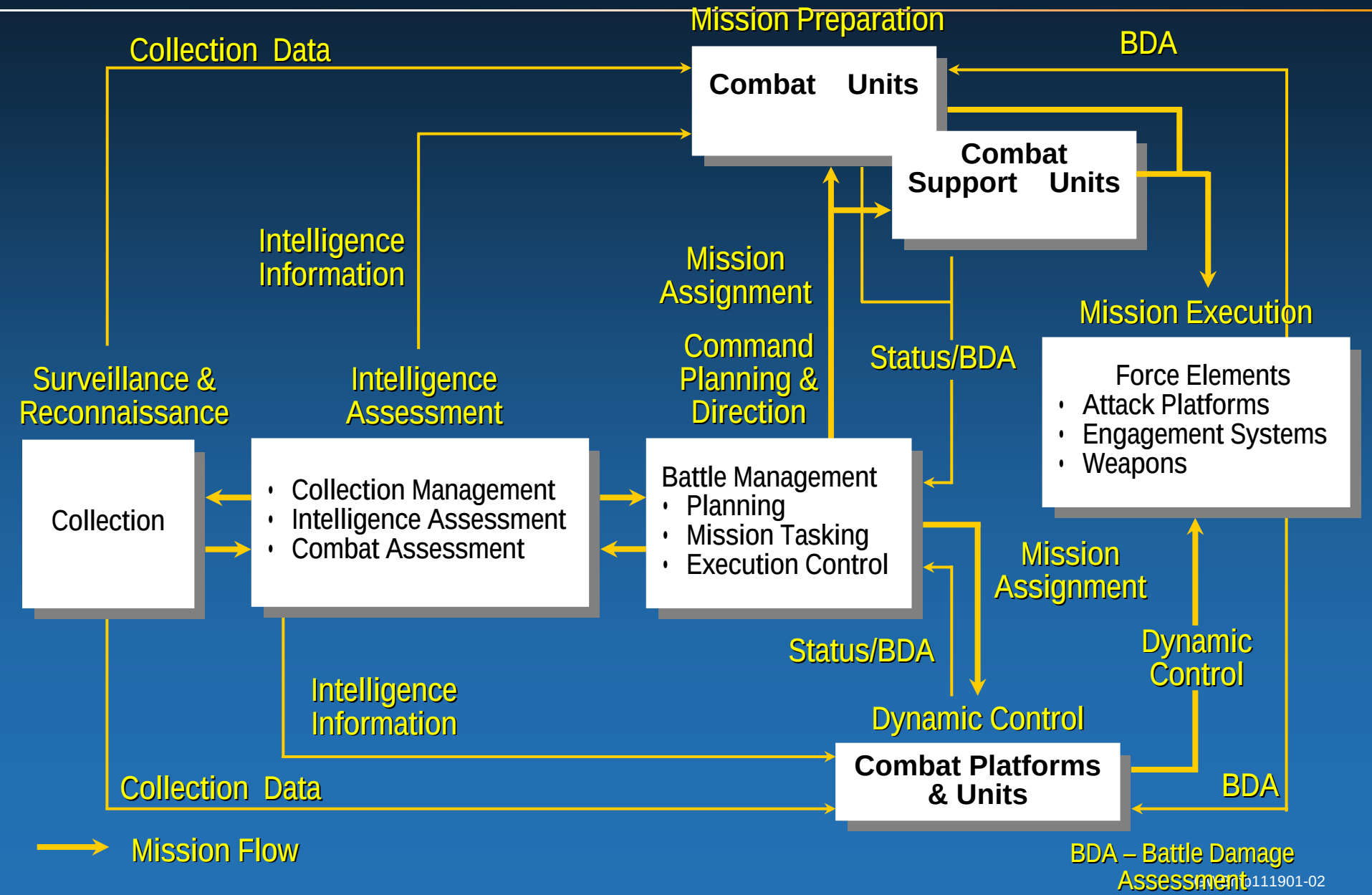
Process Improvement Focus ….
What to Look For

Seven Information System Wastes

1. Over Production---Data Overload
2. Uncontrolled Inventory---Old Data; Difficult Retrieval
3. Information Exchange---Non-Interoperable Issues
4. Unnecessary Movement—Reformatting; Indirect Access
5. Waiting---Delivery Not Timely
6. Defective---Incomplete, Incorrect
7. Inefficient Processing---Custom; Redundant

Credits: Womack & Jones, “Lean Thinking”

Force Projection Functional Architecture



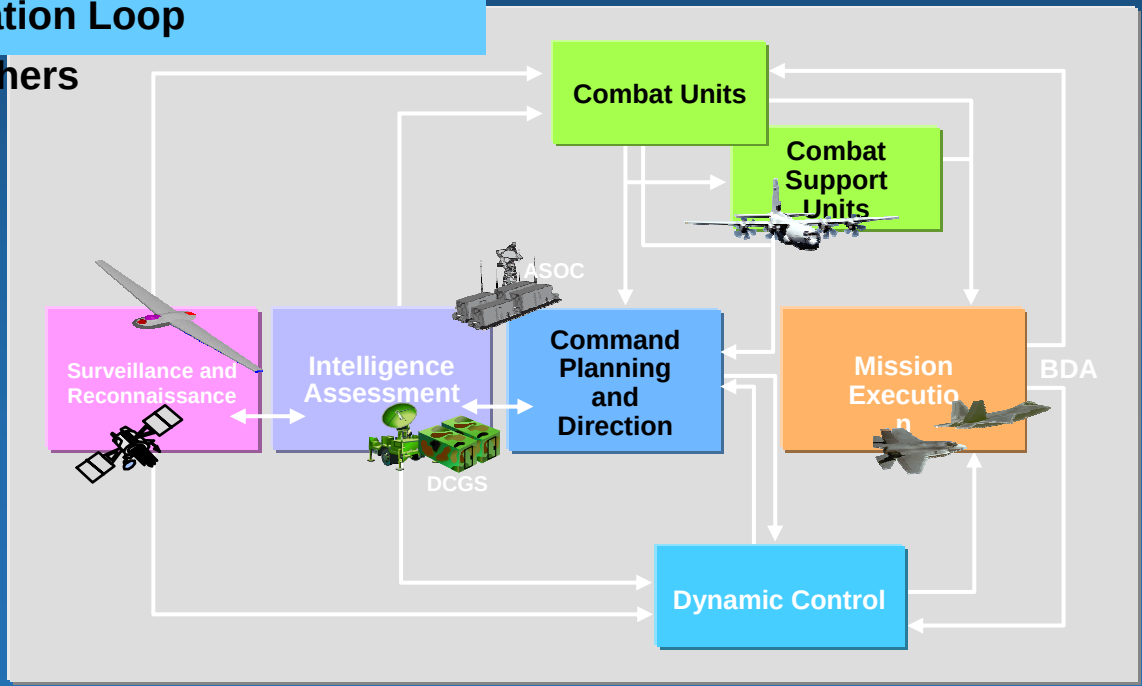
C4ISTAR Capability Loops Are Embedded in The Functional Architecture

- Mission Preparation Loop
- Command Planning Loop
- Real-Time Remote-Sensing Support to

Mission Execution

- Battle Damage Assessment Loop
- Time-Sensitive Targeting Loop
- Sortie Generation Loop
- Numerous Others

Example



A02-05227037

Improvements Process

- **Chose Something Specific to Improve**
  - ***Settle On An Improvement Measure***
- **Establish the "As Is" Information Architecture**
  - ***Use The Architecture Framework: Assures Completeness, Consistency***
  - ***Use Lean Information Systems Principles to Identify Improvement Candidates***
- **Do The CAIV Trades**
  - ***Process Models Can be Very Helpful***
- **Implement & Verify**

Sharing Insights About Improving C4ISTAR Operations

Warfighting Experience: Powerful Solutions, Often Process-Oriented Put Quickly Into Place; Solutions Tend to be Specific & Not Institutionalized

Experimentation: Excellent, But Expensive; Improvement Injected Without Formal Controls

Capability-Based Architecture: The 'Right' , But Very Hard, & Results May be Long in Coming

Under-explored

Process Focus: Pick an Information Thread, Disco

An Alternative That Can Proceed in Parallel With Other Improvement Activities