

Integrated Architecture Development

28 Jan 2004



Brig Gen J. Maluda, USAF
SIAP System Engineer

Col H. Dutchyshyn, USAF
Deputy SIAP SE

CAPT Jeffery W. Wilson, USN
Technical Director

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

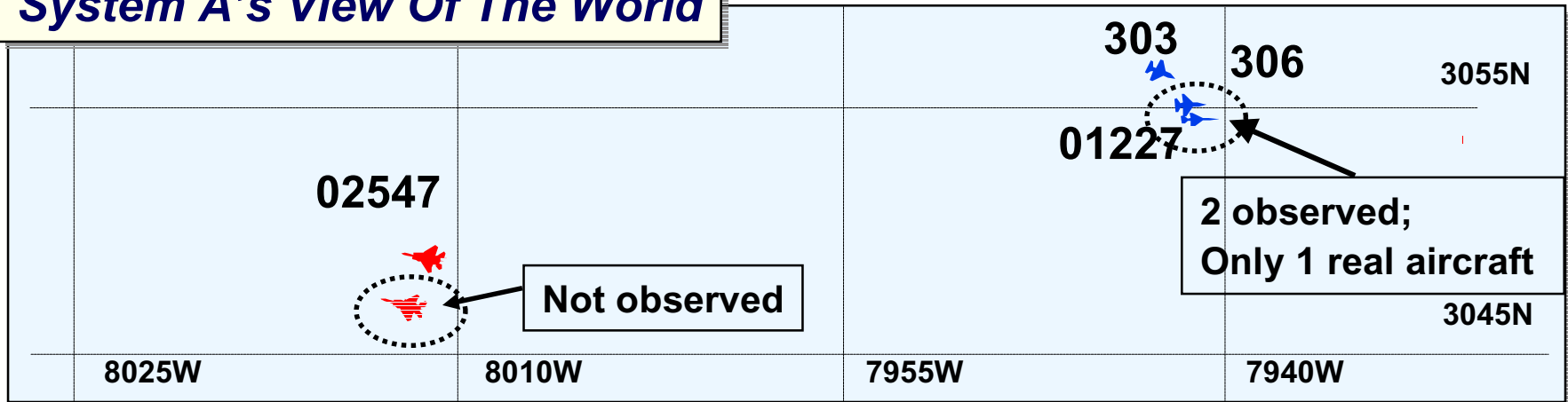
1. REPORT DATE 28 JAN 2004		2. REPORT TYPE		3. DATES COVERED 00-00-2004 to 00-00-2004	
4. TITLE AND SUBTITLE Integrated Architecture Development				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Joint SIAP System Engineering Organization (JSSEO),1931 Jefferson Davis Highway,Arlington,VA,22203				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					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



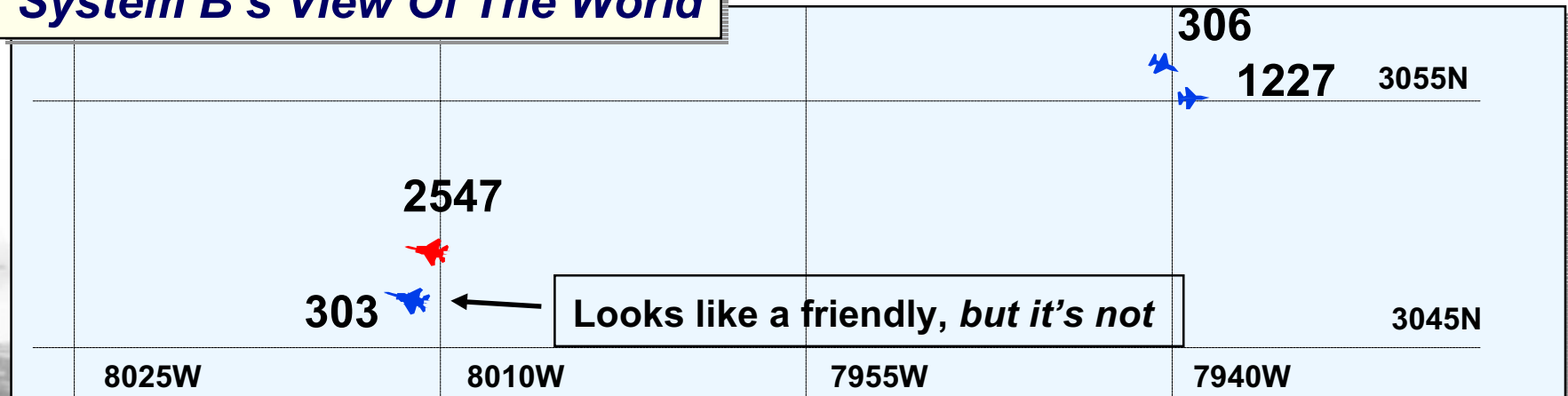
SIAP system engineering . . .

Getting everyone on the same sheet of music

System A's View Of The World

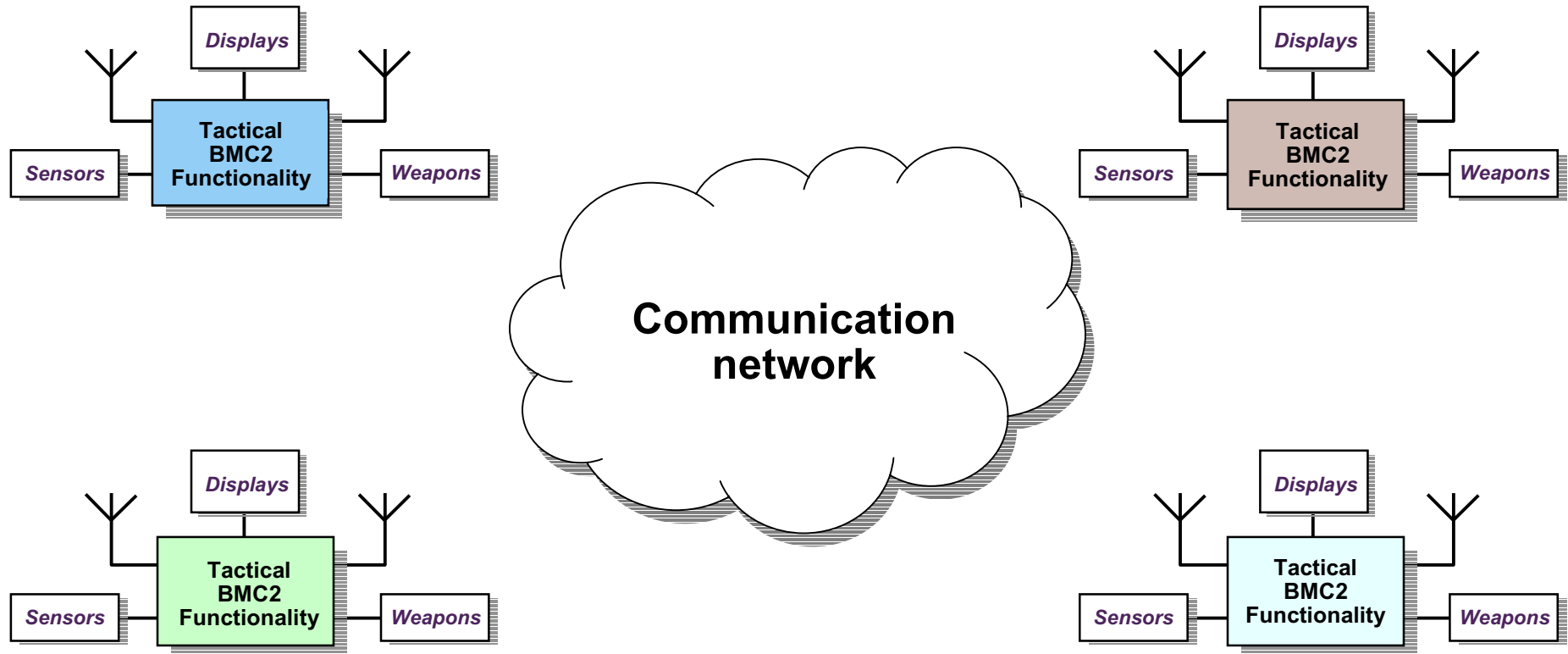


System B's View Of The World





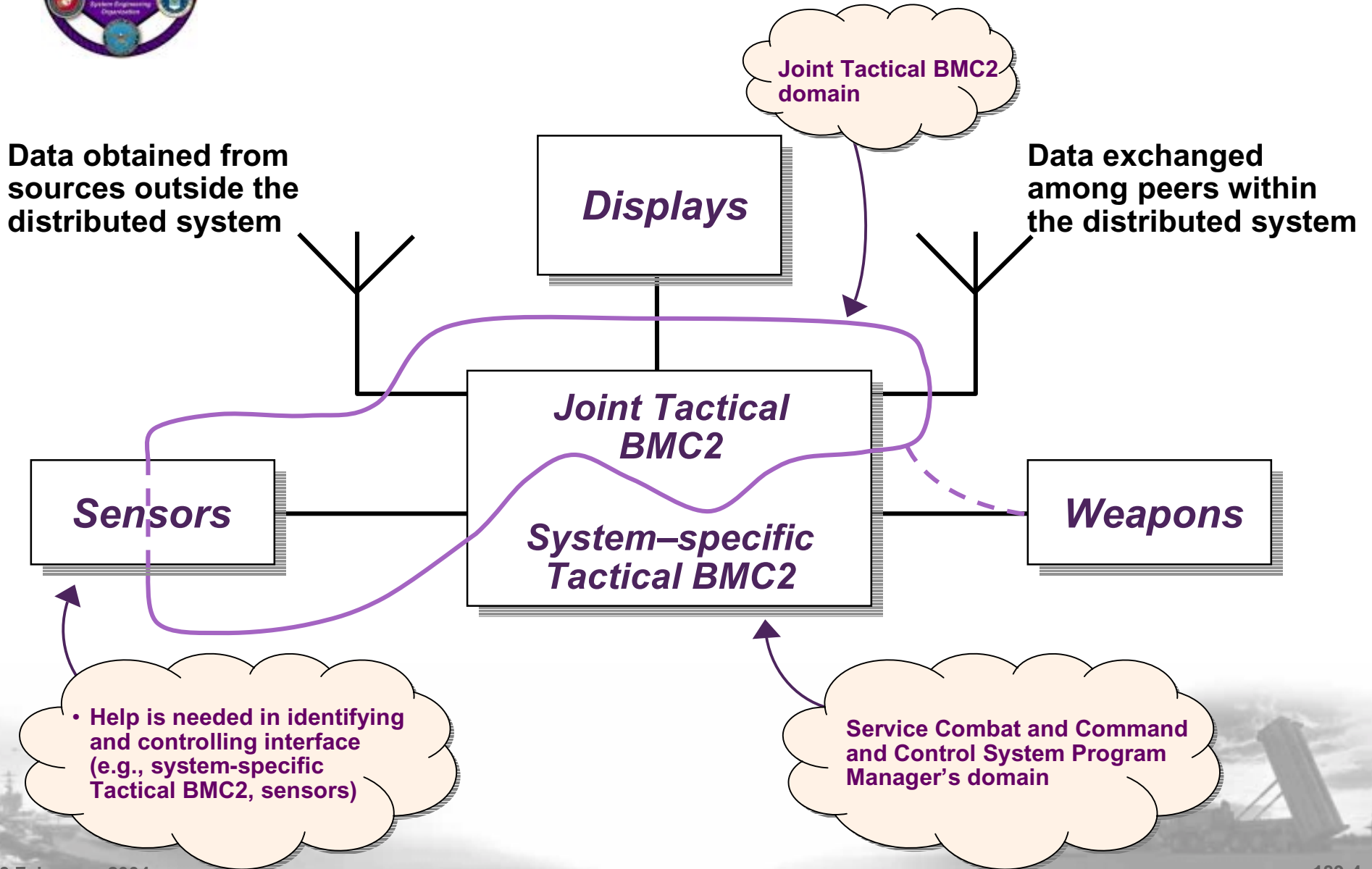
Joint Tactical BMC2 (today)



Common functionality, implemented and maintained many ways

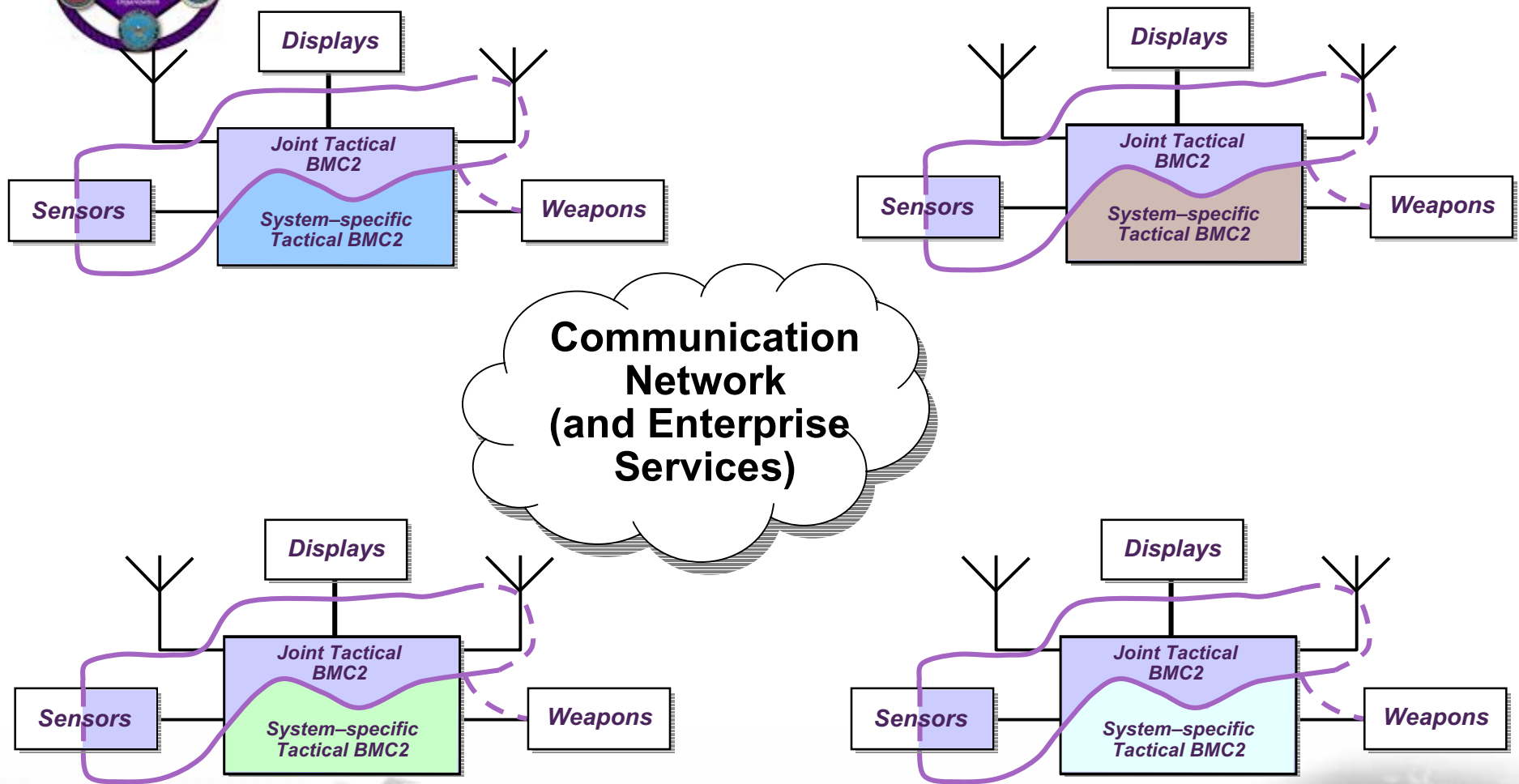


Joint Tactical BMC2





Joint Tactical BMC2 (future)

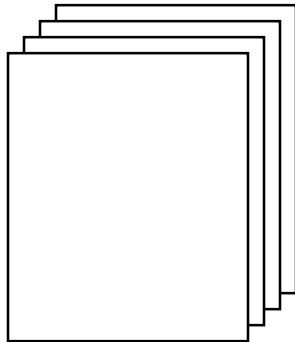


Common functionality, implemented and maintained commonly



Configuration Management

Paper Standard(s) and Specification(s)



- Gaps, overlaps, and conflicts
- Context-free
- Static
- Syntax

Integrated Architecture Behavior Model (“Platform” Independent Model)



- Unambiguous
- Described in context
- Dynamic
- Syntax and semantics
- Strong typing

Shift from static, paper artifact to dynamic behavior model



Integrated Architecture Behavior Model

- Derived from JROC-validated requirements
- Unambiguously describes dynamic system behavior in an open source model
- Supports selection among alternative solutions
- Delivered to program managers with verification/validation data and JDEP technical framework

Idealized model of distributed system performance that shows industry what “good” looks like – automates the standards



Precepts

Cornerstones

- **Continuous Readiness**
- **Sensor Netting**
- **Battlespace Dominance**
- **Proven Lethality**
- **Coordinated Weapon Employment**
- **Joint Command Support**
- **Information Assurance**

Architecture Quality Attributes

- **Performance (functionality)**
 - Correctness
 - Efficiency
 - Completeness
- **Reliability**
 - Survivability
 - Fault tolerance
 - Openness
- **Scalability**
 - Flexibility
 - Openness
- **Maintainability**
 - Openness
 - Expandability
 - Testability
- **Safety**
- **Security (Info. Assurance)**
 - Survivability
- **Verifiability**
 - Openness
- **Reusability and portability**
 - Equipment and OS independence
 - Openness

Source: IEEE-Std 1061-
ISO Std 9126
MITRE Guide to Total Software
Quality Control

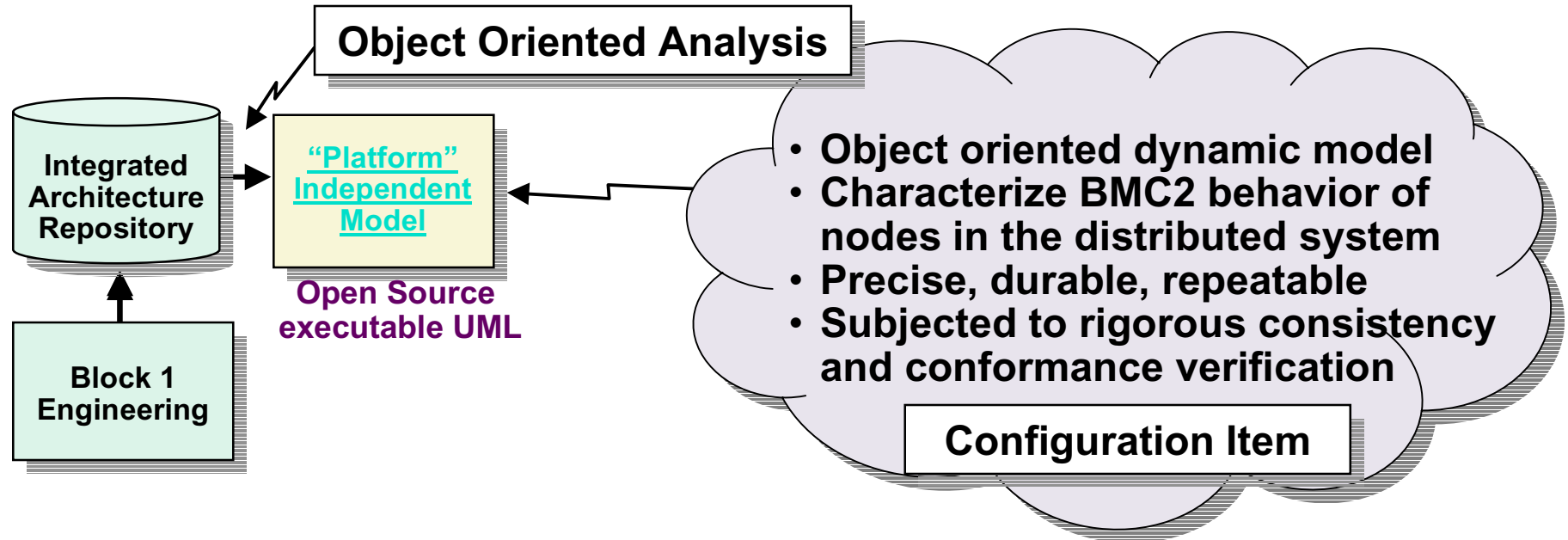
Outcomes

- **Reduce fratricide**
- **Employ weapons to design range**
- **Counter existing and emerging threats**

- **Increased performance**
- **Lifecycle cost avoidance**
- **Reduced time to field new and modified capability**



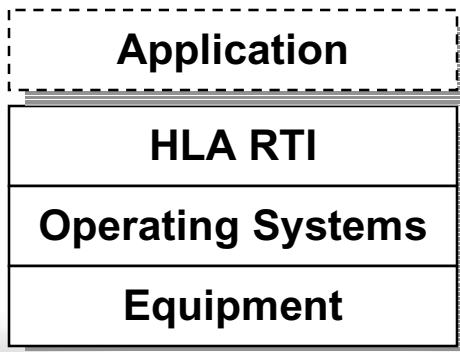
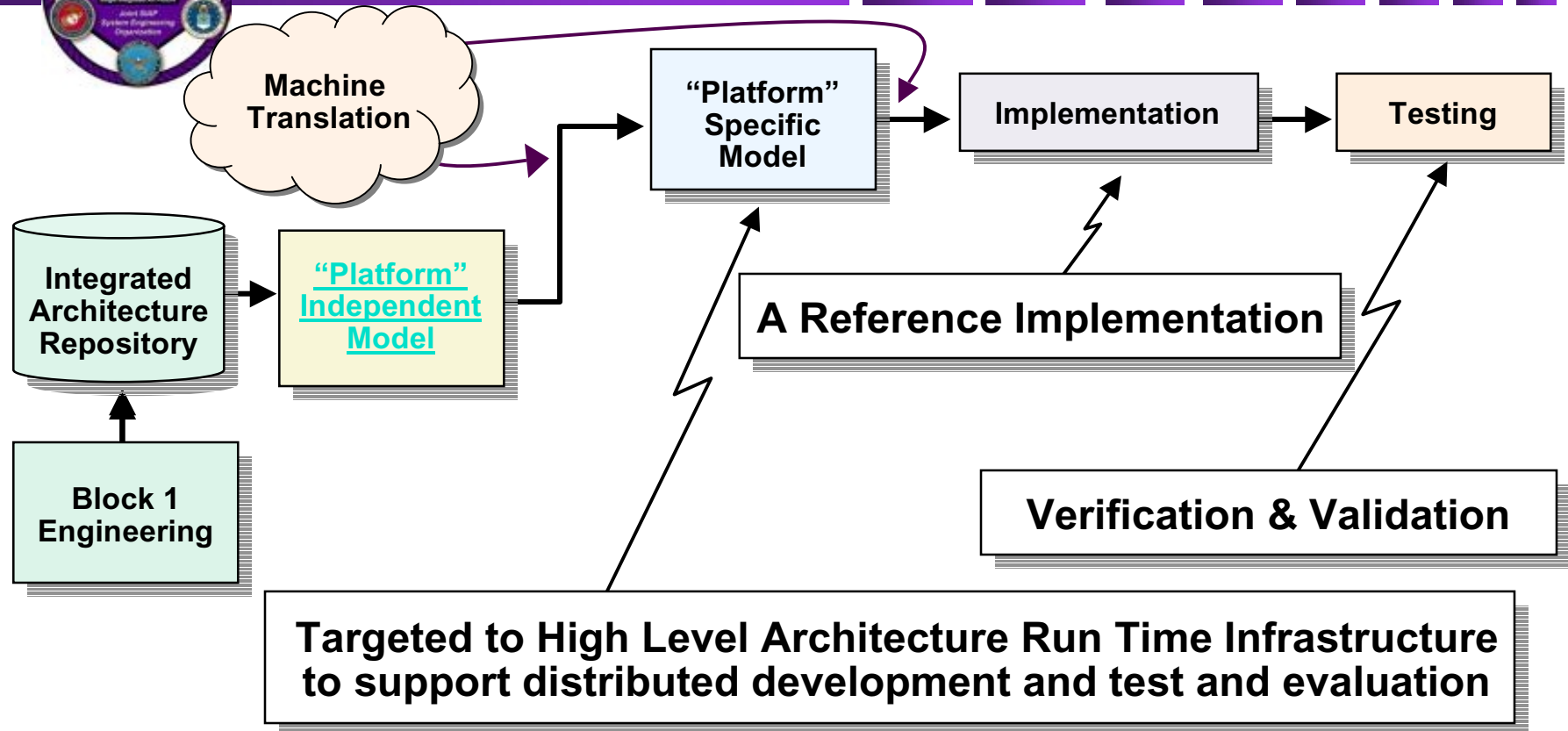
Model Driven Architecture



Isolate functionality from specific implementation technologies allows Design for Change

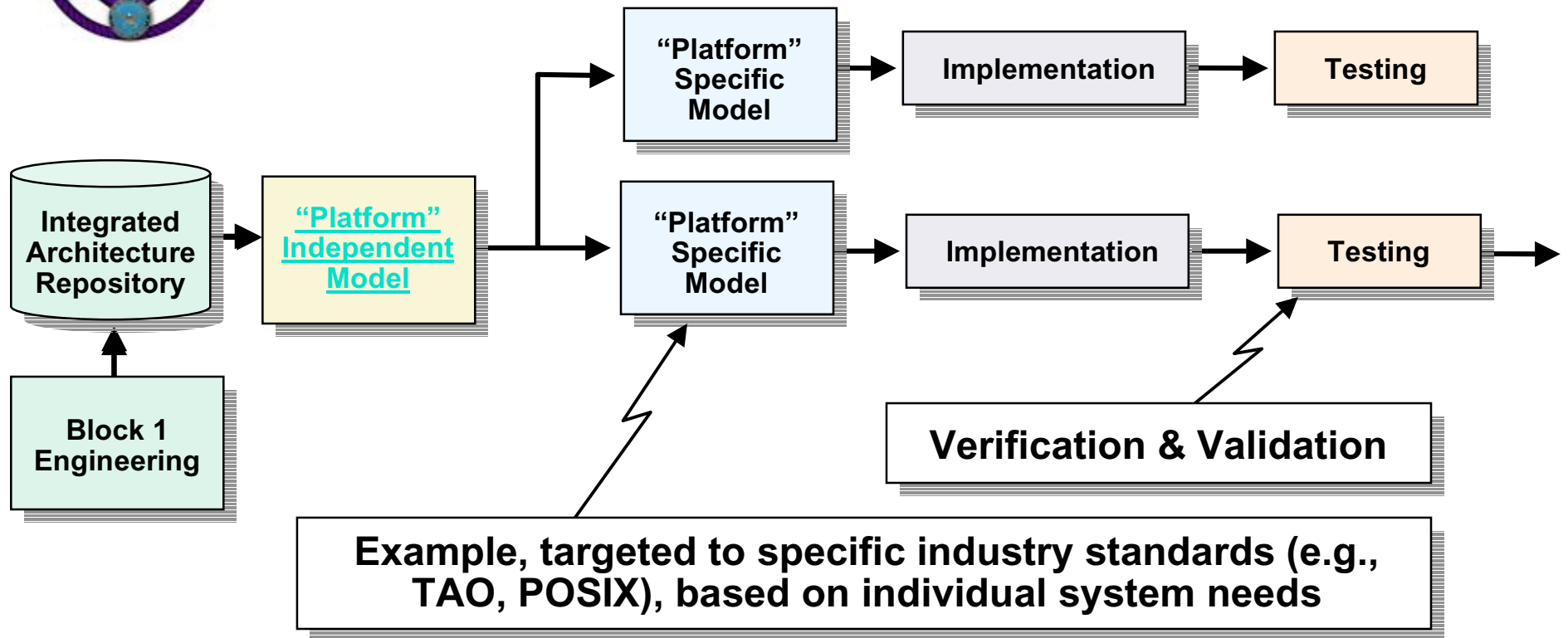


Model Driven Architecture



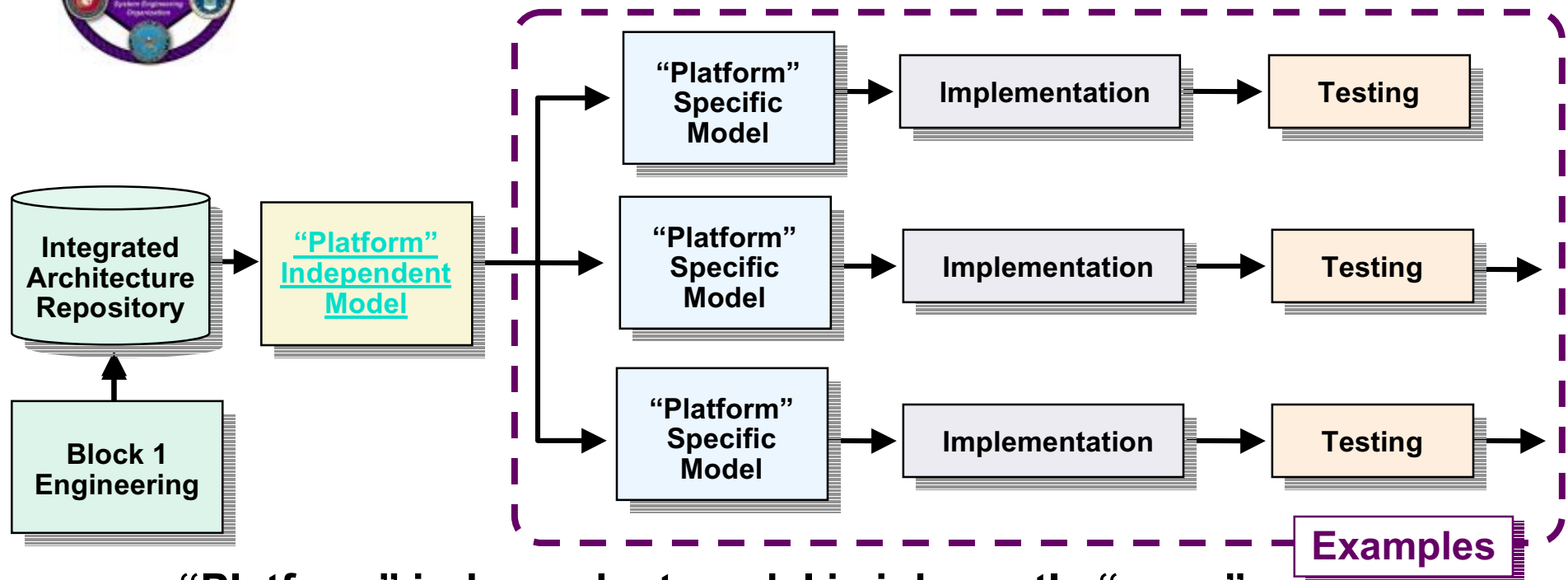


Model Driven Architecture





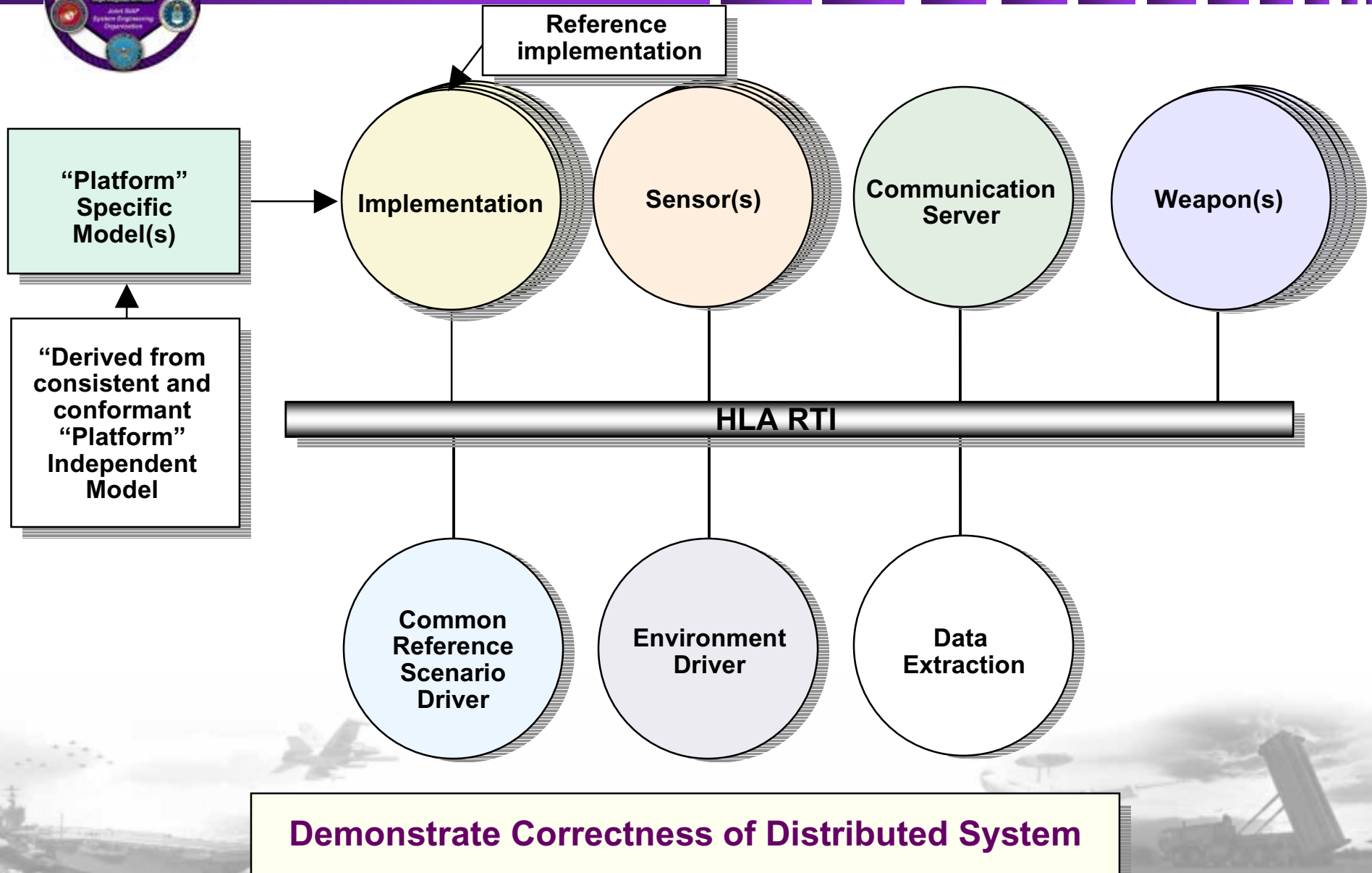
Model Driven Architecture



- **“Platform” independent model is inherently “open”, provides dynamic model of system behavior, and allows deferral of specific implementation technology decisions**
- **HLA-compliant model demonstrates distributed system performance**
- **One or more specific model(s) demonstrate distributed system performance in real system(s)**

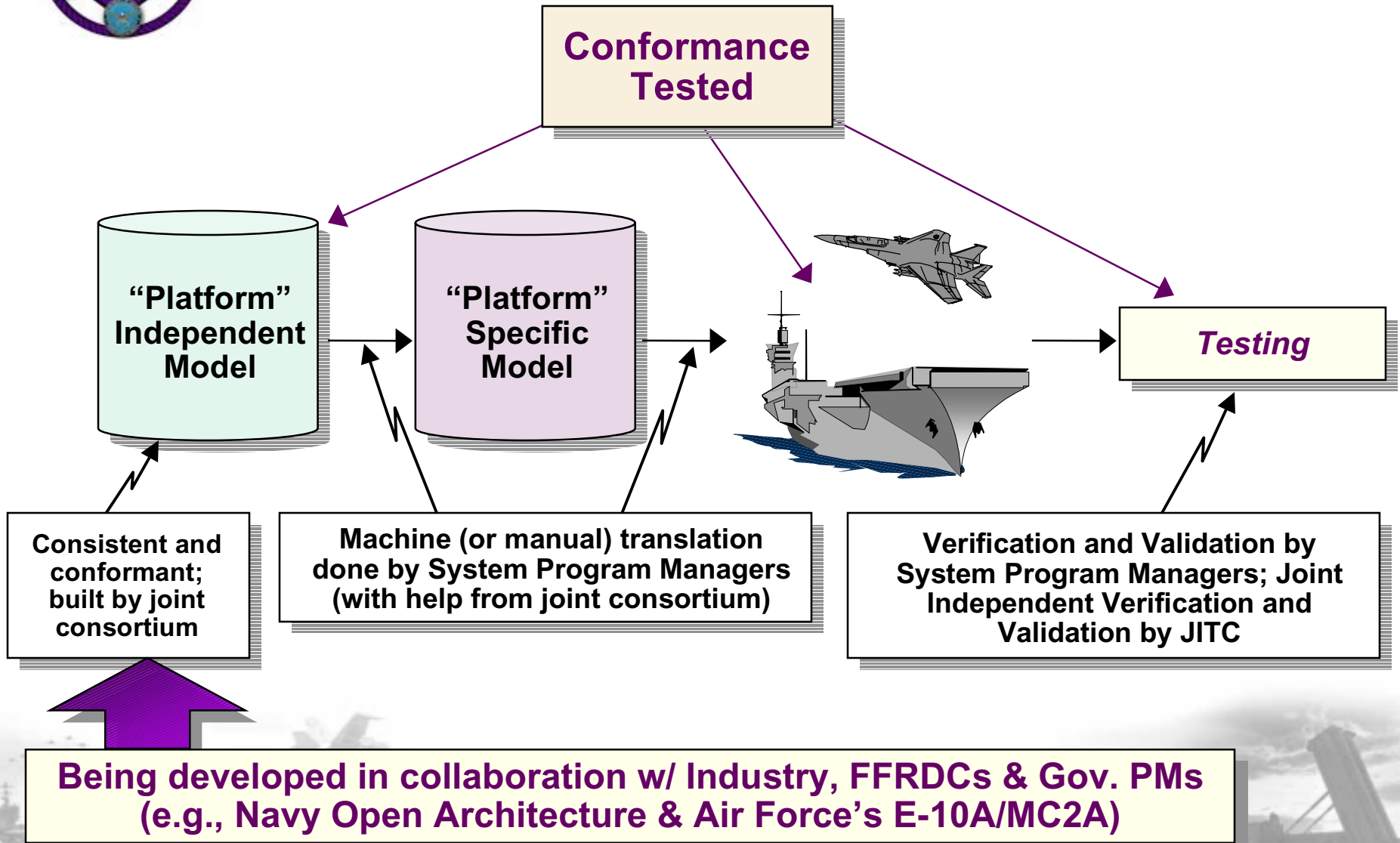


Verification and Validation





Implementation in tactical systems





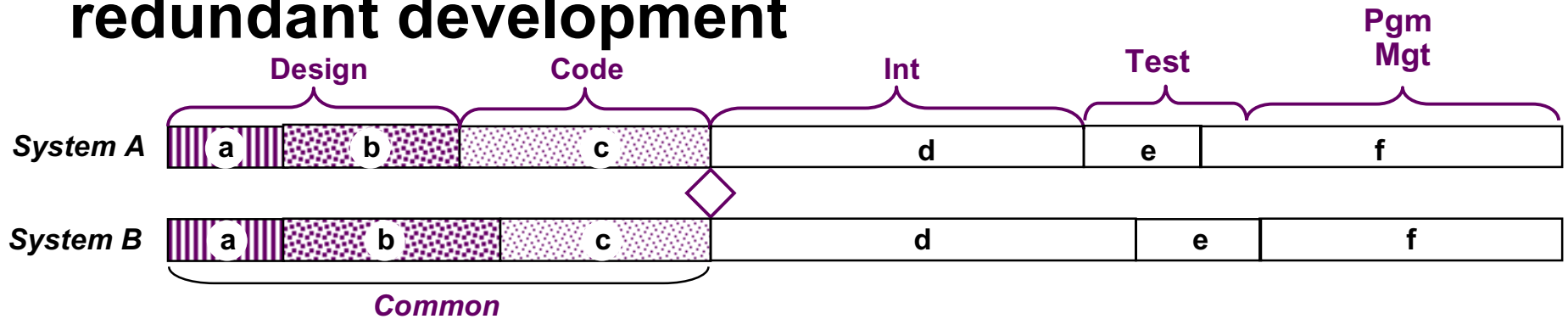
Deliverables

- **One “Platform” Independent Model**
- **Two or more example “Platform” Specific Model(s)**
 - One HLA RTI-specific
 - At least one targeted to a specific communication environment and operating system
- **Reference Implementation(s) derived from “platform specific model(s)**
- **Unit and integration test scripts and results (verification)**
- **Validation test scripts and results**
- **JDEP kit**



Funding Strategies

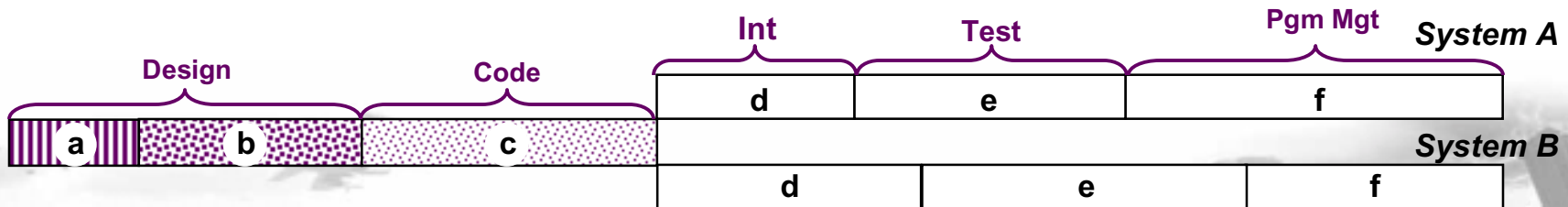
- Original Service estimates accounted for redundant development



Block 0 & Block 1 \rightarrow Total \$ = System A + System B

- A change in business model should reduce total cost and help synchronize development

New Method $Total \$ = a + b + c + A_d + B_d + A_e + B_e + A_f + B_f$



Demands change in business model



The message

- **Integrated Architecture continues to be a key task force product**
- **Integrated Architecture behavior model supports dynamic analysis and improved communication with industry**
- **Approach changes configuration item(s) from paper specifications and standards to dynamic behavior model**

The Integrated Architecture provides the basis for reducing development costs, reducing time required to field new and modified capability, and increasing operational effectiveness



Requirement sources

TAMD, CID, GIG CRDs

MIL-STD-6016B

STANAG 5516

JSLIR-16 (draft)

STANAG 5522

MIL-STD-3011

SIAP SE Technical Reports

Existing Architecture products

- Views
- Threads

Athena/Sea Athena/Common C&D

MSI

SRIG design

Navy OA materials

SGS/AC spec, source code

JDEP kit

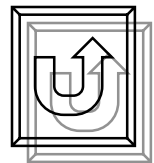
SIAP Block 0 DSB

SIAP Block 1 DSB

USAF DLI/LCI/TDLCS

USAF COLE

USMC COLE



Large number of ways to describe expected performance creates gaps, overlaps, and conflicts...Integrated Architecture can force convergence and consistency



“Platform” Independent Model

- **Who**

- Industry/University/FFRDC/Government Team

- **What**

- Independent of computer, operating system, and “middleware”
- Complete and correct model of an arbitrary distributed system peer
 - Syntax and semantics
 - Dynamically verifiable (unambiguous)
- Tailored for specific implementations (e.g., AWACS, AEGIS) when “Platform” Specific Implementation is built



“Platform” Independent Model *(cont.)*

- **Why**

- Express the behavior of the distributed system in an industry standard language
- Allow verification and validation of the integrated architecture
- Change configuration management artifact from paper standard and source code to behavior model
- Support verification and validation of end product





“Platform” Independent Model *(cont.)*

- **Where**

- Collocated team in Arlington, VA

- **When**

- Block 1 System Engineering FY 02-03
- Build and test model FY 03-05
- Integrate and test FY 06-07
- IOC FY 08





“Platform” Independent Model *(cont.)*

- **How**

- Product of disciplined, but efficient system engineering process
- Model developed by partnership of industry, university, FFRDC, government
- Implemented and integrated by industry

- **How much**

- Joint Tactical BMC2 functionality; extensible to service–unique functionality





JDEP kit contents

- **Attributes Technical Reports**
- **Common Reference Scenarios**
- **Common Reference Scenario Driver**
- **ARCTIC**
- **PET**
- **Environment services**
- **Communications services**
- **Sensor representations**
- **Weapon representations**

