Leveraging Executable Architectures in a Joint Environment

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Purpose

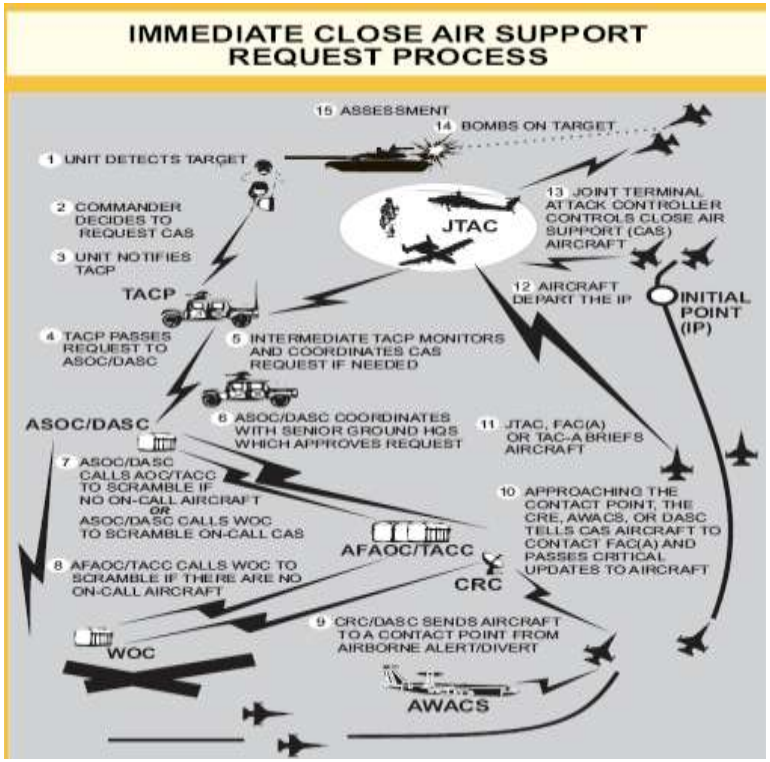
Detail analysis utilizing executable architectures and demonstrate its capabilities to support Joint Systems Engineering analysis

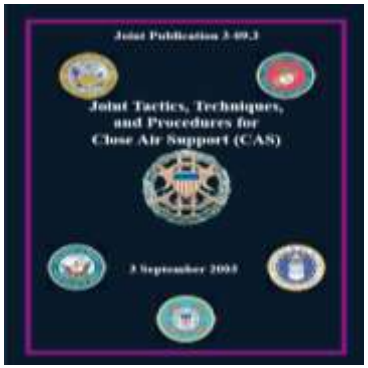
Overview

- Developing Enterprise Architecture
- Using Activity Models to develop Executable Architectures
- Leveraging Executable Architectures for use in Engineering Analysis, Testing, and Training

Develop Enterprise Architecture
(Joint Close Air Support Example)

- **Mission Thread Decomposition**
  - Multiple Doctrinal Sources, Service Architectures
  - Subject Matter Expert Inputs
  - Decompose tasks, activities, etc

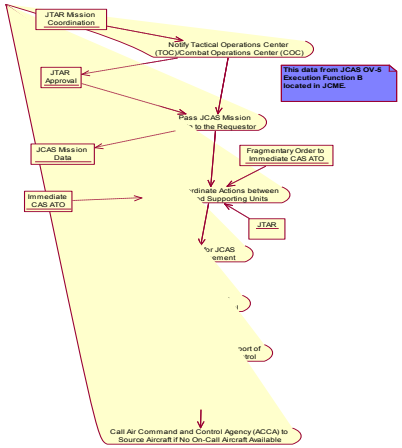




Develop Enterprise Architecture
(Joint Close Air Support Example)

- **Develop DoDAF Architectural Views**
  - Core for executable is detailed Activity Model
  - Analyze for gaps, shortfalls, etc.

OV-1



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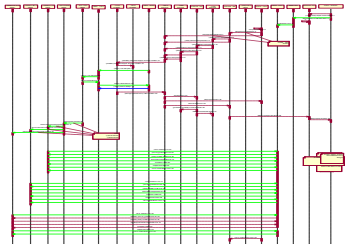

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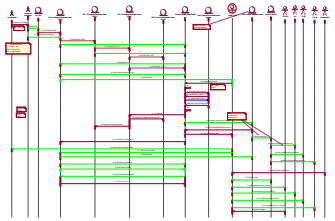

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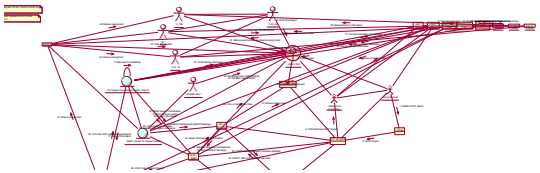
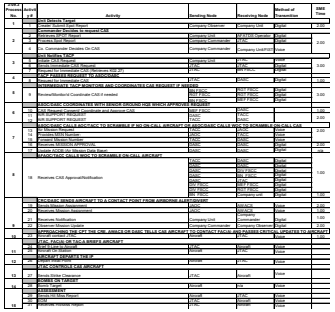


OV-2



OV-3

Develop Enterprise Architecture
(Joint Close Air Support Example)

- **Document Requirements, Capability, Gaps**
  - Desk Top Assessment (JCAS JBMC2 Final Report)

UNITED STATES JOINT FORCES COMMAND
JOINT BATTLE MANAGEMENT
COMMAND AND CONTROL

Joint Close Air Support
Joint Mission Thread

Desk Top Analysis
Final Report

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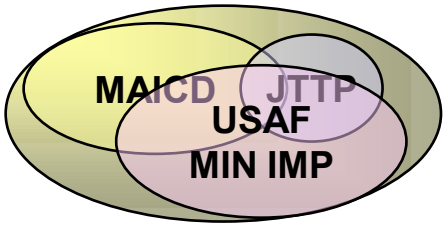

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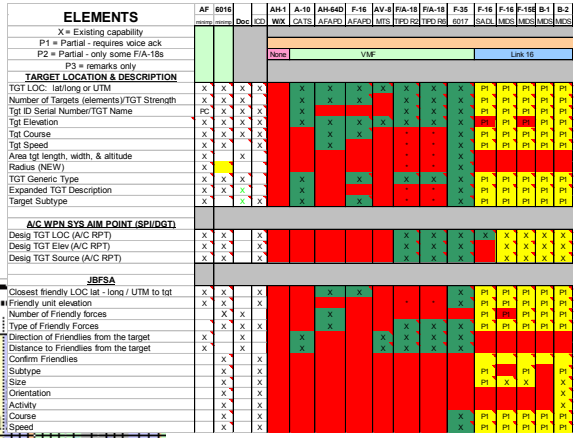
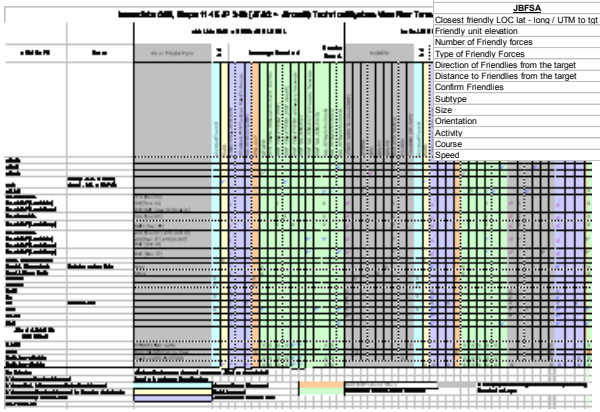
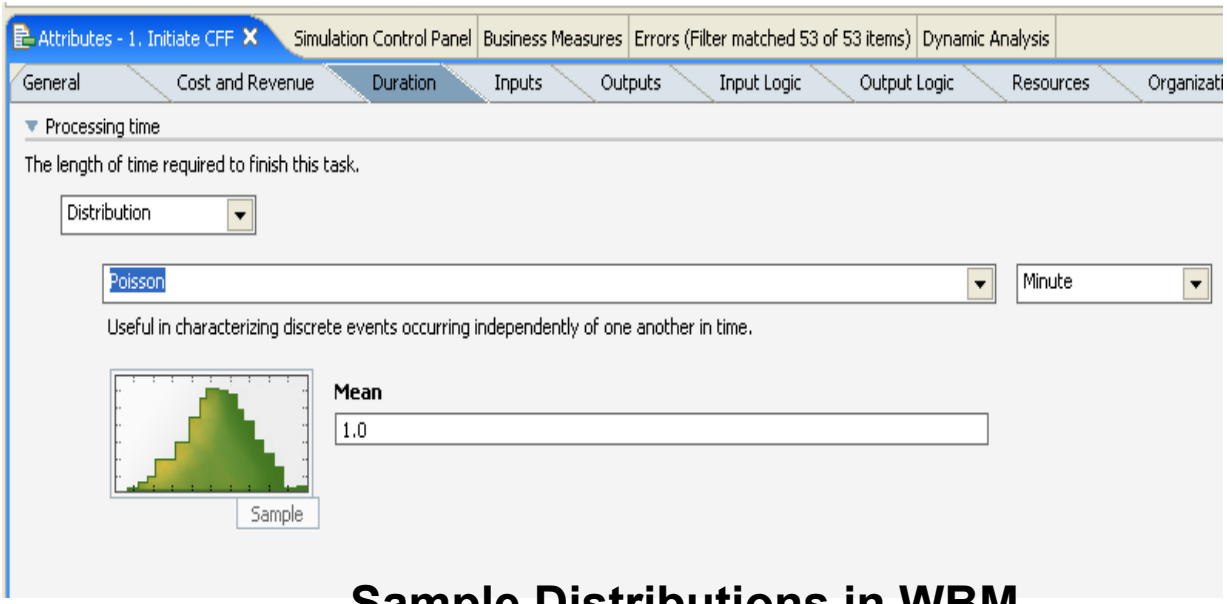




Develop Executable Architecture

- **Simulation tools provide capability to compare processes, time, costs, return on investments**
  - Input Time/Resources (distributions)
  - Map to Requirements, Tasks, etc.
- **Scenario-based**
- **Assumptions**

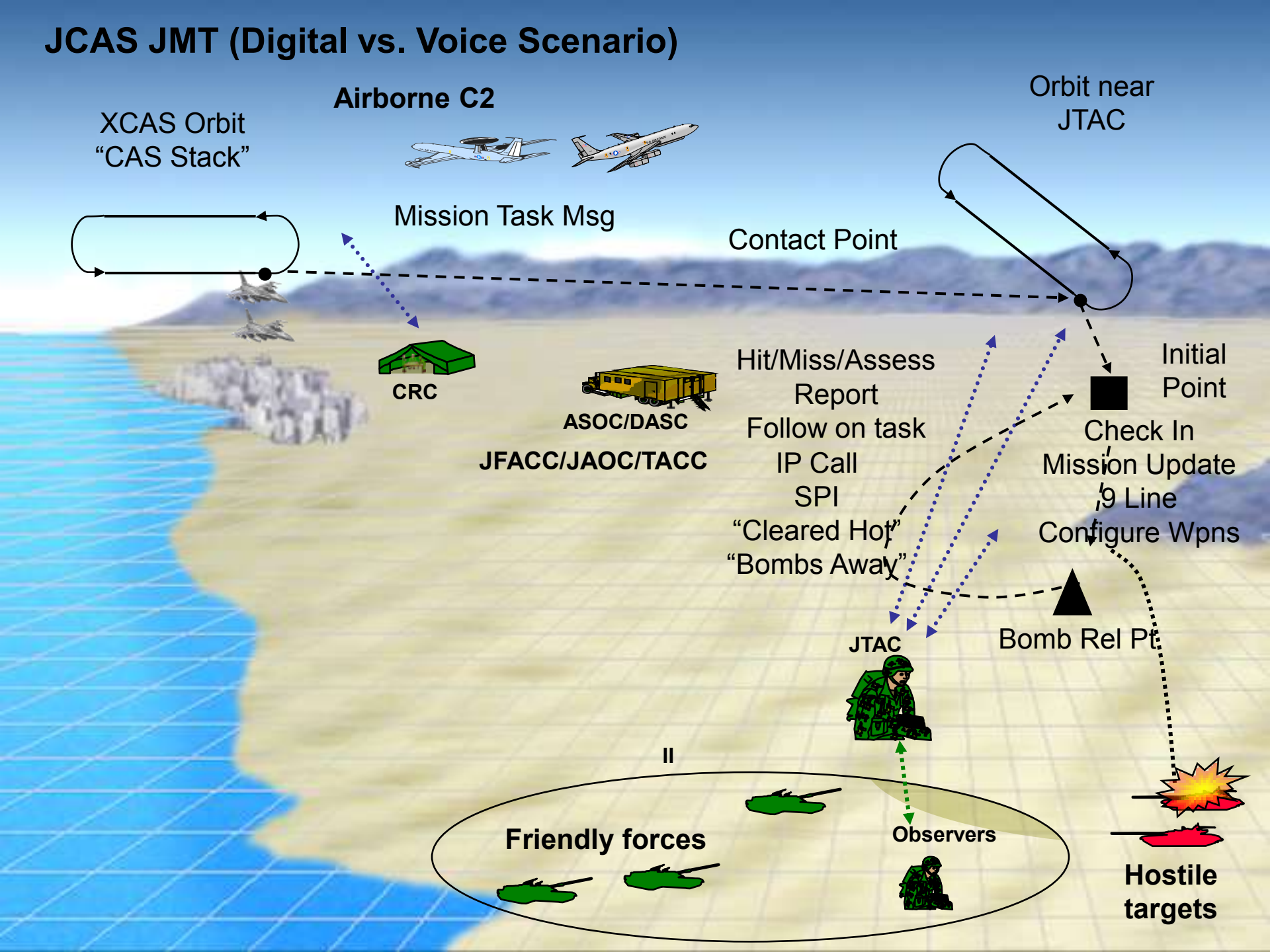


Sample Distributions in WBM

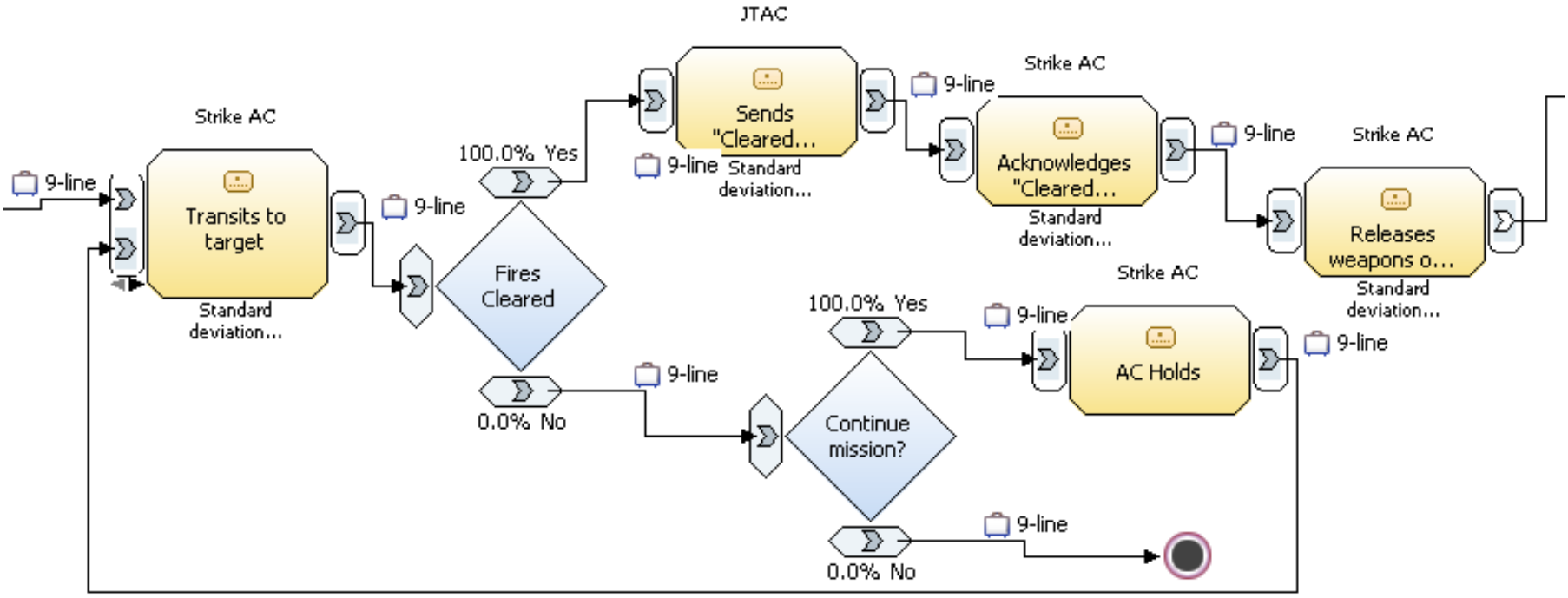
JCAS Example
(Digital vs. Voice Comparison)

- **Compare process from mission assignment to mission completion using "as is" architecture against a "to be" architecture that maximizes digital transmissions.**
- **Model: JCAS Model Scenario:**
  - Scenario 1: Aircraft in XCAS Stack conducts mission from Mission Assignment to BDA
  - Scenario 2: Aircraft conducts entire mission from Contact Point
- **Metrics**
  - Time between Voice “As is” and Digital “To Be”
  - Capability increase
  - Accuracy

JCAS JMT (Digital vs. Voice Scenario)



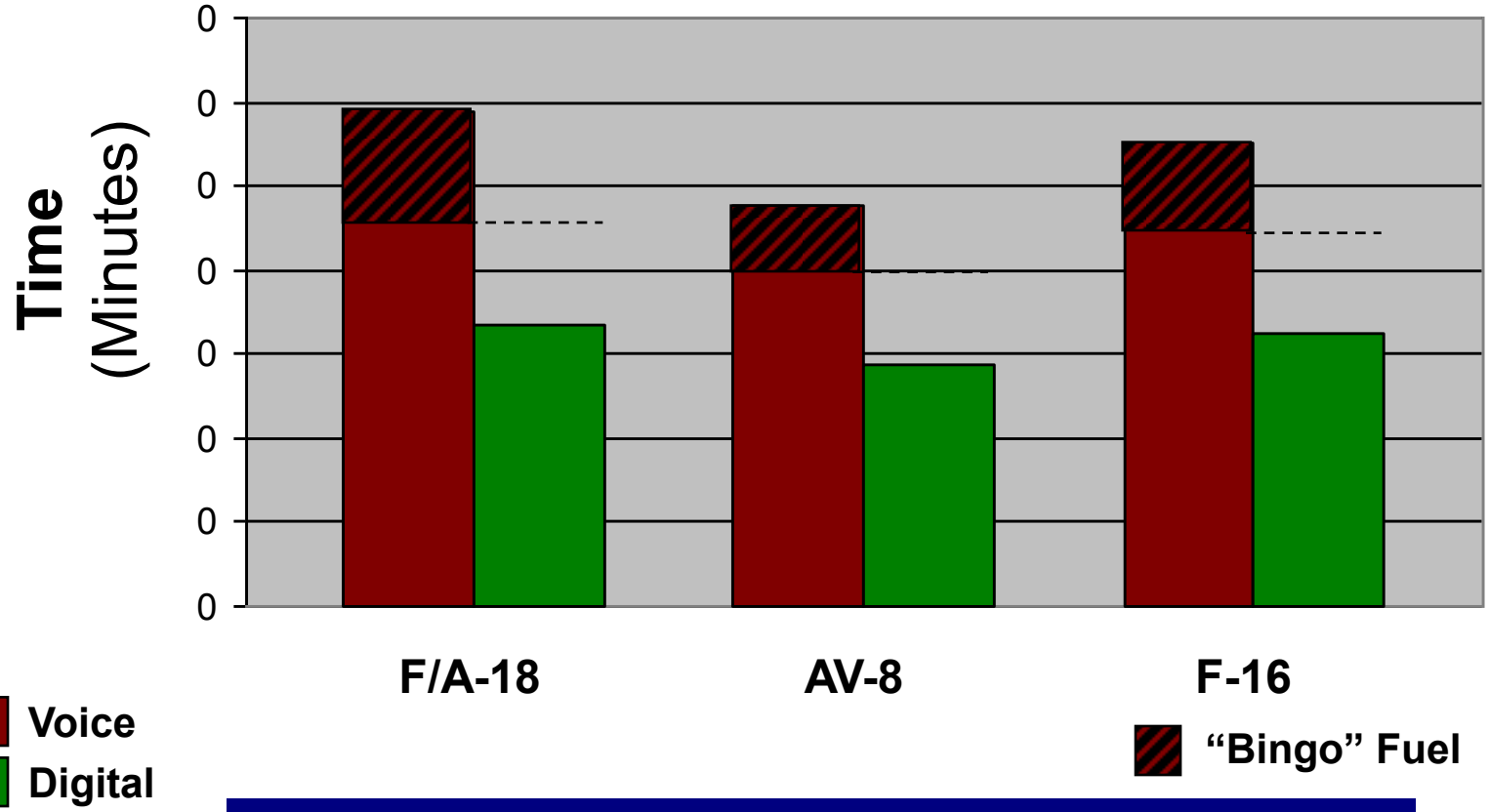
Executable Architecture
(Joint Close Air Support Example)



USJFCOM/J89 JCAS Executable Architecture (Partial View)

Digital vs. Voice Comparison Results

Complete XCAS Mission
(mission assignment through mission completion)



40-44% Time Savings Using Digital
More Weapons Employed, More Fuel Available

Digital vs. Voice Analyzed

10 Day Operations

	A-10		F-16		F/A-18		B-1		B-52		AV-8	
	Voice	Dig	Voice	Dig	Voice	Dig	Voice	Dig	Voice	Dig	Voice	Dig
Avg number of strikes/section	5.0	6.0	6.4	8	6.9	12.6	13.4	24	11	12	3.5	3.9
12 Ship (surge) squadron strikes (10 days)	900	1080	1151	1440	1259	2273	1605	2880	1324	1440	1050	1170
Days needed to strike same number of targets	10	8.34	10	7.99	10	5.54	10	5.57	10	9.19	10	8.97

*Based on average loiter times & sortie rates

Results Feed Other Models (EADSIM, JAS, STORM, etc)

Executable Architectures Applied
(Joint Close Air Support Example)

- **Operational Assessments**
  - "Bold Quest"
  - Interoperability Evaluation

- **Testing**
  - Exercise "Integral Fires 07"
  - MOE/MOPs for Test Threads
    - Timeliness
    - Accuracy
  - Traceability to Test Threads


TR-07-06

Coalition Combat Identification (CCID) Advanced Concept Technology Demonstration (ACTD) Bold Quest Close Air Support (CAS) Assessment Report

October 2007

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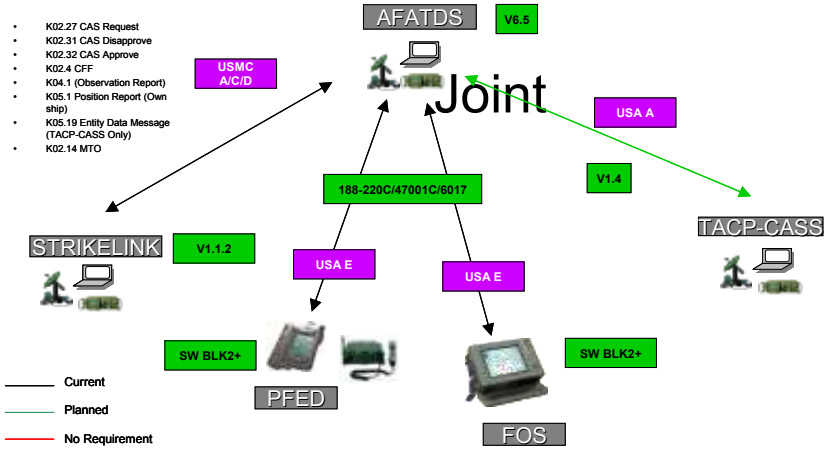
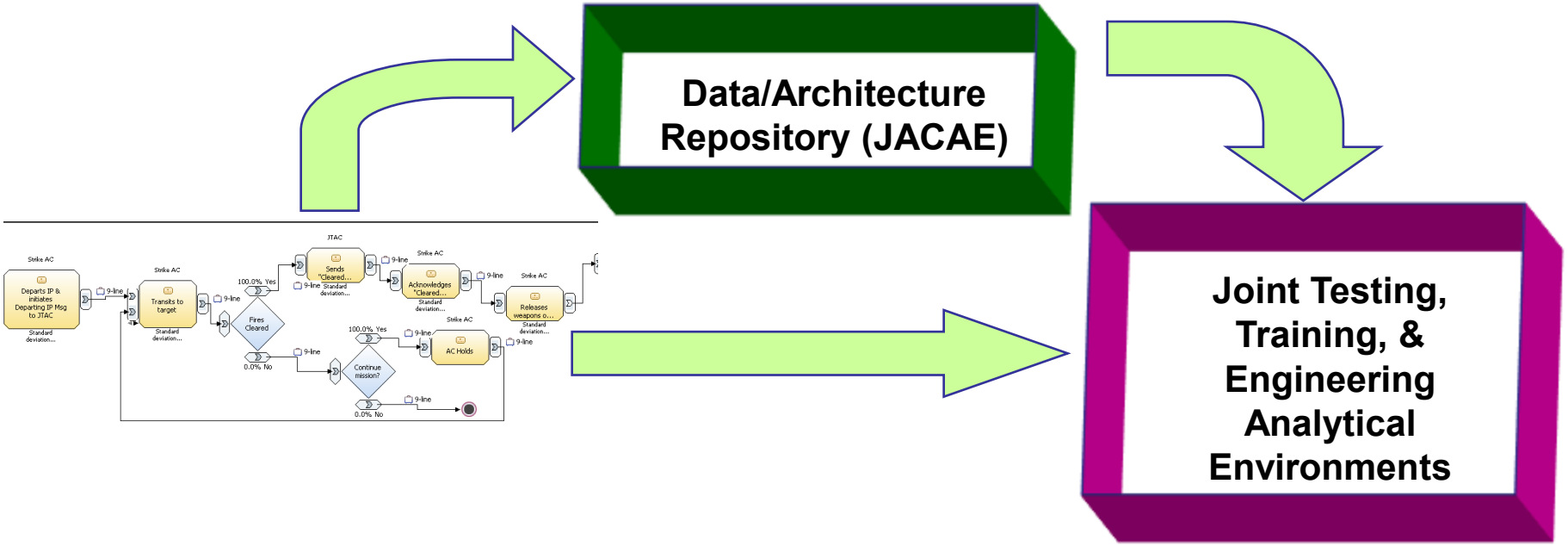


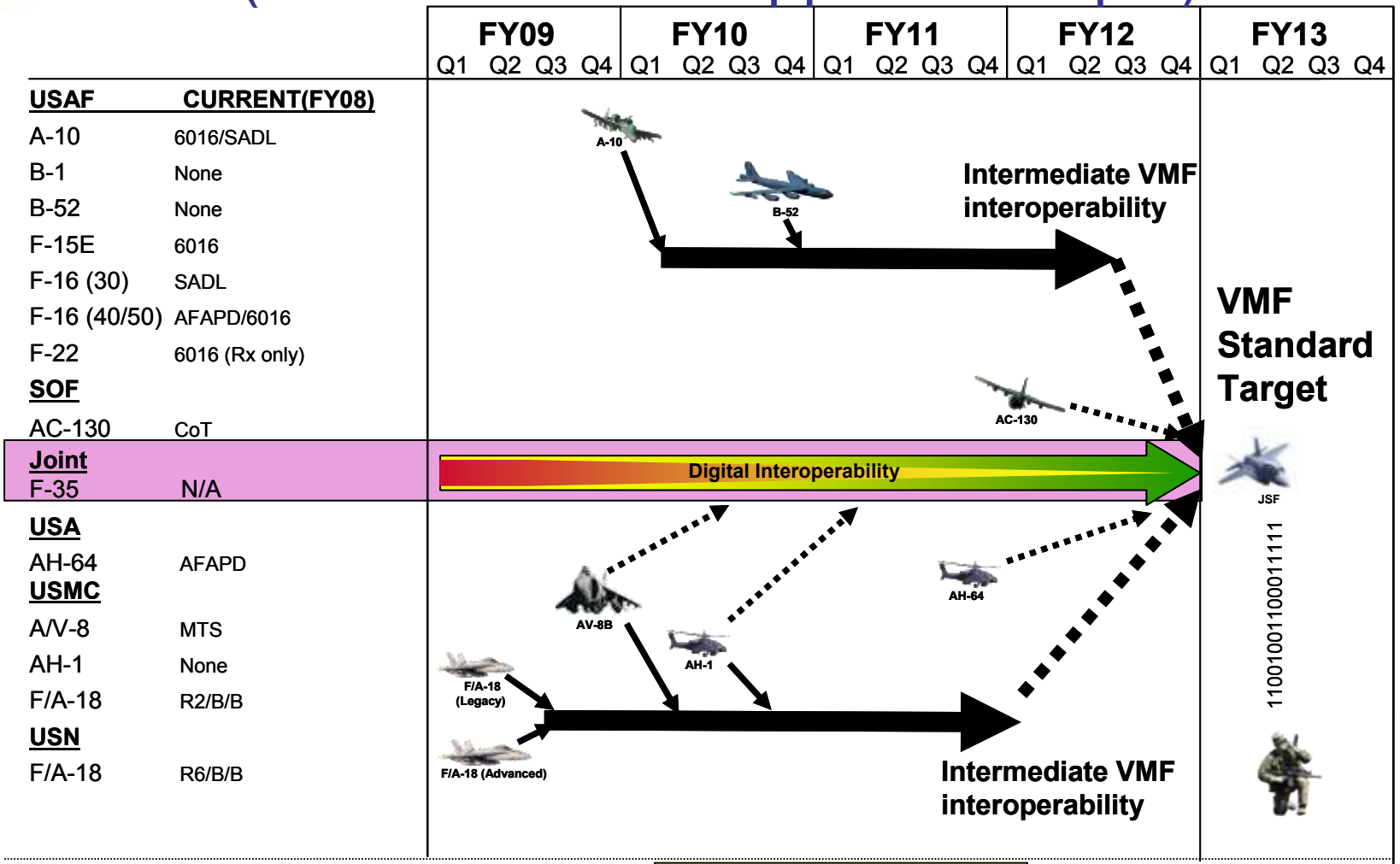
Document for Reusability

- **Objects, scenarios, tasks, sub-tasks, etc.**
  - Joint C2 (JC2) Architecture and Capability Assessment Enterprise (JACAE)
- **Available for Analytical Environments**
- **Validation, Verification, & Accreditation**
- **Coordinated Implementation**



Coordinated Implementation
(Joint Close Air Support Example)

JCAS Terminal Attack Control Interoperability Timeline



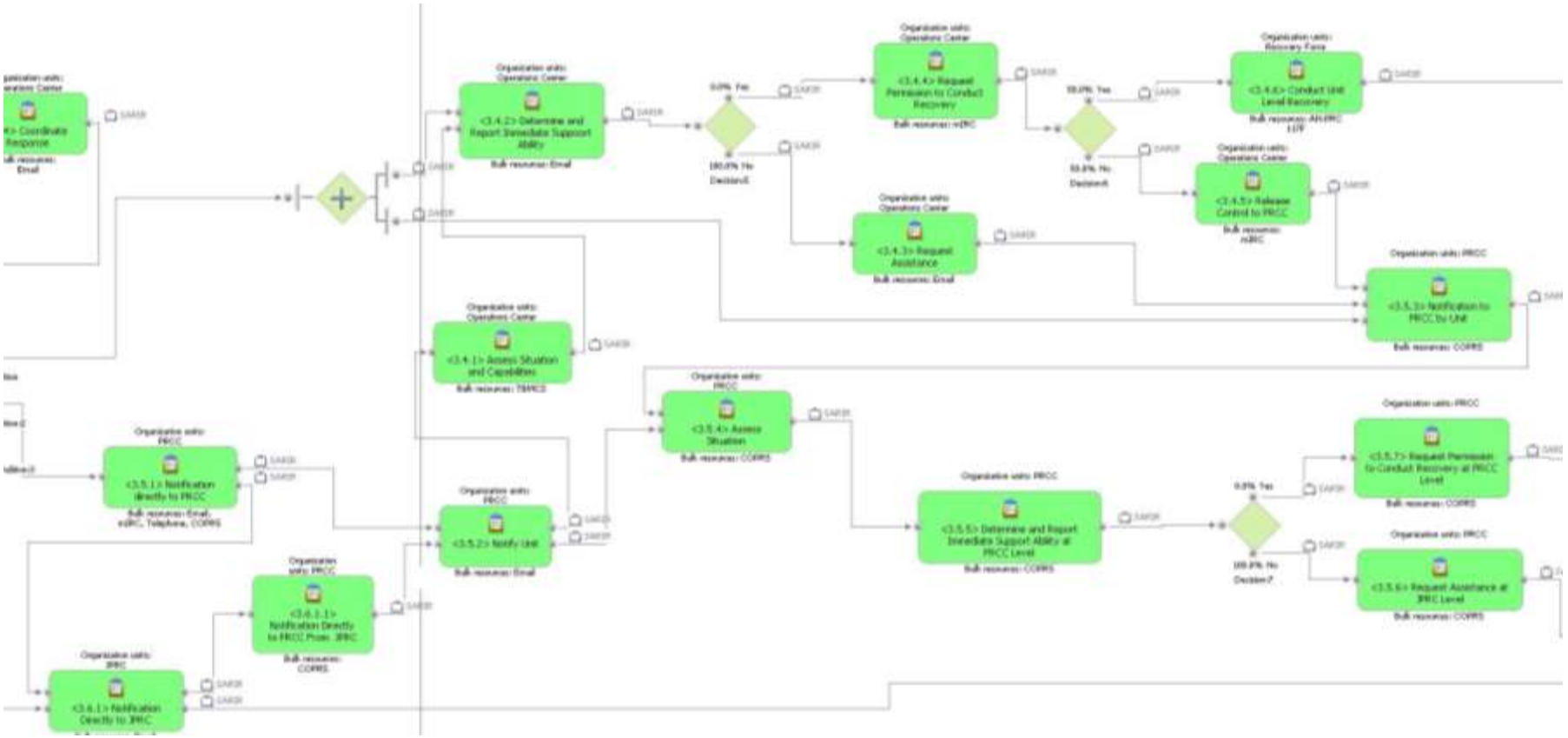
Executable Architecture Benefits

- Enables Structured Analytical Approach
  - Complete mission decomposition, including requirements, capabilities, & gaps
  - Documented through DoDAF (Core Activity Model)
  - Provides reusable repository of objects, scenarios, tasks, etc.
- Predictive Analysis
  - Generates MOE/MOPs for Gap/Trade analysis to support on going Functional Solutions Analyses
  - Results feed other models (JAS, STORM, EADSIM, etc)
  - Coordinate Implementation across Service and COCOM boundaries
- Risk Mitigation
  - Provide an environment for Joint Testing
  - Operational Assessments
  - Exercises

Summary

- Build Enterprise Architecture of a Mission Thread
  - Decompose tasks, activities, etc.
  - Document Requirements, Current Capability, Gaps
  - Documented through DoDAF (Core Activity Model)
- Using Activity Model, develop Executable Architecture
- Leverage Executable Architecture
  - Generate MOE/MOPs for Gap/Trade analysis
  - Provide an environment for Joint Testing
  - Inputs to other models (mission level/campaign level)
- Build a common repository of objects, scenarios, tasks, sub-tasks, etc.
- Reuse in Engineering Analysis, Testing, and Training

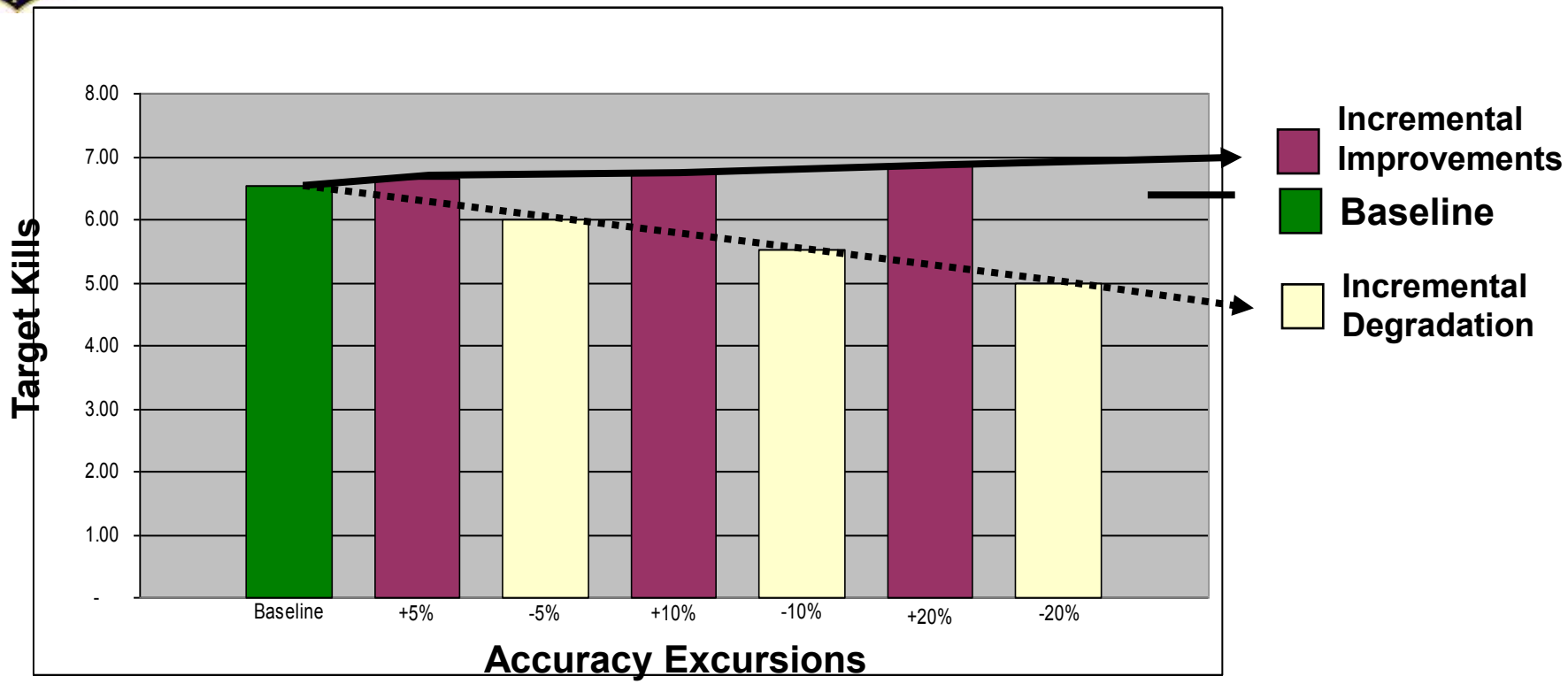
USJFCOM/J89 Way Ahead
(Personnel Recovery)



USJFCOM/J89 Personnel Recovery Executable Architecture (Partial View)

Questions

Accuracy Analysis



- Model: F/A-18 Digital Execution
- Assumptions
  - -- 1 x F/A-18 w/ 8 JDAM -- 1 Target per weapon per pass
  - -- Lethal Radius: 60 m -- Target Location Error: JCAS MT-3 (LRF/GPS)
  - -- Circular Error: Lognormal distribution between 1-40 m, centered at 13 m
  - -- For accuracy excursions, either incremental improvements or degradations of 5%, 10%, and 20% made to target location errors