



Leveraging Executable Architectures in a Joint Environment

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Report Documentation Page

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Purpose

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



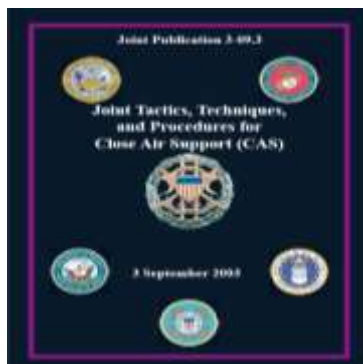
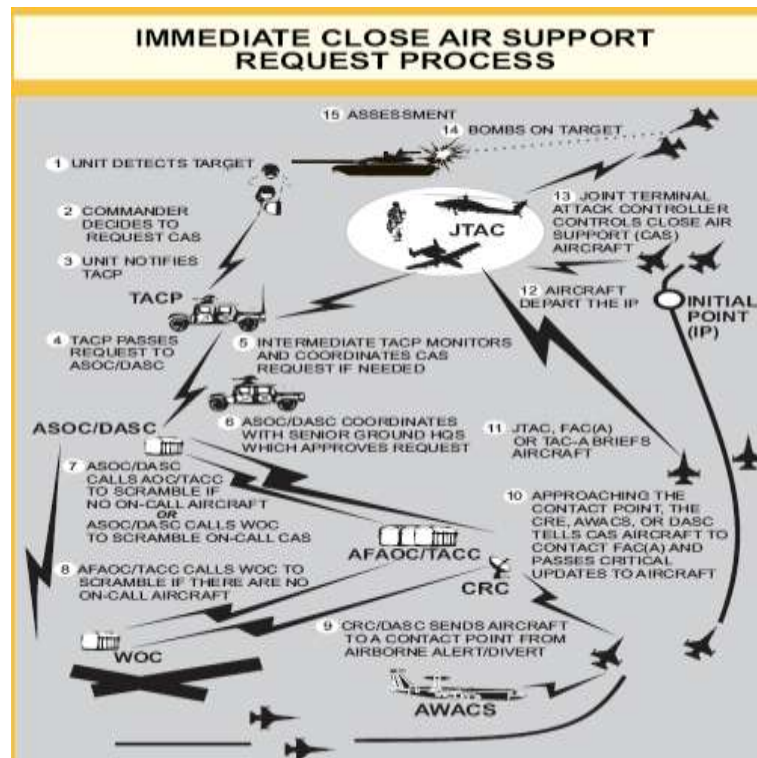
Overview

- 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





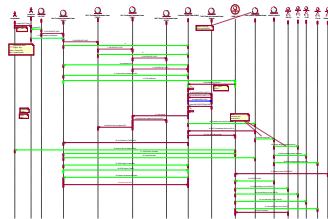
Develop Enterprise Architecture (Joint Close Air Support Example)

- **Develop DoDAF Architectural Views**

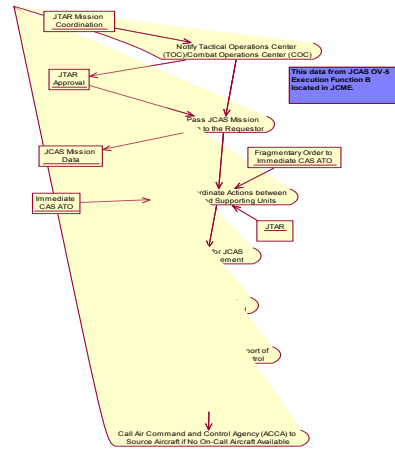
- Core for executable is detailed Activity Model
- Analyze for gaps, shortfalls, etc.



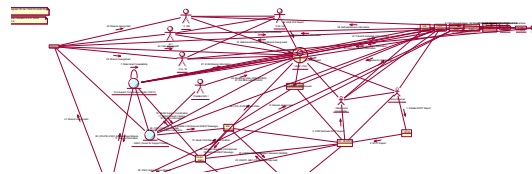
OV-1



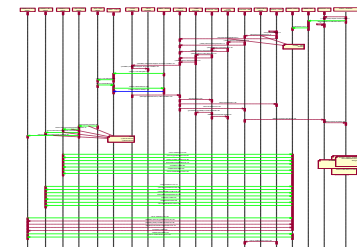
OV-6C



OV-5 (Partial)



OV-2



SV-10C

Item	Category	Activity Name	Activity Type	Number of	Unit
1	Activity	Call Air Command and Control Agency (ACCA) to Source Aircraft if No On-Call Aircraft Available	Activity	1	1
2	Activity	Coordinate Actions between Supporting Units	Activity	1	1
3	Activity	Fragmentary Order to Immediate CAS ATG	Activity	1	1
4	Activity	Pass JCAS Mission to the Requestor	Activity	1	1
5	Activity	JTAR Approval	Activity	1	1
6	Activity	JTAR Mission Coordination	Activity	1	1
7	Activity	or JCAS element	Activity	1	1
8	Activity	or JCAS element	Activity	1	1
9	Activity	or JCAS element	Activity	1	1
10	Activity	or JCAS element	Activity	1	1
11	Activity	or JCAS element	Activity	1	1
12	Activity	or JCAS element	Activity	1	1
13	Activity	or JCAS element	Activity	1	1
14	Activity	or JCAS element	Activity	1	1
15	Activity	or JCAS element	Activity	1	1
16	Activity	or JCAS element	Activity	1	1
17	Activity	or JCAS element	Activity	1	1
18	Activity	or JCAS element	Activity	1	1
19	Activity	or JCAS element	Activity	1	1
20	Activity	or JCAS element	Activity	1	1
21	Activity	or JCAS element	Activity	1	1
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23	Activity	or JCAS element	Activity	1	1
24	Activity	or JCAS element	Activity	1	1
25	Activity	or JCAS element	Activity	1	1
26	Activity	or JCAS element	Activity	1	1
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50	Activity	or JCAS element	Activity	1	1

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



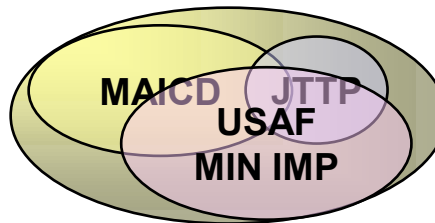
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200 Elements

ELEMENTS	AF 6016	Doc	CTI	AH-1	A-10	AH-64D	F-16	AV-8B	F/A-18	F/A-18	F-35	F-16	F-16	B-1	B-2
	WIX			CATS	AFAPD	AFAPD	MIS	TPD2G	TPD RE	6017	SAD	LES	LES		
X = Existing capability															
P1 = Partial - requires voice ack															
P2 = Partial - only some F/A-18s															
P3 = remains only															
TARGET LOCATION & DESCRIPTION															
TGT LOC: lat/long or UTM	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Number of Targets (elements)/TGT Strength	PC	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tgt ID Serial Number/TGT Name	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tgt Elevation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tgt Course	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tgt Speed	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Area tgt length, width, & altitude	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Radius (NEW)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
TGT Generic Type	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Expanded TGT Description	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Target Subtype	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
A/C WPN SYS AIM POINT (SPI/DGT)															
Desig TGT LOC (A/C RPT)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Desig TGT Elev (A/C RPT)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Desig TGT Source (A/C RPT)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

										JBFS																		
										Closest Friendly LOC lat - long / UTM to tgt																		
										Friendly unit elevation																		
										Number of Friendly forces																		
										Type of Friendly Forces																		
										Direction of Friendlies from the target																		
										Distance to Friendlies from the target																		
										Confirm Friendlies																		
										Subtype																		
										Size																		
										Orientation																		
										Activity																		
										Course																		
										Speed																		
Unit	Lat	Long	UTM	Elev	Subtype	Size	Orientation	Activity	Course	Speed	AF 6016	Doc	CTI	AH-1	A-10	AH-64D	F-16	AV-8B	F/A-18	F/A-18	F-35	F-16	F-16	B-1	B-2			
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4	33.0000	-111.0000	18QDQ8000000	10000	F-16	1	0	0	0	0	X																	
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20	33.0000	-111.0000	18QDQ8000000	10000	F-16	1	0	0	0	0	X																	



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**

A screenshot of the WBM (Work Breakdown Method) software interface. The window title is 'Attributes - 1. Initiate CFF'. The 'Simulation Control Panel' is active, showing various tabs like 'General', 'Cost and Revenue', 'Duration', 'Inputs', 'Outputs', 'Input Logic', 'Output Logic', 'Resources', and 'Organizational'. The 'Duration' tab is selected, and the 'Processing time' section is expanded. It shows a dropdown for 'Distribution' set to 'Poisson' and a unit dropdown set to 'Minute'. Below this, there is a text box for 'Mean' with the value '1.0'. A small histogram labeled 'Sample' is also visible, showing a bell-shaped distribution curve.

Sample Distributions in WBM

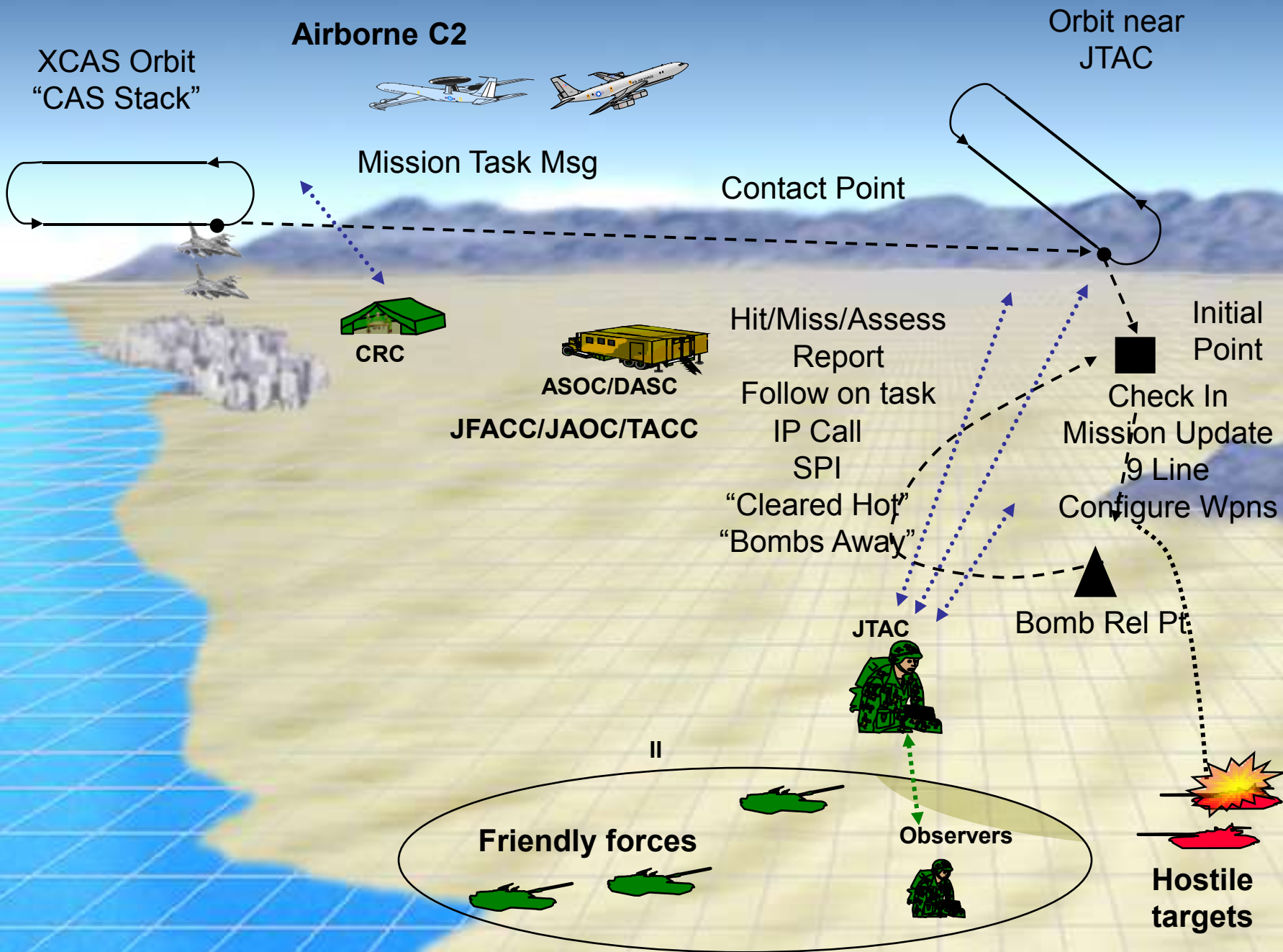


JCAS Example

(Digital vs. Voice Comparison)

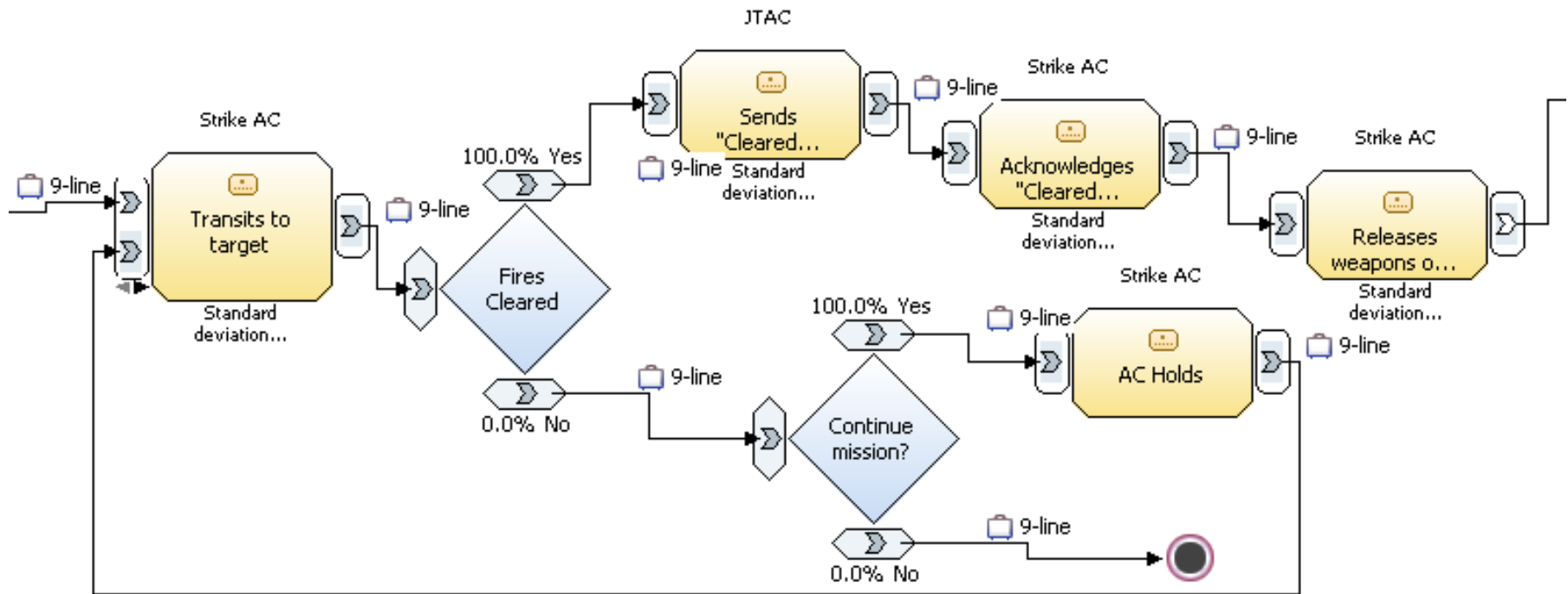
- **Compare process from mission assignment to mission completion using "as is" architecture against a "to be" architecture that maximizes digital transmissions.**
- **Model: JCAS Model Scenario:**
 - Scenario 1: Aircraft in XCAS Stack conducts mission from Mission Assignment to BDA
 - Scenario 2: Aircraft 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)

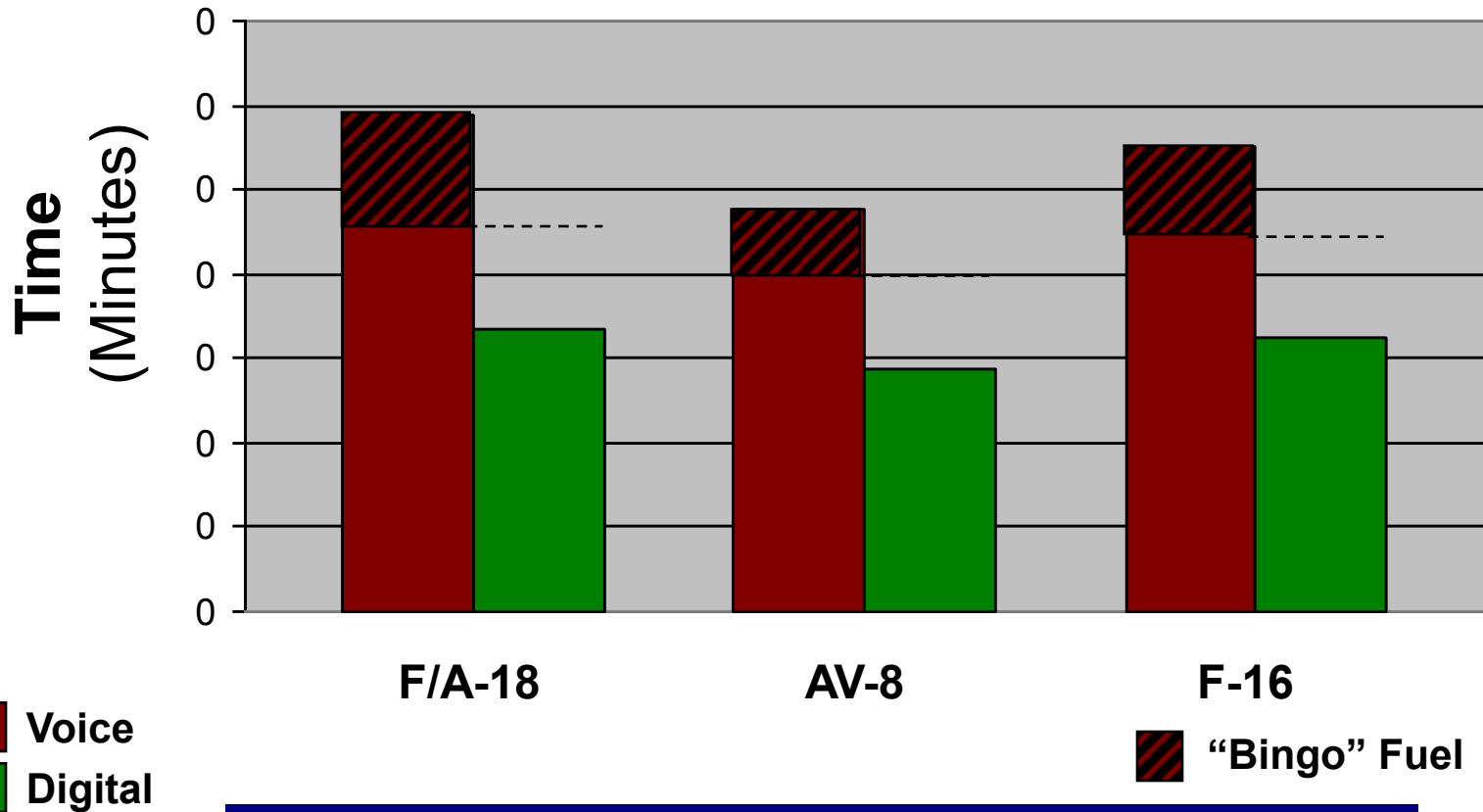


USJFCOM/J89 JCAS Executable Architecture (Partial View)



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

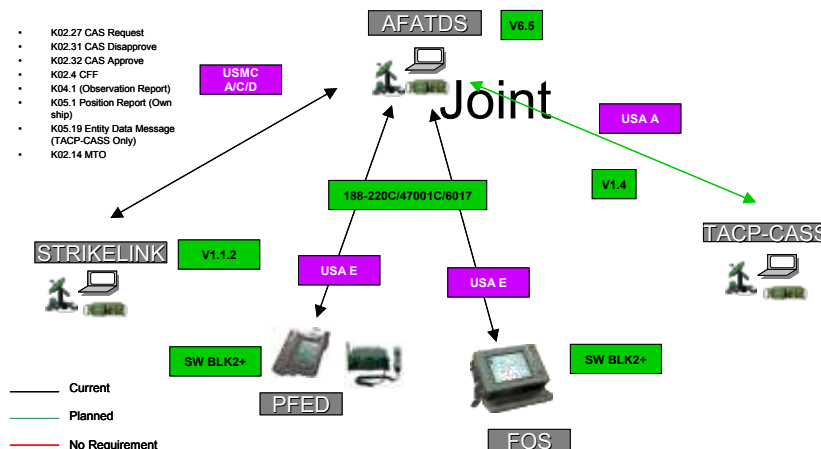
Results Feed Other Models (EADSIM, JAS, STORM, etc)



Executable Architectures Applied (Joint Close Air Support Example)

- **Operational Assessments**
 - “Bold Quest”
 - Interoperability Evaluation

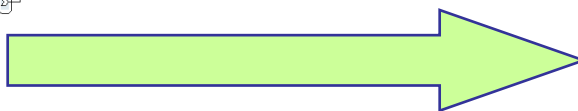
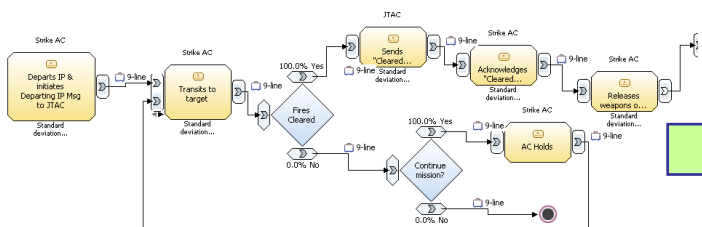
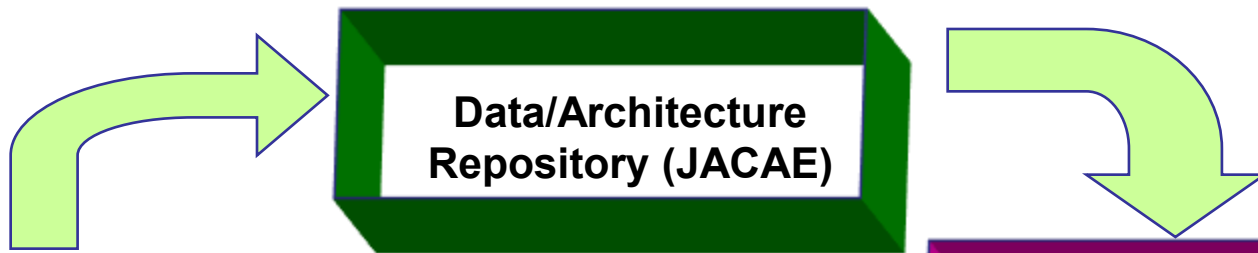
- **Testing**
 - Exercise “Integral Fires 07”
 - MOE/MOPs for Test Threads
 - Timeliness
 - Accuracy
 - Traceability to Test Threads





Document for Reusability

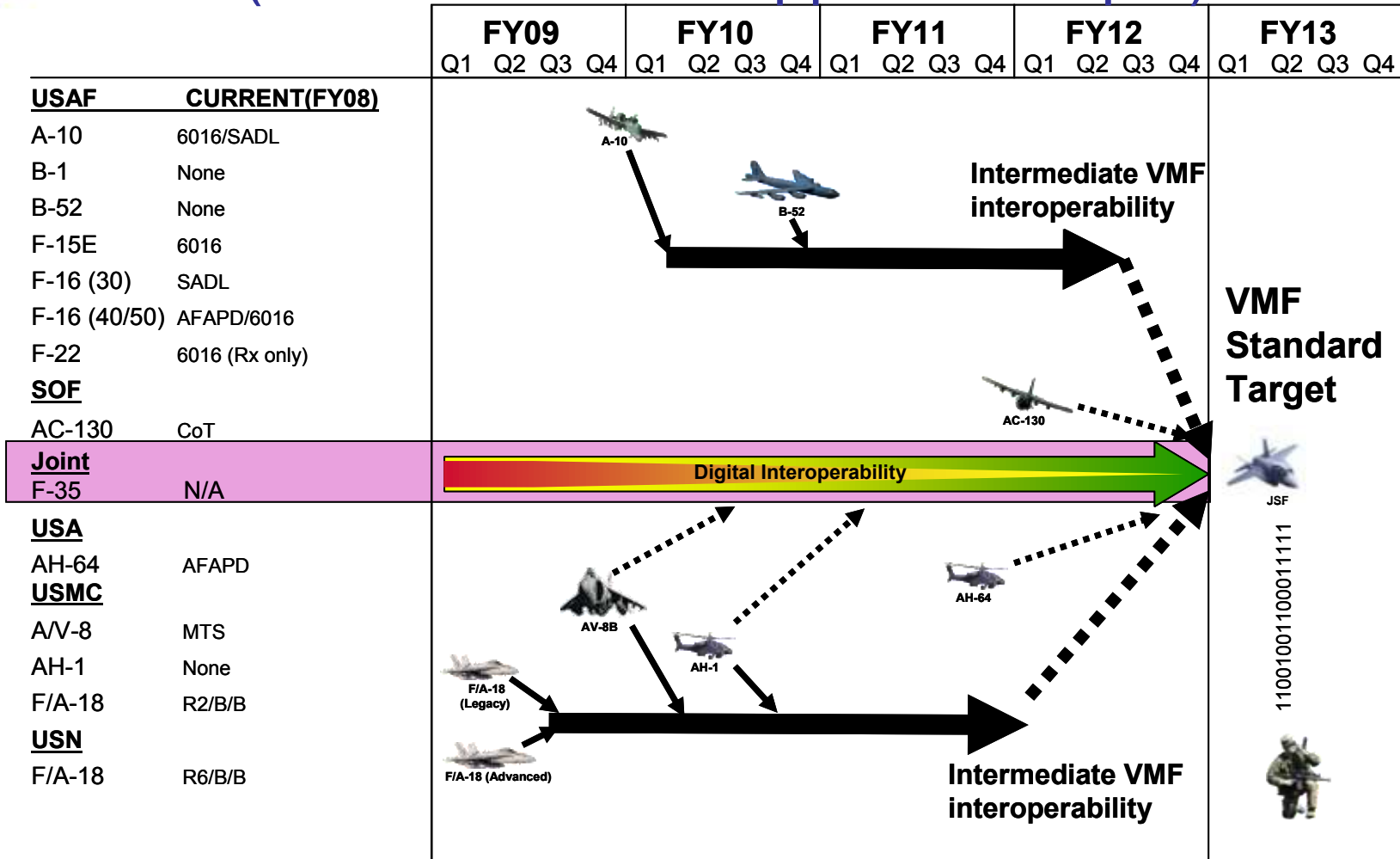
- **Objects, scenarios, tasks, sub-tasks, etc.**
 - Joint C2 (JC2) Architecture and Capability Assessment Enterprise (JACAE)
- **Available for Analytical Environments**
- **Validation, Verification, & Accreditation**
- **Coordinated Implementation**





Coordinated Implementation

(JCAS Terminal Attack Control Interoperability Timeline (Joint Close Air Support Example))



VMF Standard Target

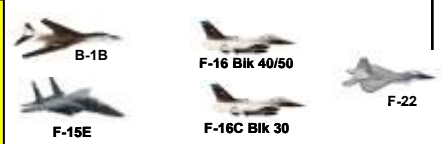


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- Planned
- JFCOM Proposed

Participation Scope: TBD





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

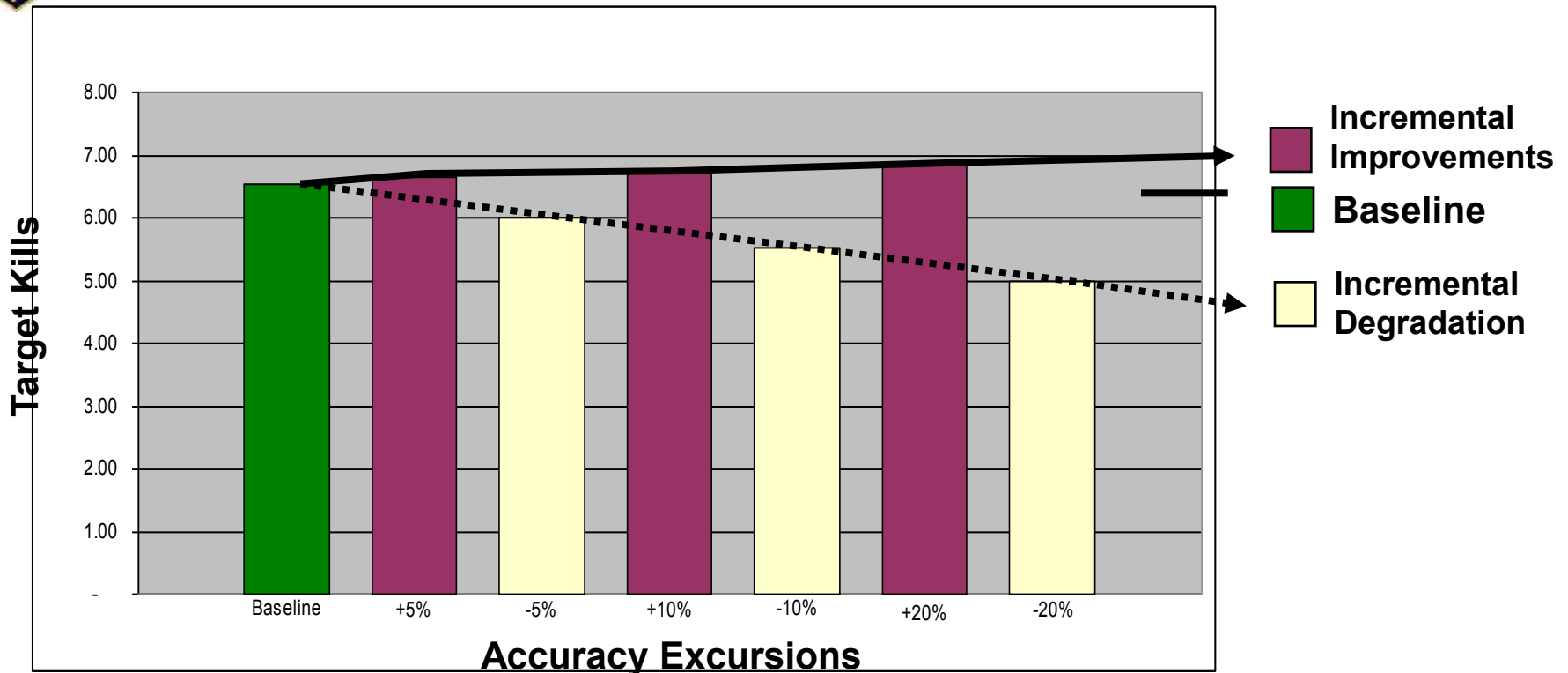
- Build Enterprise Architecture of a Mission Thread
 - Decompose tasks, activities, etc.
 - Document Requirements, Current Capability, Gaps
 - Documented through DoDAF (Core Activity Model)
- Using Activity Model, develop Executable Architecture
- Leverage Executable Architecture
 - Generate MOE/MOPs 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



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