Joint Surface Warfare Joint Capability Technology Demonstration –

Maturing Weapon Data Link Concepts into Operational Capability

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Demonstration Description

- Developing a capability, not a system
  - System of systems approach
- Leverages maturing weapon data link network technologies
  - Demonstrate the integration of multiple Intelligence, Surveillance, and Reconnaissance (ISR) and launch platforms with existing stand-off weapons
  - Allows interchangeable ISR assets to provide initial targeting data and in-flight target updates for multiple weapons
  - Provides multiple, comprehensive joint kill chain threads to the Combatant Commander
  - Significantly increases operational agility
  - Increases probability of target kill in adverse weather conditions and at extended ranges
  - Minimizes launch platform threat exposure
- Conscious decision to organize, plan and execute demonstration as if it were a program
  - Programmatic and system engineering discipline

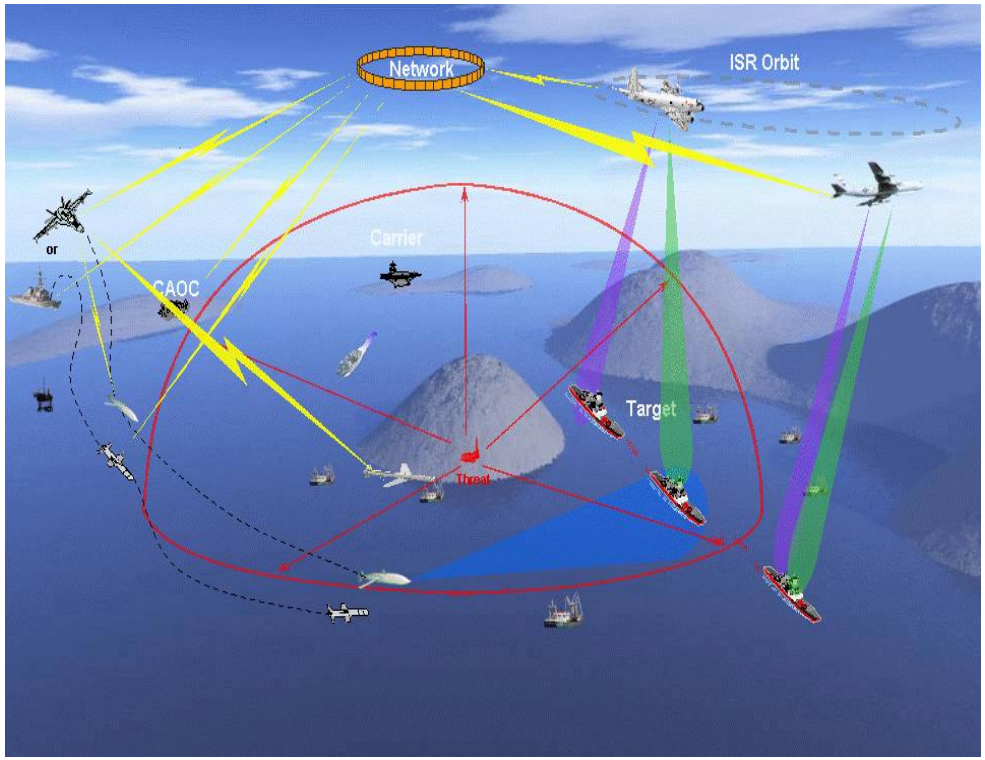
JSuW Background

- In FY07 Advanced Concept Technology Demonstrations (ACTD) were re-designated to JCTD
- Managed out of PMA 201 – Precision Strike Weapons
- JSuW approved for FY07 start
  - Kickoff in June 2007
- Approximately three year period of performance and $40M effort
- Follow-on to the Weapons Data link Network ACTD
- JSuW involves five programs of record (PoR)
  - Joint Standoff Weapon (JSOW-C-1), Harpoon Block III and F/A-18E/F are funded for J11 message integration as part of their PoR
  - Joint Surveillance and Target Attack Radar System (JSTARS) and P-3C Littoral Surveillance Radar System (LSRS) will incorporate J11 for demo purposes only

Technical Implementation

- Incorporate the J11 message software into existing Link-16 terminals
- Interim Change Proposal to Link-16 (MIL-STD-6016C)
  - J11.1 Directive messages
    - Sent to the weapon
  - J11.0 Status Response messages
    - Sent from the weapon
  - J11.2 Weapon Coordination messages
    - Coordination of NEW control
    - Sent and received by weapon controllers and In-Flight Target Update (IFTU) Third Party Sources (3PS's)
- Weapons are receiving the Strike Common Weapon Data Link radio
  - Rockwell Collins

Operational View

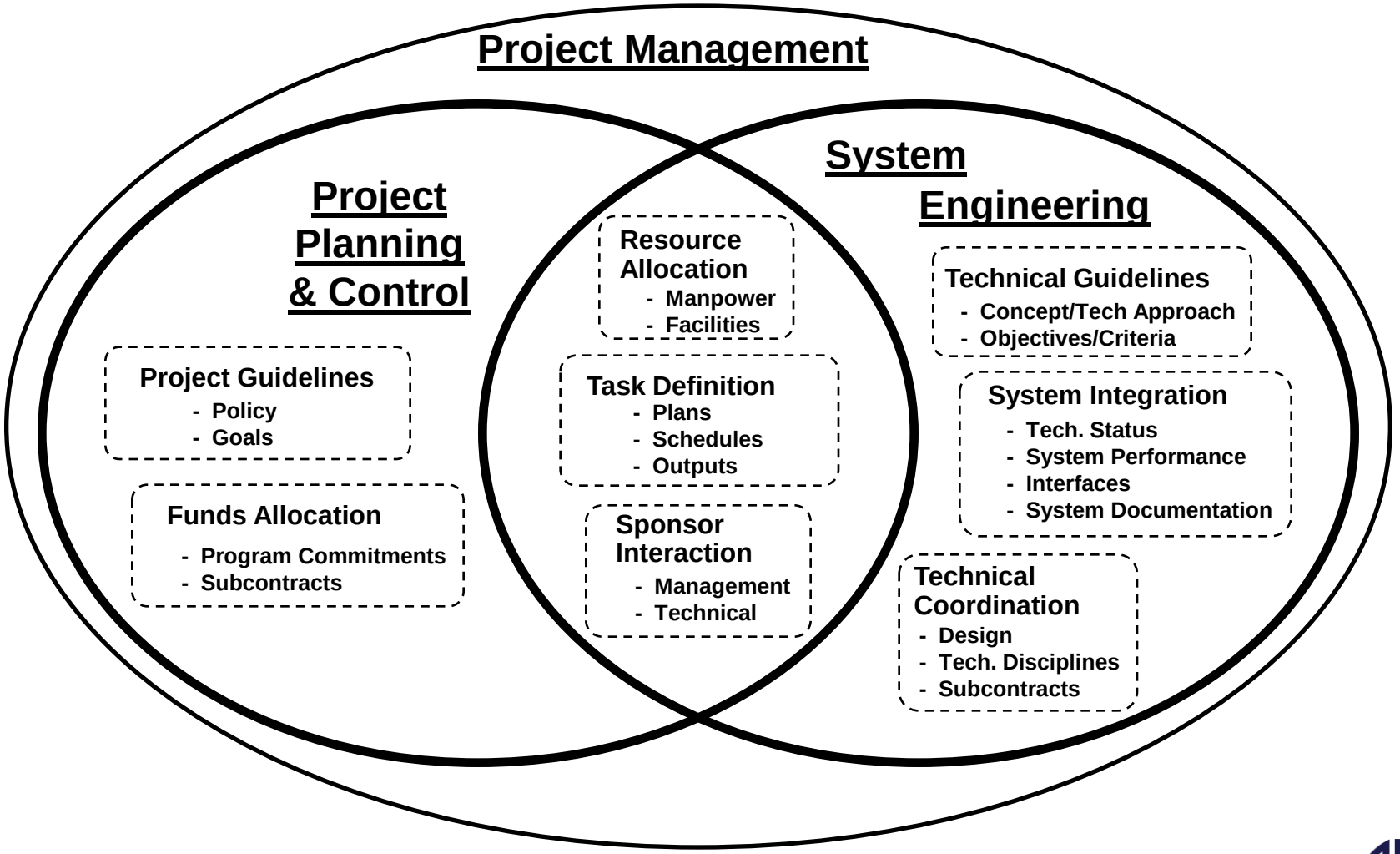


- **Integrate the Link-16 J11 Message Set into existing software architectures for the JSTARS and LSRS platforms**
- **Ensure interoperability with the JSOW-C-1, Harpoon Block III, and F/A-18E/F programs of record (incorporating J11 message set)**
- **Develop the associated CONOPS/TTPs**

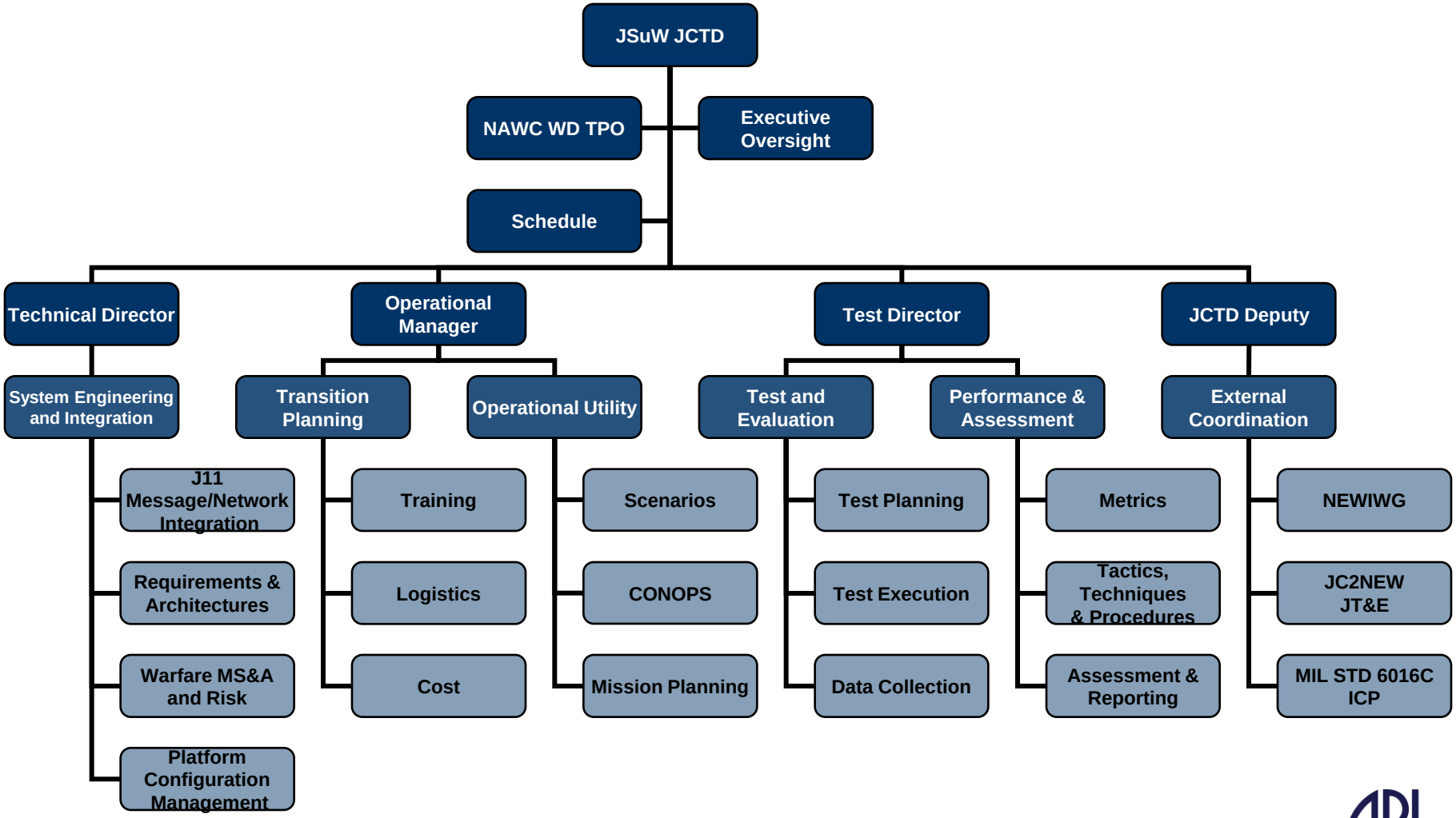
Concept of Operations

- F/A-18E/F, third party targeting source (3PS; i.e., second F/A-18E/F, JSTARS, LSRS) or other ISR platform detect enemy combatants
- J11.2 messages passed between controller / shooter (F/A-18E/F) and 3PS for coordination
- Weapon released by shooter (F/A-18E/F)
- 3PS provides In-Flight Target Updates (IFTUs) to weapon via J11.1 messages
- Weapon replies with Weapon In-Flight Track (WIFT), Ack/Nack and Bomb Hit Indication via J11.0 message

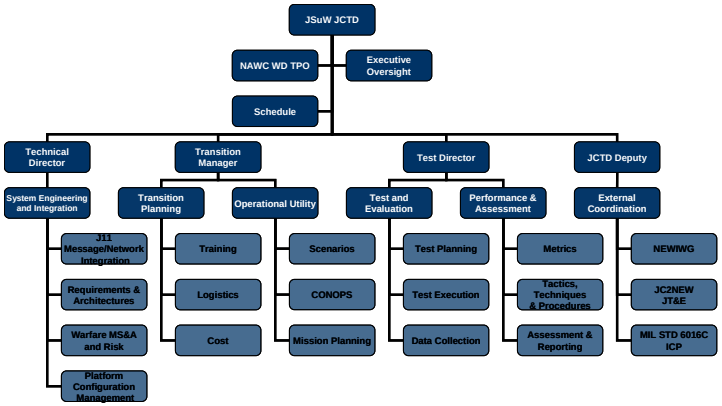
PM-SE Interaction



Organizational Breakdown Structure



Setting Constraints

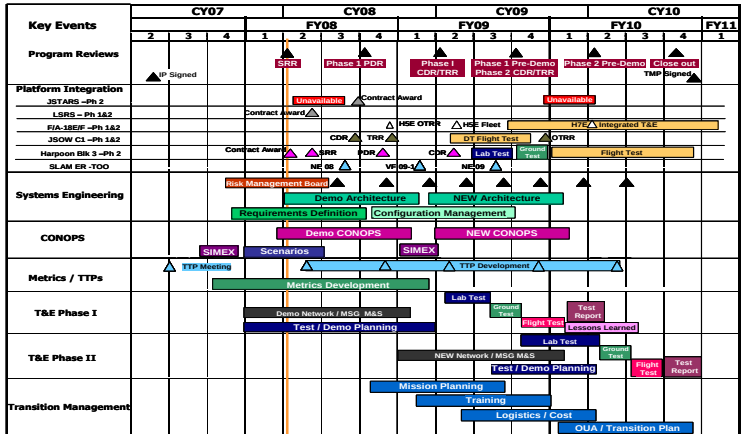


Organizational Breakdown

IMP Event	IMP Sub-Event	IMP Accomplishment	IMP Criteria	IMS Task	Deliverable Name (s) - if applicable	Responsibility
Program Manager's Review 2 (PDR/CDR June 08)						
	LSRS / JSOW PDR / CDR					
		LSRS JCTD Integration Plans Complete				
			Preliminary Design Review (Critical Design Review for JSOW) Complete	Conduct a Net Enabled Weapons PDR	PDR/CDR Summary Briefing	PM
			SW Development Plan Complete	Build J11 Message SW Development Plan	SW Development Plan (PPT Briefing)	PM
			Platform Integration Plan Complete	Write, Assemble and integrate code into OFP	Platform Integration Plan (PPT Briefing)	PM
			Platform Risk Assessment Complete	Conduct an end-to-end risk assessment	Risk Assessment Briefing and risk element integration into the JCTD risk database for management and mitigation	PM
	JSTARS Contract Award					
		Contract Award				
			Negotiated contract with the appropriate contractor	Conduct the necessary steps for contract award	Signed Contract	PM

Integrated Master Plan

Work Breakdown Structure



Integrated Master Schedule

Capability Statement

Challenge: Cost effective, simultaneous, multi-axis strike in the littorals, against a mutually supported, state-of-the-art surface action group (SAG); at the time and place of our choosing

Defining Scenarios

- Understand the environmental conditions
  - Use a guide to ensure all potential impacts have been addressed
- Look at a range of scenarios
  - Address each mission
  - Across the spectrum of “easy to hard”
- Understand the requirements and/or desired capabilities for each scenario
  - How does this affect system design and performance?
- Distribute demonstration resources to address the scenario spectrum
  - Engineering level analysis, modeling and simulation, flight test, etc.

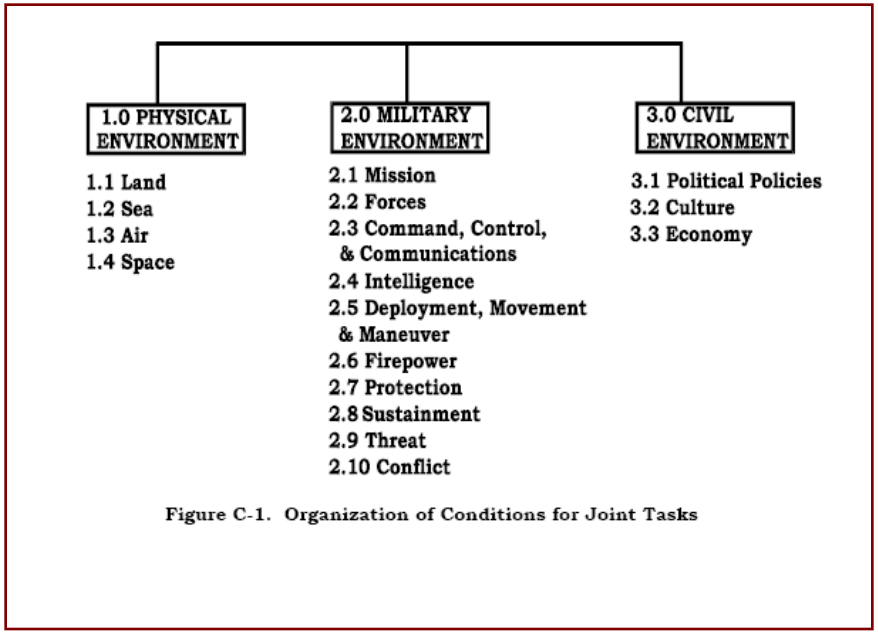


Figure C-1. Organization of Conditions for Joint Tasks

CJCSM 3500.04D, Universal Joint Task List, 1 August 2005

Capability Decomposition

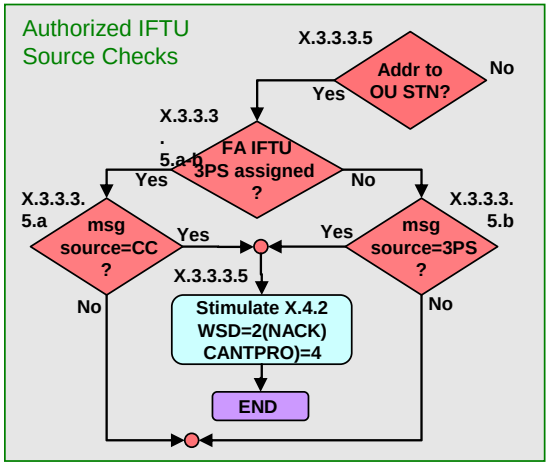
Capability	Attribute / Requirement	Sensor	Shooter	Controller	Weapon	External Sources	Network / Message
Cost Effective	Efficient use of assets	Minimize standoff sensors	Increase survivability	Co-locate with shooter/sensor	Level of effort weapons	Low cost intel. collection platforms	Use existing network
Simultaneous	Coordinated (timing, position)	Synchronized with shooter and weapon	Synchronized, positioned	Auto-logic; advanced USI	Predictable / programmable flight profile	Multiple, dispersed collection	Number of users
Multi-Axis	Pre-planned	Position wrt shooter/weapon	360 LAR wrt target	Controller positioning	Maneuver in flight	Multiple, dispersed collection	Range
Strike	Kinetic attack	Targeting wrt weapon	Loadout, weapon support	ROE feed; combat ID assurance	Lethality vs target set	Multi-role platforms; collect and strike	Detailed message set
Littorals	Clutter, neutral shipping	Resolution, accuracy, fusion	Range from base, CVN	Advanced SA	Selectivity, AI, scan volume	Deployable; survivable	Spectrum management
SAG – Mutual Support	Integrated air defense system	Standoff, fusion	Standoff	Standoff	Survivability	Survivable	Range
SAG - SOTA	Stealth, CCD, decoys, firepower	Accuracy, fusion, jam resistant	Situational awareness	Advanced decision tools – superior SA	Selectivity, CCM, AI, Jam resistant	Embedded artificial intelligence	Resilient
Time and Place of our Choosing	Independent of environment	All Weather (vis, sea state, etc.)	Endurance	Endurance; comm links	Detect target in all weather	Persistent	Reliable

System Performance Measures

Metrics / Entities	Extent	Accuracy	Timeliness	Reliability	Robustness
Sensor	# targets Range	TLE Update rate Resolution	Internal latency IFTU rate	MTBF ETOS Turn time	Survivability Discrimination Jam effects
Shooter	# weapons Sensor range Launch envelope	Msg processing HSI	Platform speed	MTBF ETOS Sys. Architecture	Survivability Launch envelope
Weapon	Range Flight profile	Seeker res. Control logic Aero perf.	IFTU processing Speed Loiter ability	MTBF WIFT trans.	Env. Effects Survivability Discrimination
Network	Range # JUs Bandwidth	Msg. transfer Mission planning	Latency Aircraft interface	Packet loss MTBF Protocols	Jam effects Encryption
Controller	# weapons # targets	IFTU rate Data fusion HSI	Internal latency	MTBF	Location Tgt. Processing Jam effects
External Sources	# available	Gateway	Network-network latency	Data security Intel fusion	Network access Msg. format

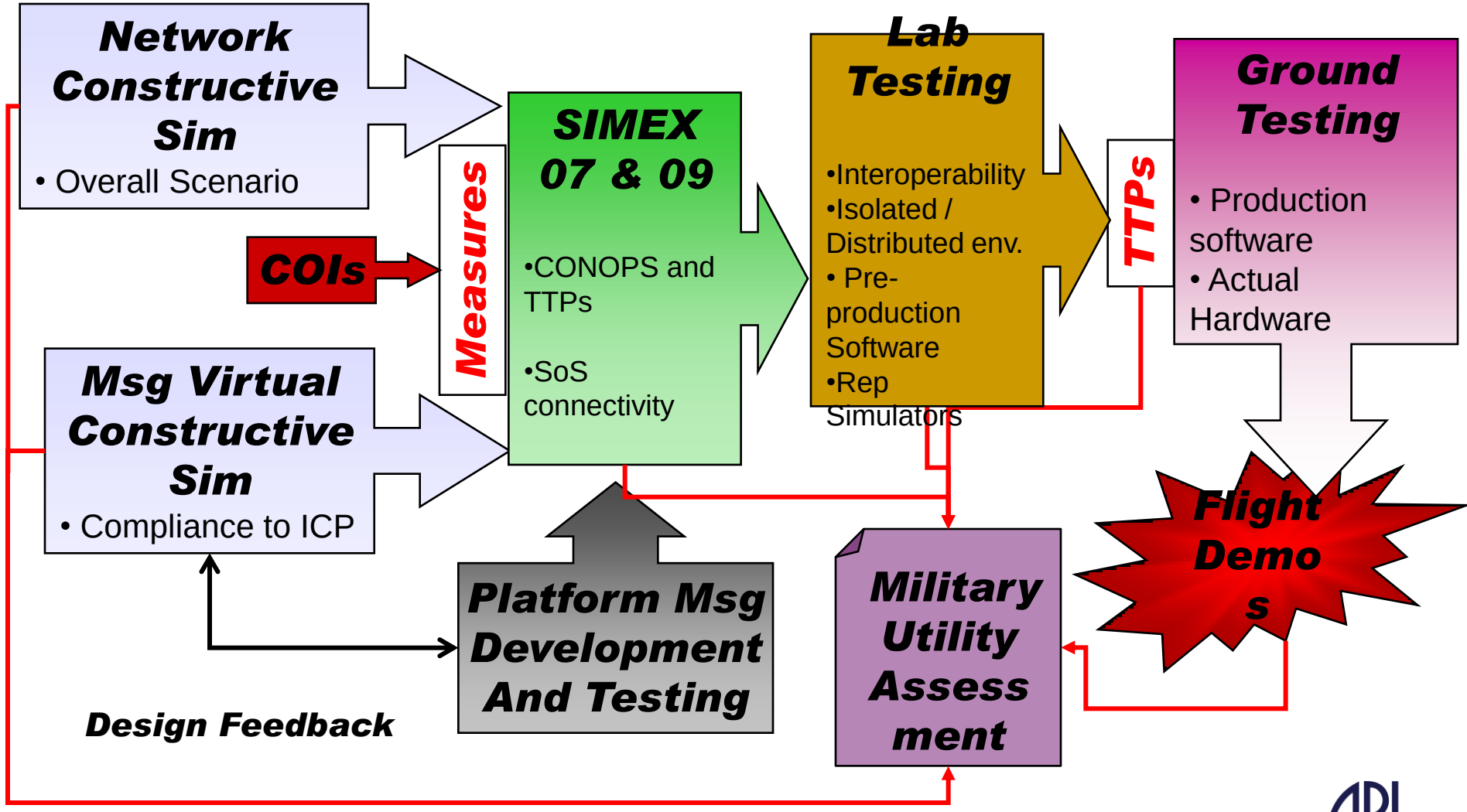
Interoperability Challenge

- Link-16 (MIL-STD-6016C, Interim Change Proposal TM06-093Ch2)
  - Approved by the Joint Multi-TADIL Configuration Control Board (JMTCCB) on 02 May 2008
  - Staffing underway for NATO review
  - Message standard is still in “interim state”
- Using Excel spreadsheets for interoperability assessment and configuration management
  - Awaiting Interoperable Systems Management and Requirements Transformation (iSMART) configuration change to the ICP
  - Compare each platform’s implementation by software version
  - Identify interoperability gaps and work with platform’s to eliminate discontinuities
- Migrate eventually to iSMART as well as MS&A tools currently under development



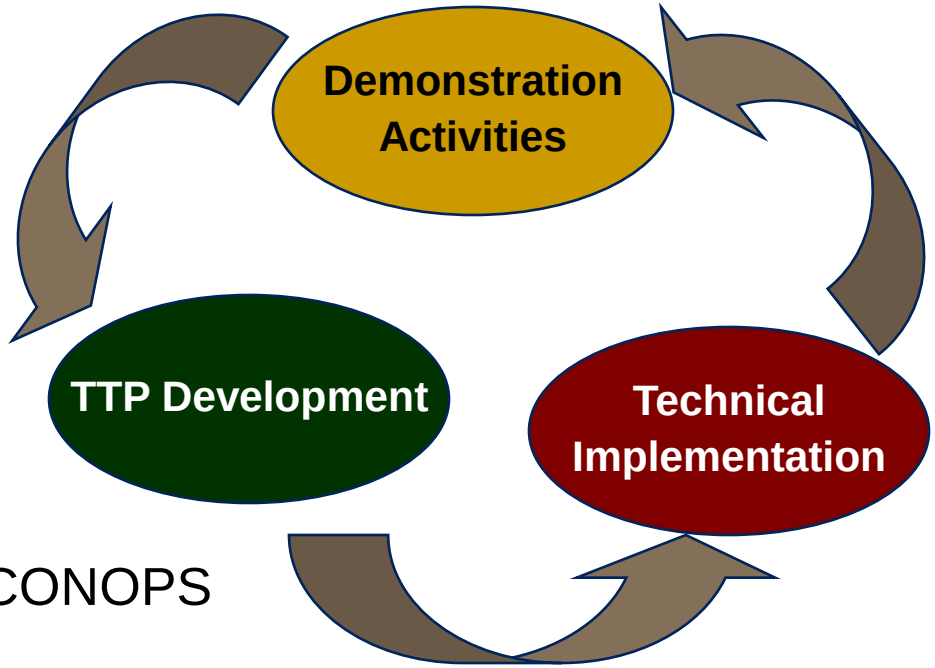
J11.0 Word Definitions			(Your Name Here) 3PS Implementation																						
			Transmit Implementation										Maturity Level	Receive Implementation										Maturity Level
Message Use			1	2	3	4	5	6	7	8	9			1	2	3	4	5	6	7	8	9		
Weapon Status Discrete Value			1	2	7	9	10	3	8	5	6	4		1	2	7	9	10	3	8	5	6	4		
Change 2 Version			ACK	NACK	BHI	Basic WIFT	WIFT Supplement	Ping Response	Self Abort	Contact Report	Handoff Checkin - Directed	Handoff Checkin LostCom		ACK	NACK	BHI	Basic WIFT	WIFT Supplement	Ping Response	Self Abort	Contact Report	Handoff Checkin - Directed	Handoff Checkin LostCom		
J11.0I	WEAPON RESPONSE/STATUS INITIAL WORD												N/A												
1550	001	WORD FORMAT											N/A	0	0	0	0	0	0	0	0	0	0		
270	004	LABEL, J-SERIES											N/A	11	11	11	11	11	11	11	11	11	11		
271	005	SUBLABEL, J-SERIES											N/A	0	0	0	0	0	0	0	0	0	0		
800	001	MESSAGE LENGTH											N/A												
704	NEW20	WEAPON STATUS DISCRETE											N/A	1	2	7	9	10	3	8	5	6	4		
700	NEW18	TYPE OF NEW											N/A												
NEW98	NEW99	WEAPON PROFILE											N/A												
1664	NEW44	FUZE/PAYLOAD SUBSYSTEM STATUS											N/A												
1664	NEW39	MISSION PROCESSOR STATUS											N/A												
1664	NEW40	IMU SUBSYSTEM STATUS											N/A												
1664	NEW41	GPS SUBSYSTEM STATUS											N/A												
1664	NEW42	TERMINAL GUIDANCE SUBSYSTEM STATUS											N/A												
1664	NEW43	PROPULSION/CONTROL ACTUATOR SUBSYSTEM STATUS											N/A												
387	NEW13	BASE TIME											N/A												
1606	NEW38	NAV MODE											N/A												
4085	NEW66	PREPLANNED/ACTIVE MISSION INDEX NUMBER											N/A												
358	NEW152	SEEKER ACQUISITION CONFIDENCE											N/A												
1107	NEW37	JDPI/MISSION NUMBER INDICATOR											N/A												
1107	NEW30	CONTROLLER COMMUNICATIONS INDICATOR											N/A												
1107	NEW31	ALTERNATE CONTROLLER COMMUNICATIONS INDICATOR											N/A												
1107	NEW32	THIRD PARTY COMMUNICATIONS INDICATOR											N/A												
1107	NEW33	THIRD PARTY IFTU ENABLED INDICATOR											N/A												
1107	NEW34	LAUNCH PLATFORM CONTROL INHIBIT INDICATOR											N/A												
4077	NEW295	TERMINAL GUIDANCE TYPE											N/A												
756	004	SPARE																							

JSuW T&E Strategy

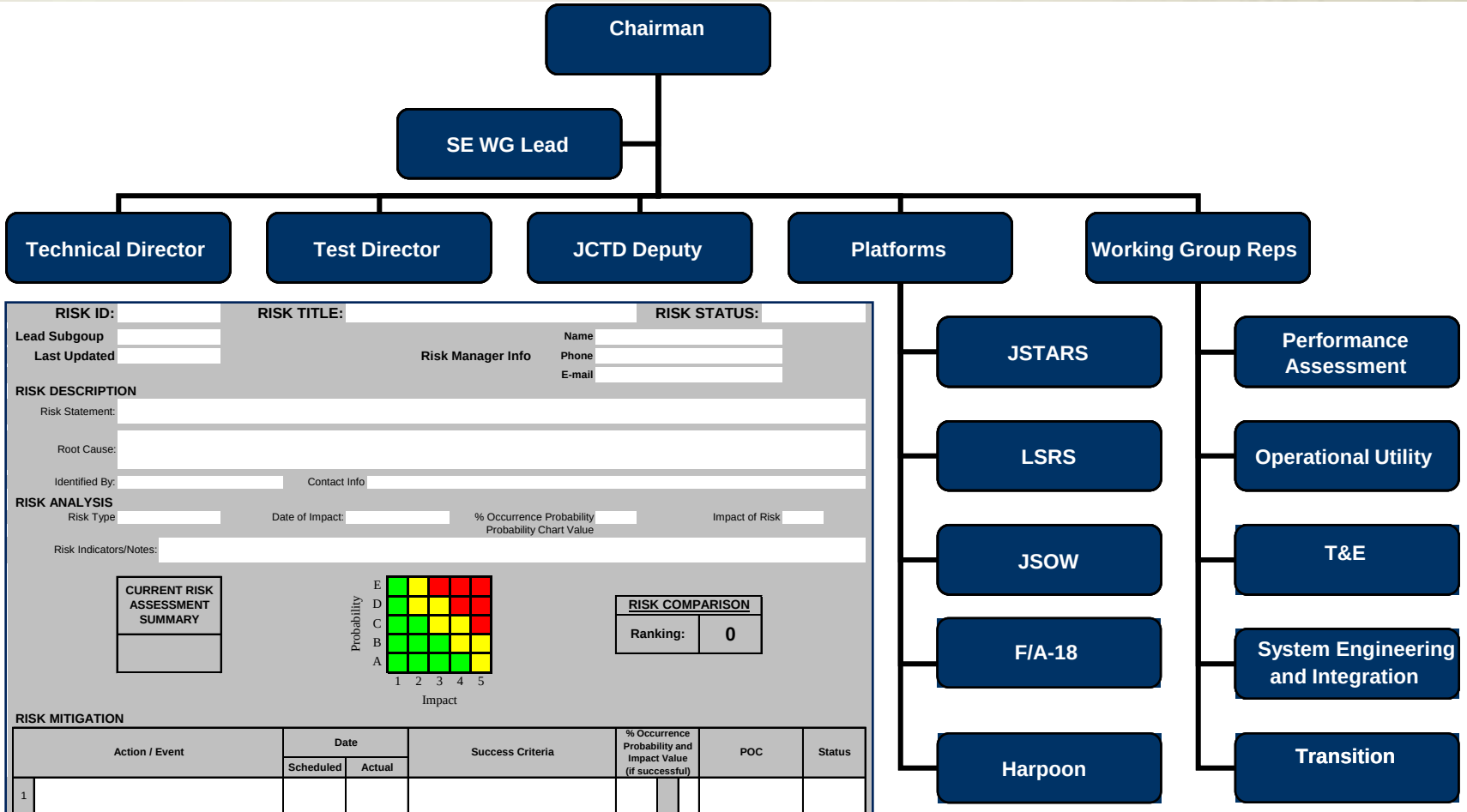


Tactics, Techniques and Procedures Development

- Maturing TTPs through:
  - Engagement Simulation
  - Table top role play
  - Simulation Exercise
    - Constructive, virtual
  - Ground demo
  - Flight demo
- Balance demo ops with real world CONOPS development
  - Scenario dependent, design to succeed
- Continual trade-off and maturation of TTPS in parallel with message set implementation
- Validation and modification with demo (T&E) activities



Risk Management Board



Interoperability Certification Proposal

- Can JSOW-C-1 and Harpoon Block III use the JSuW demonstration events to obtain certification?
  - Save $$
  - Improve understanding of NEW certification process
  - Streamline test planning and execution
  - Develop a process for certifying future Net Enabled Weapons

JITC Certification

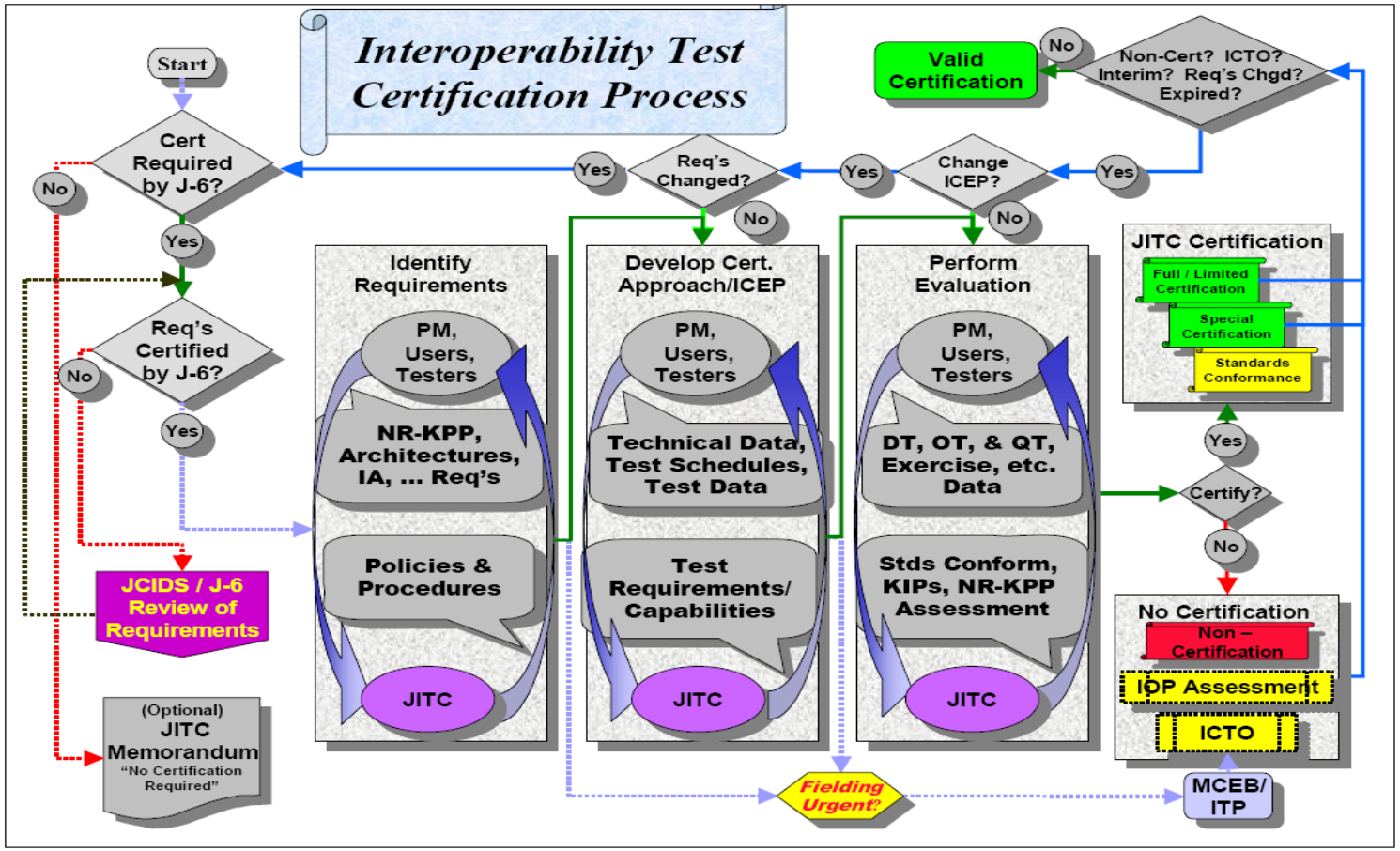


Figure E-1. Interoperability Test Certification Process

CJCSM 6212.01D, Interoperability and Supportability of IT and NSS, 14 March 2007

Summary

- Joint Surface Warfare JCTD has provided a challenging systems engineering environment
  - Engineering a capability more than a system
  - Team dispersion
  - Requirements allocation
  - Interoperability assurance
- Programmatic and SE discipline, practices and procedures still apply
  - Demonstrations don't give you a "free pass" when it comes to project management and engineering
- Expect more of the same in the coming decades
  - Unmanned system expansion
  - Weapon maturity and migration
  - Adaptation of CONOPS and TTPs to optimize NEW capability