

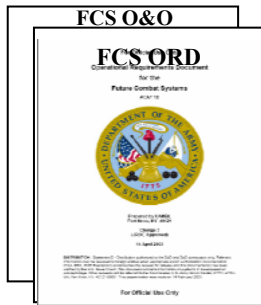
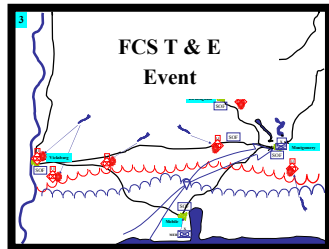


## Testing In a Joint Environment: A “Missions and Means Framework” Application Case Study

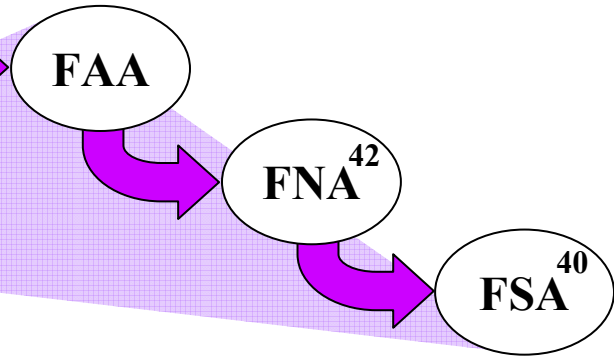
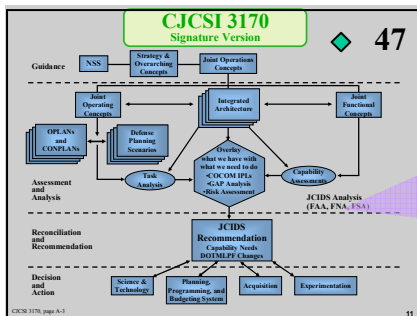
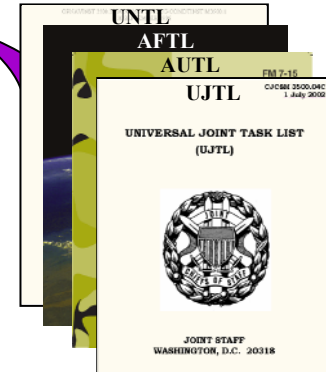
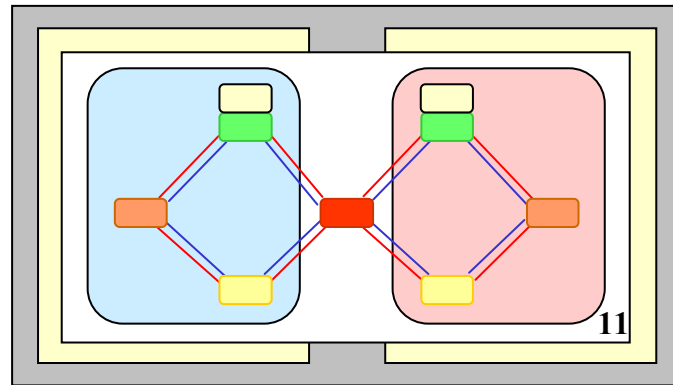
# Purpose

To illustrate the results of a “mission decomposition to performance measure” crosswalk involving the Joint Tactical Tasks of Joint Close Air Support / Joint Combat Identification and the functional capabilities of a Future Combat System networked sensor.

# Methodology



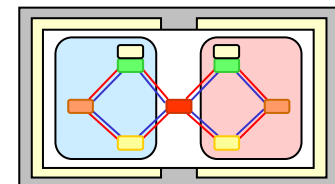
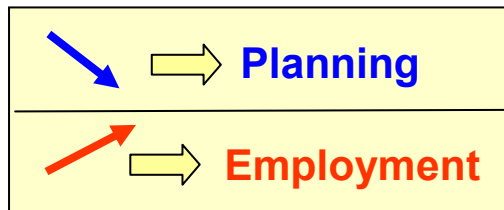
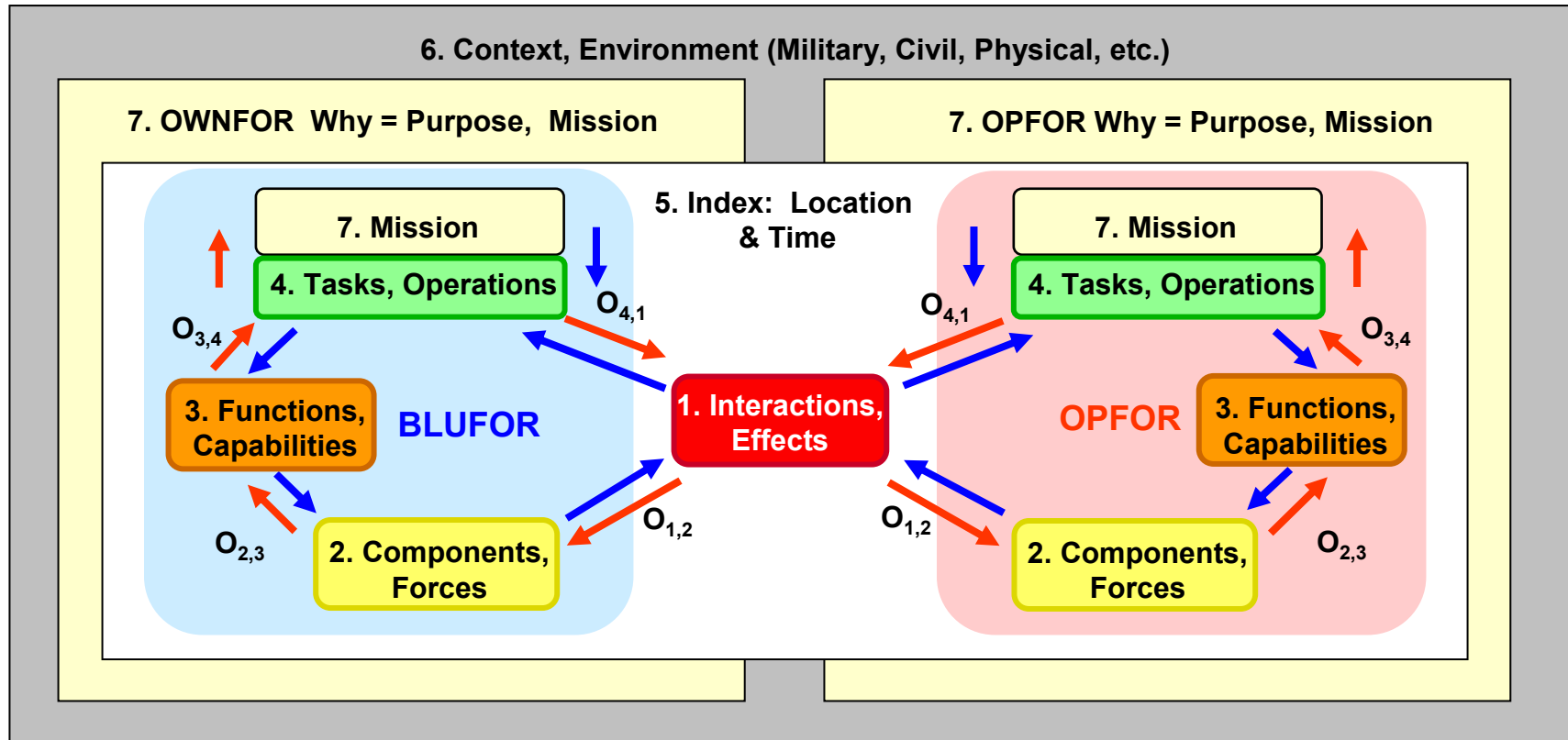
## Missions and Means Framework



# A Two-Sided Missions and Means Framework

11 Fundamental Elements:

Seven Levels, Four Operators



# A Two-Sided Missions & Means Framework

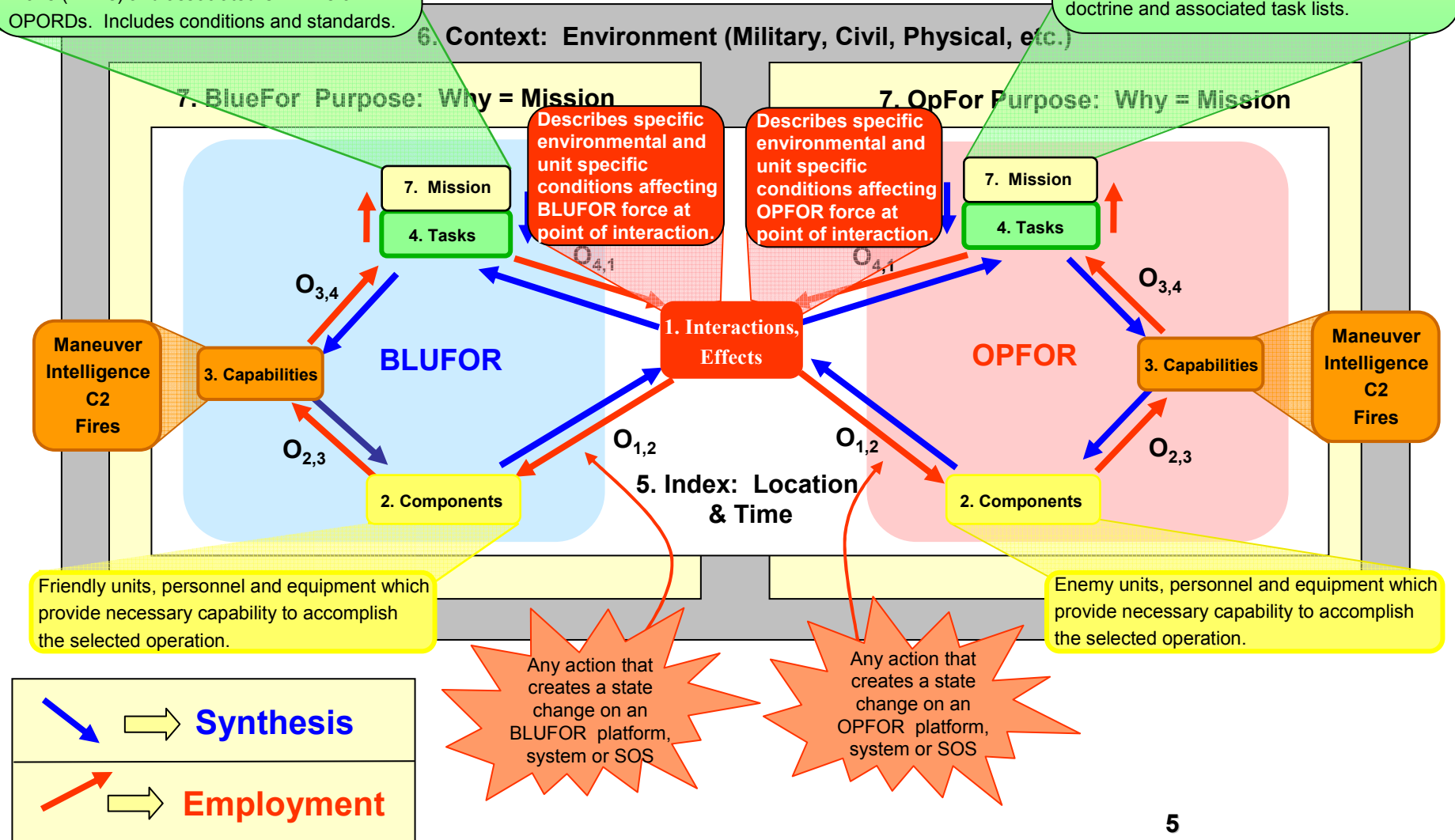
## Illustration

**Mission:** Answers the questions Who, What, When, Where and most importantly, Why.

**Tasks:** Derived from the UJTL, Service Task Lists (AUTL, NTTL, AFTL) or Mission Training Plans (MTPs) and associated OPLANs or OPODs. Includes conditions and standards.

**Mission:** Answers the questions Who, What, When, Where and most importantly, Why.

**Tasks:** As identified by established OPFOR doctrine and associated task lists.



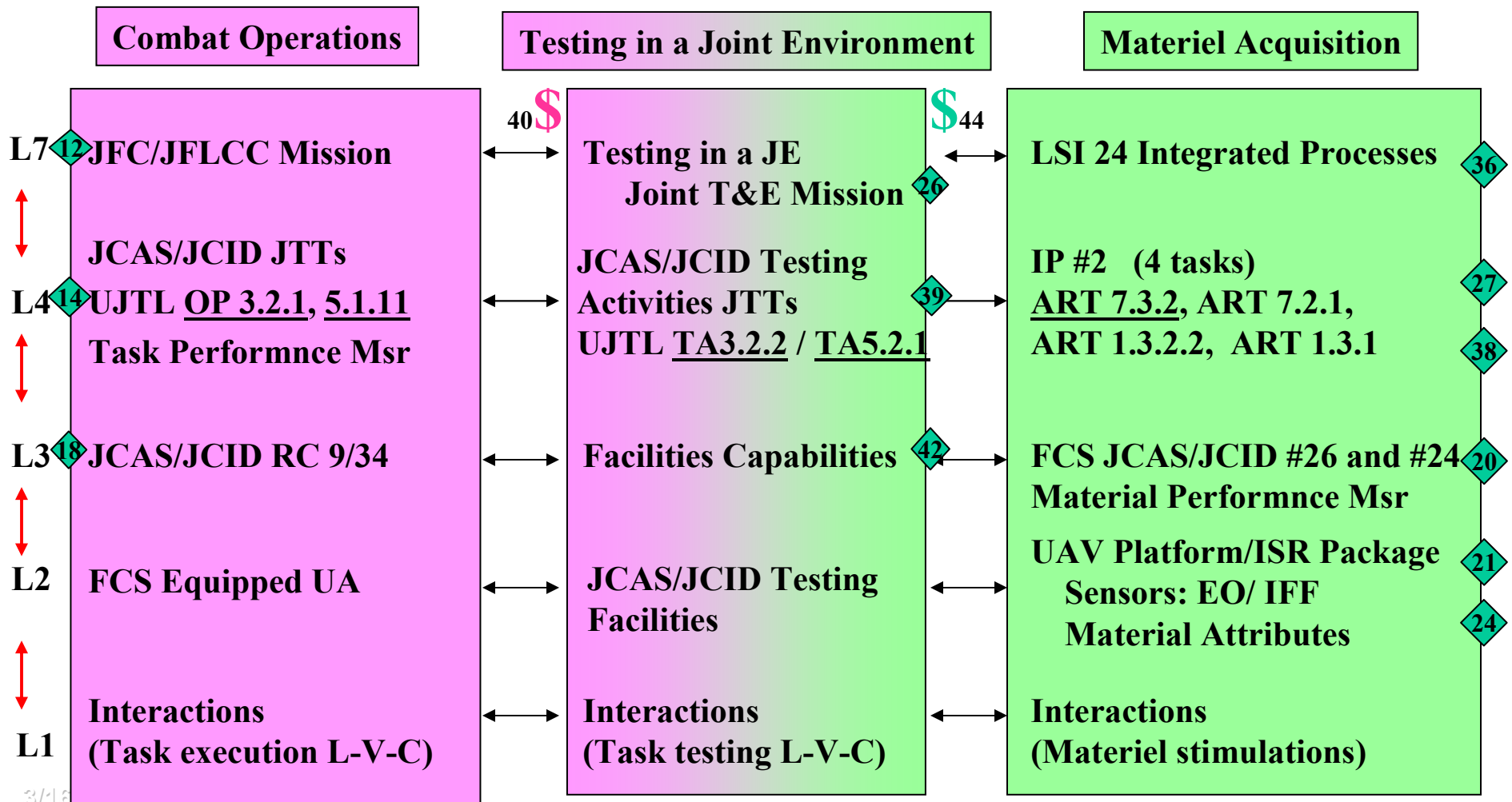


# Combat Operations to Acquisition to Testing Comparison Linkage

Level 6 FCS T & E Scenario



Level 5 Vignette #3



# Study Team Performance Measure Crosswalk

BCIS provides a >95% probability of correct friendly identification within one second at the gunner's site with no impact on firing function

**UAV IFF Sensor Performance Measures**

**Current Force version: Battlefield Combat Identification System (BCIS):**  
 "BCIS is a secure, encrypted question and answer identification system which provides a high confidence, ground combat vehicle identification capability. The system operates in the millimeter wave (mmW) frequency region at 38Ghz. The "Shooter Platform" has an interrogator antenna boresighted to the gunners targeting system and integral with the BCIS system integrated on the module are mounted in the vehicle.

**2.1.1 BCIS Functional Characteristic:**  
 risk of fratricide. BCIS is a millimeter wave system that positively identifies friendly forces **effectively on a dirty battlefield** coverage is ± 1.3 ° or ± 22.5 miles. BCIS is used by combat, combat support, and combat service support units in the Brigade Support Area (BSA) to identify friendly ground vehicles and minimize the risk of fratricide.

**Potential Future Force version:**  
<http://www.dtic.mil/ndia/2001ev>

**ART 7.3.2 Performance Measures**

**ART 7.3.2 EVALUATE SITUATION OR OPERATION**  
 Analyze and compare the actual situation or progress of the operation against criteria of success. Highlight variances between the planned situation at that time in the operation and the current situation, and forecast the degree of mission accomplishment. (FM 6-0) (USACAC)

Evaluate situation or operation...  
 95 Percent of accurate friendly evaluations  
 10? Number of opportunities or threats recognized

**JCAS Supporting Task Performance Measures**  
 OP 3.2.1 Provide CAS Integration for Surface Forces

To attack operational land and sea targets with available joint and multinational operational firepower delivery systems. To delay, disrupt, destroy, or degrade enemy operational forces or critical tasks and facilities (including C2I targets) and to affect the enemy's will to fight. **This task includes integrating the tasking and targeting options.**

This task includes integrating the tasking and targeting options  
 90 Percent targets correctly identified

**JCID Supporting Task Performance Measures**  
 OP 5.1 Provide Positive Identification of Friendly Forces Within the JOA

**To determine discretely and positively, by any means the individual identity of forces, objects or phenomena (such as communications electronic patterns). The objective of this task is to identify friendly and neutral forces, objects, or phenomena from attack by operational level force systems. This task facilitates the concentration of effort against the adversary. Under certain circumstances, this task may apply within the United States with limitations for homeland security operations. (JP 3-01.1, 3-03, 3-09, 3-09.3, 3-10.1, 3-52, 3-56.1) (JP 3-01.1, 3-07.3, 3-09, 3-09.3, 3-54, CSM 3500.05)**

Minutes	to complete attack
Percent	of attacking systems
Percent	of enemy forces
Percent	of enemy troops
Percent	of friendly COA
Percent	of targets correctly identified
Percent	of joint tactical operations
Minutes	to provide intelligence
Percent	of friendly forces
Percent	of attacks
Hours	before enemy begins to mimic identification or recognition procedure
Minutes	To confirm identity of unidentified friendly target
Percent	of coalition nations accurately reporting force locations
Percent	of force with passive identification interrogation capability employing capability
Percent	of friendly aircraft destroyed by friendly air defense
Percent	of friendly aircraft destroyed by friendly fire
Percent	of friendly casualties from friendly fire
Percent	of friendly fire incidents cross-national
Percent	of friendly fire incidents cross-service
Percent	of friendly forces with procedures or equipment to allow positive identification, employ such procedures or equipment
Percent	of positive identification false negatives (friendly identified as enemy)
Percent	of positive identification false positives (enemy identified as friendly)
Percent	of friendly casualties, caused by friendly weapon systems
Percent	of friendly missiles destroyed by friendly air defense.

To determine discretely and positively, by any means, the individual identity of forces  
 <5 Percent of positive identification false negatives (friendly identified as enemy)

All values are NOTIONAL



# Observations

- MMF offers an integrated procedure for explicitly specifying the results of a capabilities gap analysis. Its employment helps to:
  - Organize available information pertinent to Joint Testing in Force Transformation
  - Analyze that information to identify T&E capability gaps in a Joint Environment
  - Provide inputs for a ROM cost estimate for the corrective investment.
- DOT&E appears to lack a comprehensive database of T&E range capabilities
- The Roadmap for Testing in a Joint Environment (TJE) envisions enhancements to JDEP
  - T&E will need to leverage Joint training venues for live forces to replicate the joint context
  - T&E will have to depend even more on virtual and constructive capabilities to construct the Joint environment.

# The Way Ahead

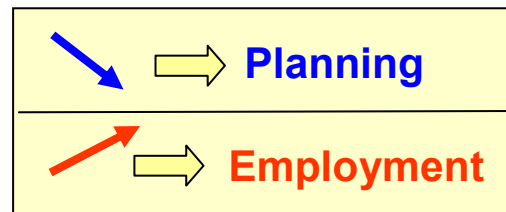
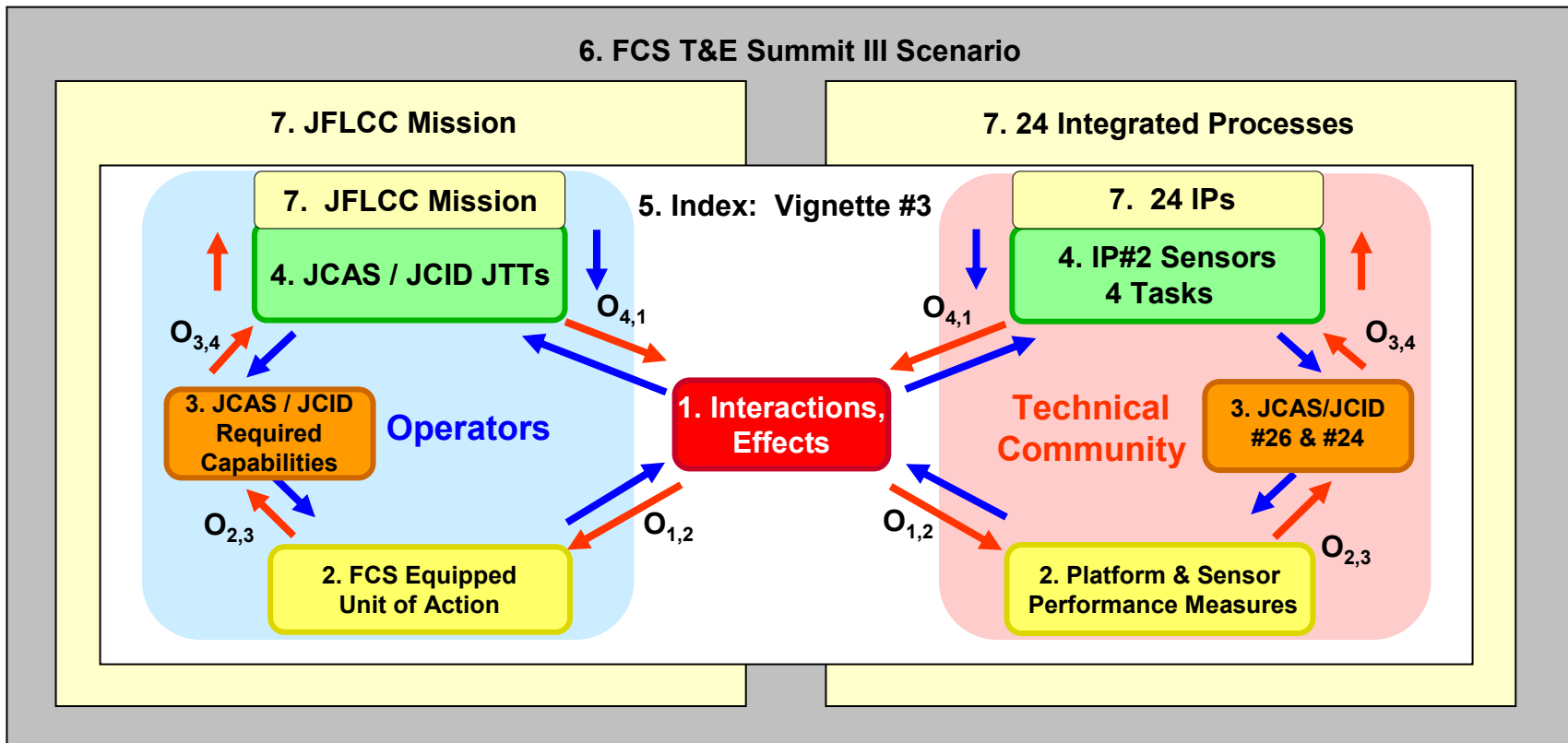
- Establish DoD requirement for MMF-like analysis of “Beacon” projects as a disciplined, repeatable procedure in support of the Joint testing community
- “Beacon” projects represent significant Joint and Service capability requirements; i.e., Littoral Combat Ship (LCS), Joint Strike Fighter (JSF), Future Combat System (FCS), JMMC2, and the E-10 (MC2A AWACS follow-on)
- Require Services and Program Managers to provide full support and cooperation to the MMF-like analysis effort
- MMF-like analysis effort will provide a “Roadmap and Way Ahead” for Services and other programs in developing truly Joint capabilities and articulate the “Joint” test and evaluation requirements for these programs and capabilities



# Backup Slides

DEDICATION RESPECT CONTINUOUS IMPROVEMENT

# MMF Applied Methodology



# FCS Test & Eval Scenario\* Mission Statements

## Joint Force Cdr

1. Achieve air superiority
2. Destroy WMD capability
3. Facilitate control of energy centers
4. Defeat resisting rebel forces

*“On order, JTF conducts operations to control energy centers, defeat Rebel forces, and secure the capital region in order to restore the legitimate government of Orangeland.”*

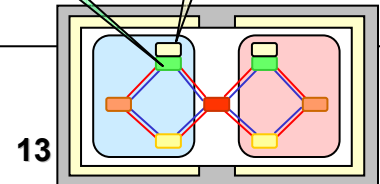
## Joint Force Land Component Cdr

1. Defeat Rebel forces in zone
2. Secure key oil & gas pipelines and production facilities
3. Secure capital region of Orangeland
4. Destroy WMD capability
5. Facilitate restoration of legitimate government

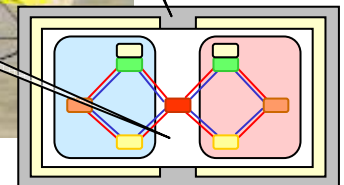
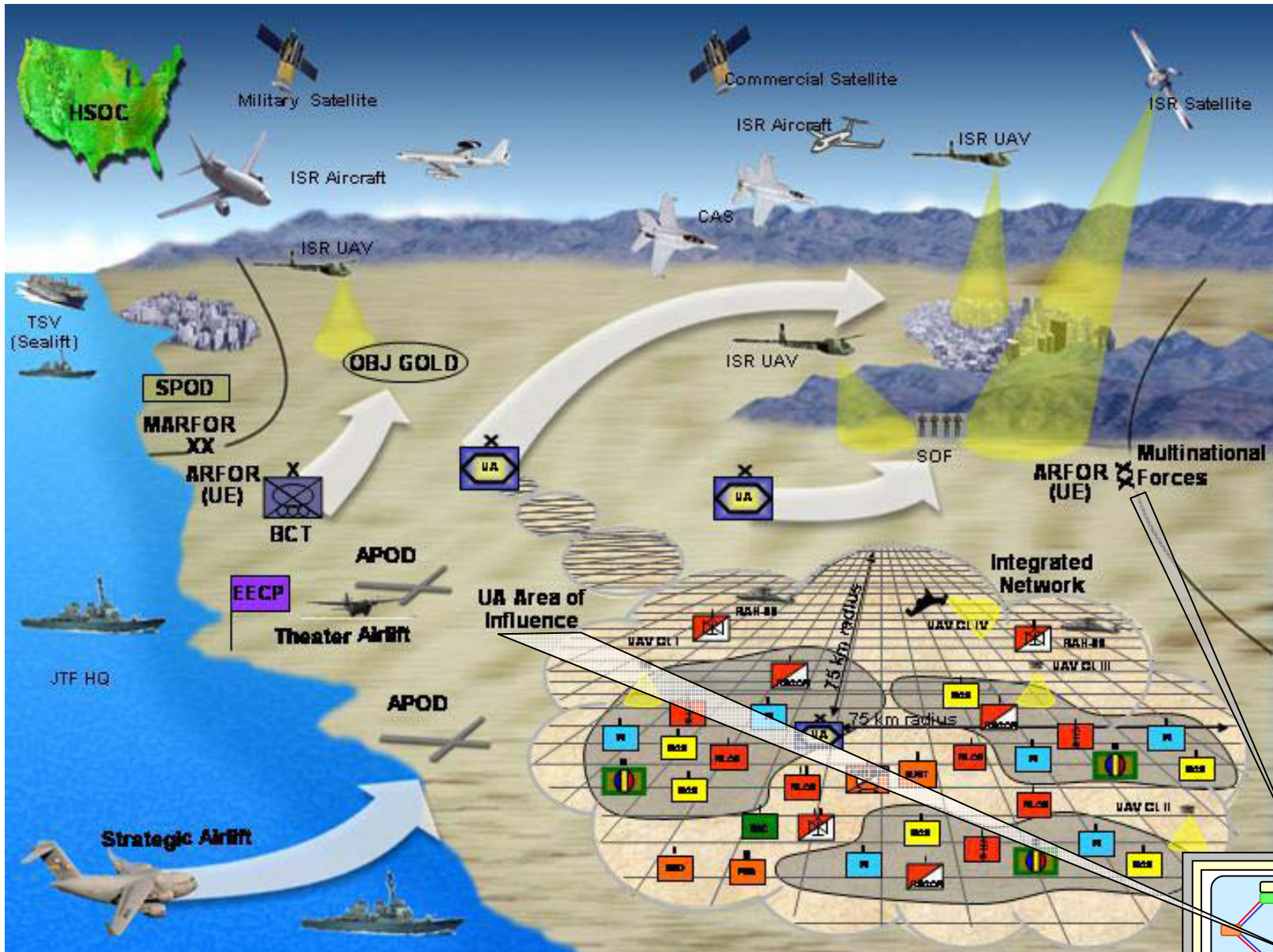
*“On order, JFLCC attacks to defeat Rebel forces in order to support the restoration of the legitimate government of Orangeland.”*

*\*Derived from DPG Illustrative Planning Scenario “Caspian Sea”*

3/16/2005



# FCS JCAS/JCID Environment



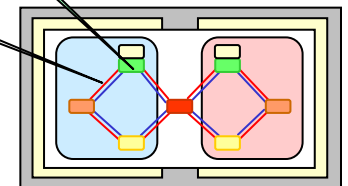
# JCAS Supporting Task Performance Measures

## OP 3.2.1 Provide CAS Integration for Surface Forces



To attack operational land and sea targets with available joint and multinational operational firepower delivery systems. To delay, disrupt, destroy, or degrade enemy operational forces or critical tasks and facilities (including C2I targets) and to affect the enemy's will to fight. **This task includes integrating the tasking and targeting options**, as well as the liaison requirements for aircraft to provide direct close air support to surface forces. (JP 2-01.1, 3-0, 3-09, 3-09.3, 3-10, 3-10.1, 3-60) (JP 3-09, 3-09.1, 3-09.3, 3-50.21, CJCSM 3500.05)

- Minutes to complete attack after target identification
- Percent of attacking systems deliver ordnance
- Percent of enemy forces destroyed, delayed, disrupted, or degraded
- Percent of enemy troops surrender
- Percent of friendly COAs altered or discarded
- Percent of targets correctly identified**
- Percent of joint tactical air requests filled
- Minutes to provide surge CAS assets to friendly forces ISO urgent tactical situations
- Percent of friendly ground maneuver events covered by CAS on station
- Percent of attacks assessed to have greater collateral damage/effects than planned/expected.

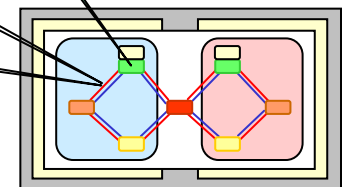


# JCID Supporting Task Performance Measures

## OP 5.1.11 Provide Positive Identification of Friendly Forces Within the JOA

**To determine discretely and positively, by any means the individual identity of forces**, objects (military formations), or phenomena (such as communications electronic patterns). The objective of this task is to protect friendly and neutral forces, objects, or phenomena from attack by operational level forces or systems. This task facilitates the concentration of effort against the adversary. Under certain circumstances, this task may apply within the United States with limitations for homeland security missions. (JP 3-01.1, 3-03, 3-09, 3-09.3, 3-10.1, 3-52, 3-56.1) (JP 3-01.1, 3-07.3, 3-09, 3-09.3, 3-54, CJCSM 3500.05)

- Hours before enemy begins to mimic identification or recognition procedure
- Minutes To confirm identity of unidentified friendly target**
- Percent of coalition nations accurately reporting force locations
- Percent of force with passive identification interrogation capability employing capability
- Percent of friendly aircraft destroyed by friendly air defense
- Percent of friendly aircraft destroyed by friendly fire
- Percent of friendly casualties from friendly fire
- Percent of friendly fire incidents cross-national
- Percent of friendly fire incidents cross-service
- Percent of friendly forces with procedures or equipment to allow positive identification, employ such procedures or equipment
- Percent of positive identification false negatives (friendly identified as enemy)**
- Percent of positive identification false positives (enemy identified as friendly)**
- Percent of friendly casualties, caused by friendly weapon systems
- Percent of friendly missiles destroyed by friendly air defense.





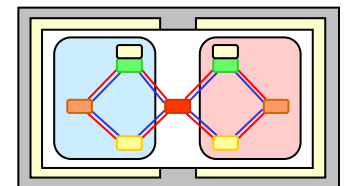
## JTT Task TA 3.2.2 Conduct Close Air Support



To provide support for amphibious and/or land operations by air assets through attacking hostile targets in close proximity to friendly forces. (JP 3-09)

Minutes Preplanned close air support (CAS) missions execute weapons delivery/release within \_\_\_\_ minutes of air tasking order (ATO)-tasked time-on-target (TOT).

Minutes Airborne Alert or preplanned on-call CAS missions arrive at Control Point (CP) within \_\_\_\_ minutes of ATO-tasked time-on-station (TOS)

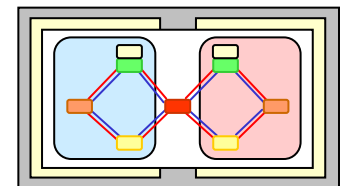


# JTT Task TA 5.2.1 Establish, Operate and Maintain Baseline Information Exchange



Establishment and implement at a tactical communications system that provides voice, data, facsimile, seamlessly and securely in an operator friendly environment.

- Percent Of the Equipment strings and system configurations are standardized as top allow communication throughout the units.
- Percent System redundancy incorporated among commanders, headquarters, and units.
- Percent Of operations delayed, disrupted, or degraded due to improper establishment and implementation of tactical communications system



# Analysis of Required JCAS and JCID Capabilities

39 JCAS and JCID  
required capabilities  
Developed by Study Team

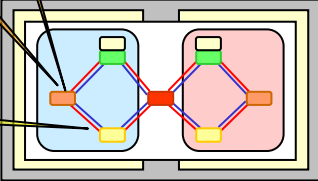
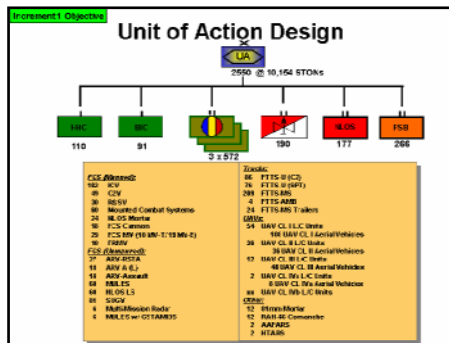
9. (JCAS) Enable positive target identification  
at all levels of visibility

34. (JCID) Enable positive shooter identification of  
friend, foe, non-combatants and systems at all  
levels of visibility

Stack of documents titled "JCAS Required Capabilities". The top document lists 15 capabilities:

1. Enable Force Application
2. Enable Force Protection
3. Enable Logistics Support
4. Develop and Maintain Battle Space Awareness via Common Operating Picture (COP)
5. Enable development of integrated JCAS / ground maneuver plan
6. Enable Joint Close Air Support (JCAS) Command & Control (C2) needed to synchronize JCAS and ground maneuver
7. Enable rapid detection of friend, foe, non-combatants, and systems at all levels of visibility
8. Enable target location at all levels of visibility
9. Enable positive target identification at all levels of visibility
10. Enable target designation at all levels of visibility
11. Request JCAS
12. Approve JCAS
13. Enable collaborative mission planning
14. Enable taskings for Intelligence, Surveillance, Reconnaissance (ISR) platforms
15. Provide task-organized, trained, and equipped teams to facilitate the coordination of air, artillery, and naval surface fires

Source: DRC Analysis      MMF Level: 4 & 3      Page 10

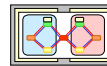


# FCS Architecture IPT Integrated Processes

## LSI Produced Integrated Processes List

IP 1: Battle Command	IP 14: Conduct Cooperative Engagements
IP 2: Sensors	IP 15: Survivability
IP 3: Networked Fires	IP 16: Conduct Tactical Maneuver
IP 4: Common Operating Picture	IP 17: Conduct Vertical Maneuver
IP 5: Networks	IP 18: Robotics
IP 6: A2C2	IP 19: Deploy
IP 7: Maintenance	IP 20: Intelligence Operations
IP 8: Resupply	IP 21: Information Assurance
IP 9: Perform Air and Missile Defense	IP 22: Establish Soldier System Interface
IP 10: Training	IP 23: Interoperability
IP 11: Health Protection	IP 24: Information Management
IP 12: Combat identification	
IP 13: Mobility	

5/21/2004



## FCS Architecture Integrated Processes #2/24 (Sensors)

**ART 7.3.2: Evaluate Situation or Operation:** Analyze and compare the actual situation or progress of the operation against criteria of success. Highlight variances between the planned situation at that time in the operation and the current situation, and forecast the degree of mission accomplishment. (FM 6-0) (USACAC)

**ART 7.2.1: Collect Relevant Information:** Continually collect relevant information about METT-TC from the information environment by any means for processing, displaying, storing, and disseminating to support conducting (planning, preparing for, executing, and assessing) current and future operations. (FM 6-0) (USACAC)

**ART 1.3.2.2: Execute/Update the ISP Plan:** The operations officer updates the ISR plan based on information he receives from the intelligence officer. The operations officer is the integrator and manager of the ISR effort through an integrated staff process and procedures. As PIRs are answered and new information requirements arise, the intelligence officer updates intelligence synchronization requirements and provides the new input to the operations officer who updates the ISR plan. He works closely with all staff elements to ensure the unit's organic collectors receive appropriate taskings. This ISR reflects an integrated collection strategy and employment, production and dissemination scheme that will effectively answer the commander's PIR. (FM 3-90) (USACAC)

**ART 1.3.1: Perform Intelligence Synchronization:** The intelligence officer, with staff participation, synthesizes the entire collection effort to include all assets the commander controls, assets of lateral units (lateral units and organizations, and intelligence reach to answer the commander's PIR and IR. (AIC&FH)



## ART 7.3.2 Performance Measures

### ART 7.3.2 EVALUATE SITUATION OR OPERATION

Analyze and compare the actual situation or progress of the operation against criteria of success. Highlight variances between the planned situation at that time in the operation and the current situation, and forecast the degree of mission accomplishment. (FM 6-0) (USACAC)

Yes/No evaluation reflects reality of the degree of mission accomplishment and forecasts the degree of mission accomplishment.

Time to evaluate progress or situation and determine type of decision.

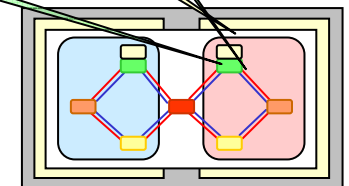
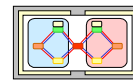
Time to complete evaluation of situation or progress.

Percent accuracy of evaluation of situation or progress.

**Percent of accurate friendly evaluations. (OP 3.2.1, OP 5.1.11)**

**Number of opportunities or threats recognized. (OP 3.2.1, OP 5.1.11)**

5/21/2004



# PM-FCS CTO Functional Capabilities

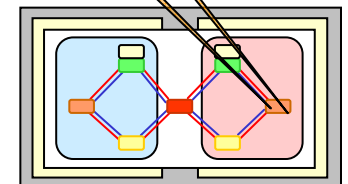


## 52 FCS Functional Capabilities

FCS Functional Capabilities	
F1:	Capability to destroy enemy formations via LOS, BLOS, and/or NLOS
F2:	Organizationally employ fire delivery systems
F3:	Scale effects to focus precisely
F4:	Employ minefields
F5:	Maximize lethality of dismounted operations
F6:	"Avenge" kill enemy systems engaging or preparing to engage friendly systems
F7:	Air defense (AD) lethality
F8:	Support mission planning/mission rehearsal
F9:	Enable battle command and control
F10:	Enable continuous estimate of situation
F11:	Enable visualization of tactical scheme
F12:	Enable dissemination of tactical scheme
F13:	Detect presence/identify disposition of anti-tank/personnel mines, booby traps
F14:	Detect, locate other, non-mine/booby trap man-made obstacles
F15:	Enable continuous situational understanding through networked force
F16:	Facilitate automatic language translation
F17:	Enable information exchange via adaptive, integrated communications
F18:	Detect/prevent intruders/malicious software; identify points of intrusion/origin, information compromised/introduced into the network
F19:	Enable Positional Navigation (POSNAV)
F20:	Enable information management to fuse, monitor and disseminate information to support CCIR, combat action, decision-making and analysis
F21:	Establish an adaptive learning repository to build and manage a library of friendly and enemy DTLOMS and lessons learned

**F24: Provide combat identification to detect, locate, and identify friend, foe and noncombatants and systems**

**F26: Enable C2 needed to synchronize fire, maneuver and ISR**



# FCS ORD UAV Platform (Class IV)

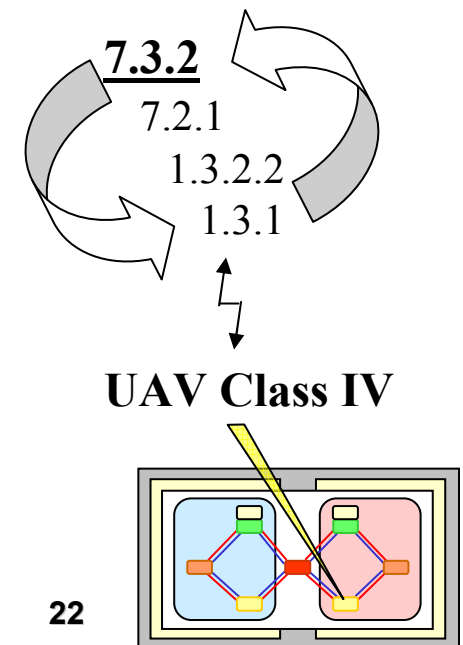


## Unit of Action Level

**1.0 General.** The Unmanned Aerial Vehicle Class IV (UAV CL IV) will be multifunction aerial systems capable of providing reconnaissance, security/early warning, long endurance persistent stare, **target acquisition and designation, wide area surveillance and have the ability to team (with Level IV Control) with air-ground forces throughout the UA.** The aerial systems will provide information from operating altitude and standoff range both day/night and adverse weather. The aerial systems should be capable of acting as a communication relay and performing emitter mapping, detect CBRN, and perform meteorological survey for the UA throughout their Area of Influence (AI). More than one type of air vehicle may be used to accomplish the roles/capabilities outlined herein.

**1.1 Operational Context.** UAV at the UA level must provide the following roles/capabilities:

- Provide a reconnaissance and security / early warning capability for the UA
- **Perform wide area R&S, target classification, recognition, identification....**
- Perform long endurance persistent stare across the UA AI (75 km)
- **Perform target acquisition and designation for precision fires**
- **Provide RSTA products to the UA through Jt common data links/network via FCS BCS**
- Provide information directly to C2 nodes and FCS C2 platforms
- Perform wide area search to cue other sensors
- **Conducting MUM Teaming operations with other air-ground force units**
- **Enable detection of Soldiers and vehicles (moving and stationary) through foliage**
- **Provide automatic fire adjustment calculations for indirect fire weapons and CAS**





## Platform Characteristics

### Payload, Endurance, and Speed

Nominal Echelon: Battalion/Brigade

Type of Platform: Fixed Wing (similar to Shadow 200+)

Gross Weight: TBD

Payload Weight (including communications): TBD

Operational Altitude: 1000-6500 ft AGL

Endurance: 6 hours

Range: 40 km

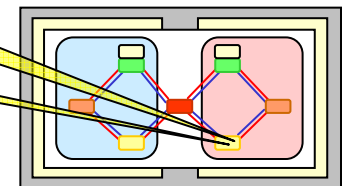
Cruise Speed: 140 kph

Maximum Speed: 200 kph

Transport: Carried 4 per HEMTT

## Platform Sensor Packages

<b>1</b>	<b>UAV Meteorological</b> <b>UAV IFF</b> <b>UAV C2 Relay</b> <b>Comms Relay</b>
<b>2</b>	<b>UAV Meteorological</b> <b>UAV IFF</b> <b>UAV GMTI/SAR</b>
<b>3</b>	<b>UAV Meteorological</b> <i>UAV IFF</i> <i>UAV EO (Medium)</i> <b>UAV MWIR w/ Mine Detection and AITD</b> <b>UAV LRF/TD</b> <b>UAV Acoustic</b>
<b>4</b>	<b>UAV Meteorological</b> <b>UAV IFF</b> <b>CBRNE</b> <b>SIGINT Emitter Mapping</b>



# AMSAA Systems Book UAV Class IV Technologies



**UAV Electro-Optic (EO), medium: Passive EO sensor detects, classifies, identifies, and localizes targets using image/signal processing techniques; stabilized sensor; available to UAV (CL III), UAV (CL IV-a).**

UAV Mid-Wave Infrared (MWIR) with Mine Detection and Aided Target Detection (AiTD): Cooled 640x480 passive sensor; detects, classifies, identifies, and localizes targets using image/signal processing techniques; stabilized sensor; includes mine detection capability with IR filter; integrated AiTD technologies; available to UAV (CL III), UAV (CL IV-a).

UAV Synthetic Aperture Radar (SAR)/Ground Moving Target Indicator (GMTI) RADAR, medium: Payload with SAR to detect stationary targets and MTI to detect moving targets (CL IV-a).

UAV CBRNE UAV Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE): Description To be provided: available to UAV (CL II), UAV (CL IV-a), UAV (CL IV-b)

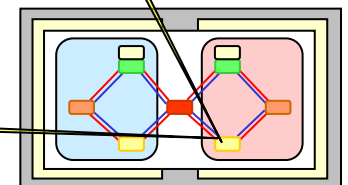
UAV Electronic Attack (EA) provides a non-lethal jamming capability to disrupt and deny enemy Communications at crucial times: available to UAV (CL IV-a/b).

UAV Comms Relay UAV Communication Relay (Comms Relay): Comms relay to extend communications range; available to UAV (CL III), UAV (CL IV-a).

UAV Meteorological, Description to be provided: available to UAV (CL III), UAV (CL IV-a)

UAV Laser Rangefinder/Target Designator (LRF/TD): Integrates laser target designator with eye-safe laser rangefinder; available to UAV (CL II), UAV (CL III), UAV (CL IV-a).

**UAV Identification Friend-or-Foe (IFF): Description to be provided; available to UAV (CL II), UAV (CL III), UAV (CL IV-a), UAV (CL IV-b).**





# Raytheon's Electro-optical Medium Sensor Specifications and Performance Measures

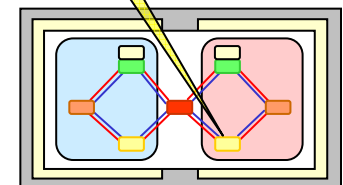


## Global Hawk Integrated Sensor Suite

The Global Hawk Integrated Sensor Suite, developed by Raytheon, Electronic Systems, provides pairs of very-high-resolution synthetic aperture radar (SAR) and moving target indication (MTI) with electro-optical (EO) and infrared (IR) sensors offering multiple imaging capabilities. The SAR can operate simultaneously with either the EO or IR sensor, enabling wide-area search (WAS) for situational awareness and threat assessment as well a narrower focus on specific targets for prosecution or BDA.

Specifications	Performance Parameters
<p><b><u>EO/IR</u></b>                      Focal length: 1.75 m                      Aperture: 0.28 m (11 in.)                      Array: IR InSb: 3.7-5 um                      EO CCD: 0,55-0.8 um                      Field of View                      Pixel, instantaneous                      11.4, urad, MWIR                      5.1 urad, visible                      Array                      5.5 x 7.3 urad, MWIR                      5.1 x 5.2 urad, visible</p> <p><b><u>Radar</u></b>                      Frequency: x-based                      Bandwidth: 600 Mhz                      Peak Power: 3.5 kW                      Antenna field of regard: +/- 45 Deg squint,                      either side of aircraft</p>	<p><b><u>EO/IR</u></b>                      WAS: 138,000 km<sup>2</sup>/24 hr                      NIIRS*                      MWIR: 5.0                      Visible: 6.0                      Spotlight: 1900 2x2 km spot images/24 hr                      NIIRS*                      MWIR: 5.5                      Visible: 6.5</p> <p><b><u>Radar</u></b>                      WAS: 138,000 km<sup>2</sup>/24 hr, 10-km wide strip, at 1-m resolution out to 200 km range                      Spotlight: 1900 2x2 km spot images/24 hrs at 0.3-m resolution out to 200-km range                      GMTI: 15,000 km<sup>2</sup>/min: minimum detectable Velocity, 2.1 m/s (4 kn)</p>

\*NIIRS=National Image Interpretability Rating Scale



# UAV IFF Sensor Performance Measures



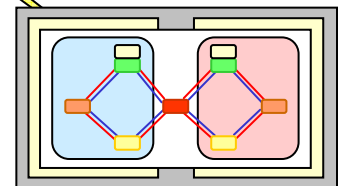
## Current Force version: Battlefield Combat Identification System (BCIS):

“BCIS is a secure, encrypted question and answer identification system which provides a high confidence, ground combat vehicle identification capability. The system operates in the millimeter wave (mmW) frequency region at 38GHz. The "Shooter Platform" has an interrogator antenna boresighted to the gunners targeting system and integral with the platforms laser rangefinder sub system. Other major components of the BCIS system integrated on the platform are shown below. The receiver - transmitter unit and display module are mounted in the vehicle commander's area. “

**2.1.1 BCIS Functional Characteristics.** BCIS provides a combat identification capability to reduce the risk of fratricide. BCIS is a millimeter wave (38GHz), secure question and answer, point of engagement system that positively identifies friendly targets. **BCIS provides a > 95% probability of correct friendly identification within one second at the gunner's site with no impact on firing function. BCIS works effectively on a dirty battlefield at an operational range of 150 to 5500 meters.** Interrogator azimuth coverage is  $\pm 1.3^\circ$  or  $\pm 22.5$  mils. Transponder azimuth coverage is  $360^\circ$  at an elevation of  $-10^\circ$  to  $+45^\circ$ . BCIS is used by combat, combat support and combat service support vehicles operating forward of the Brigade Support Area (BSA) to positively identify, or be identified, by other BCIS equipped friendly ground vehicles and minimize the risk of fratricide during the conduct of land battle.

**Potential Future Force version:** Multilateration Combat Identification System (MCIS):

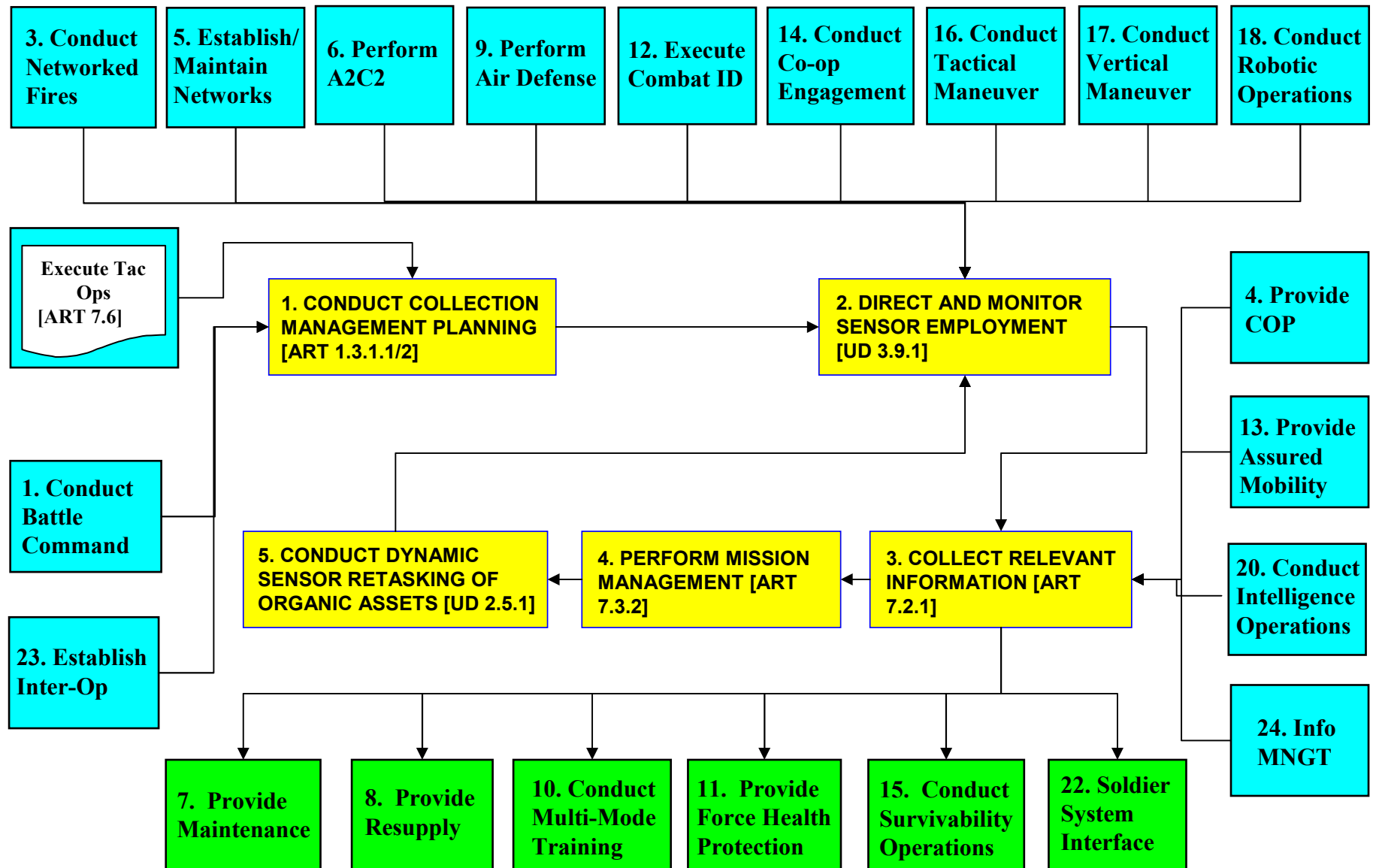
<http://www.dtic.mil/ndia/2001ewc/colasanti.pdf>





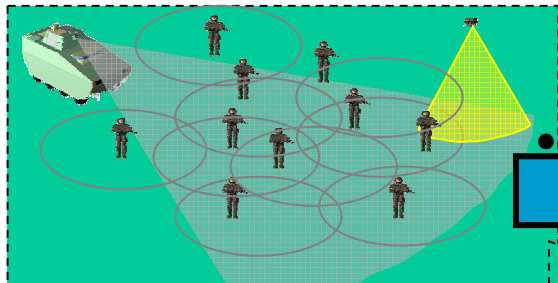
# IP - 2: Establish/Maintain/Manage Sensor Networks

## Integrated Process Flow Diagram



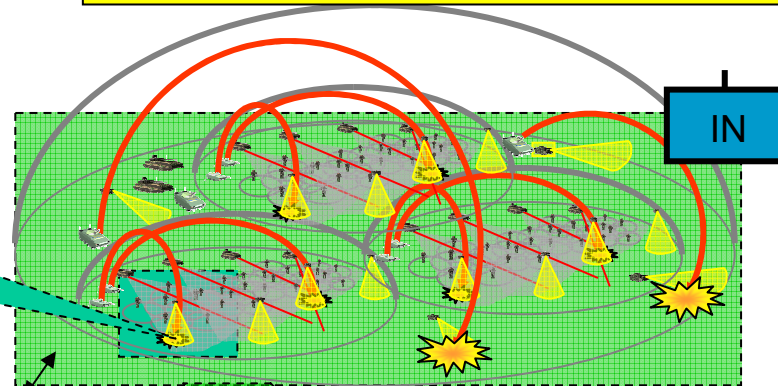
# IP 2: Establish/Maintain/Manage Sensor Networks OV-1

- Co Cdr can pre-set criteria for downward/ upward information flow
- Layered building blocks of information



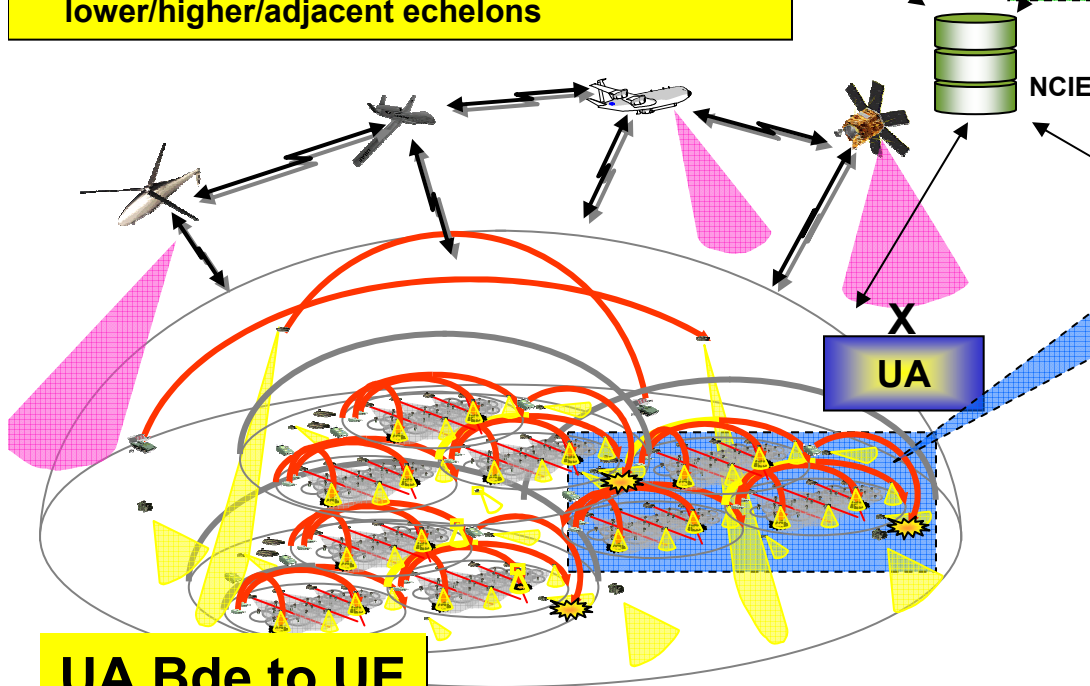
## Soldier to Platoon

- Small unit sensor grid creates a sphere of SA
- Automated reporting to/from lower/higher/adjacent echelons



## Layered Sensors at Bn & Bde

- UA Bn & Bde Cdrs set criteria for information flow
- UA/UE/JTF feeds filtered to prevent info overload
- UA linkage to UE, Joint, and National assets
- Automated fusion / Pattern Analysis process
- Layered approach supports Battle Command
- Provides information to the NCIE/COP



## UA Bde to UE

# FCS UAV Platform (Class III)



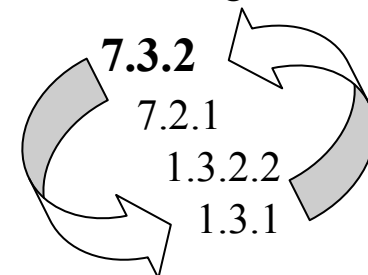
## Appendix B to Section 1 to Annex E to FCS ORD (Unmanned Aerial Vehicle (CL III))

### Battalion Level

**1.0 General.** The UAV (CL III) is a multifunction aerial system capable of providing reconnaissance, security/early warning, **target acquisition and designation for precision fires**, throughout the battalion area of influence by remotely over watching and reporting changes in key terrain, avenues of approach and danger areas in open and rolling, restrictive, and urban areas. The aerial system will provide information from operating altitude and standoff range both day/night and adverse weather. The aerial system should be capable of communication relay, detecting mines, performing CBRN detection, and performing meteorological survey for the NLOS battalion to deliver precision fires.

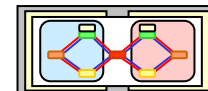
**1.1 Operational Context.** UAV at the Battalion level must provide the following roles/capabilities:

- Provide a reconnaissance and security/early warning capability for the UA – See Day/Night
- Remotely overwatch and report changes in key terrain, avenues of approach and danger areas in open and restrictive terrain, and urban areas
- Perform **target acquisition and designation for the UA**
- Act as a communications (wide band) relay
- Detect CBRN
- Perform target area meteorological survey
- Does not require an airfield
- Support CA Battalion by performing R&S on a minimum of three routes or :
- Enable NLOS targeting and fires



**UAV Class III**

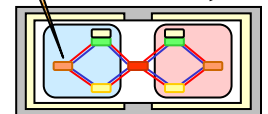
MMF Level: 3



# Study Team Analysis of JCAS Required Capabilities



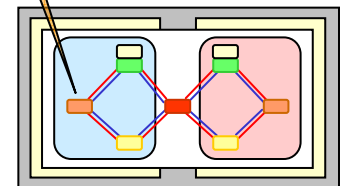
1. Enable Force Application
2. Enable Force Protection
3. Enable Logistics Support
4. Develop and Maintain Battle Space Awareness via Common Operating Picture (COP)
5. Enable development of integrated JCAS / ground maneuver plan
6. Enable Joint Close Air Support (JCAS) Command & Control (C2) needed to synchronize JCAS and ground maneuver
7. Enable rapid detection of friend, foe, non-combatants, and systems at all levels of visibility
8. Enable target location at all levels of visibility
- 9. Enable positive target identification at all levels of visibility**
10. Enable target designation at all levels of visibility
11. Request JCAS
12. Approve JCAS
13. Enable collaborative mission planning
14. Enable taskings for Intelligence, Surveillance, Reconnaissance (ISR) platforms
15. Provide task-organized, trained, and equipped teams to facilitate the coordination of air, artillery, and naval surface fires



# Study Team Analysis of JCAS Required Capabilities (con't)



16. Enable information exchange via interoperable communications (visual / voice / digital)
17. Enable collaborative mission rehearsal
18. Provide JCAS aircraft
19. Enable Suppression of Enemy Air Defenses (SEAD) planning & execution
20. Provide task-organized, trained, and equipped teams to facilitate the terminal control of air, artillery, and naval surface fires
21. Enable sensor to shooter linkages
22. Conduct JCAS attack
23. Scale effects to focus precisely in support of ground maneuver
24. Enable JCAS Battle Damage Assessment (BDA)

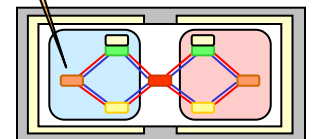




# Study Team Analysis of JCID Required Capabilities



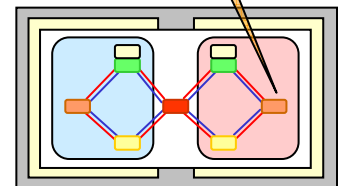
25. Conduct air Intelligence, Surveillance, and Reconnaissance (ISR)
26. Enable national and theater Signals Intelligence (SIGINT) integration
27. Develop and Maintain Battle Space Awareness via Common Operating Picture (COP)
28. Detect and report Close Air Support (CAS) targets and formations
29. Enable real-time information exchange via interoperable communications (visual / voice / digital)
30. Enable collaborative mission planning
31. Enable collaborative mission rehearsal
32. Enable combat detection of friend, foe, non-combatants and systems at all levels of visibility
33. Reduce initial target detection to positive identification time
- 34. Enable positive shooter identification of friend, foe, non-combatants and systems at all levels of visibility**
35. Enable integration of Unmanned Aerial Vehicle (UAV) ISR for Positive Hostile ID
36. Enable sensor to shooter linkages
37. Conduct forward area Command and Control (C2) of aircraft
38. Enable AWACS / E2C aircraft handoff to Forward Area Controller (FAC) and Joint Terminal Attack Controller (JTAC)
39. Provide Battle Damage Assessment (BDA)



# FCS Functional Capabilities



- F1: Capability to destroy enemy formations via LOS, BLOS, and/or NLOS
- F2: Organizationally employ fire delivery systems
- F3: Scale effects to focus precisely
- F4: Employ minefields
- F5: Maximize lethality of dismounted operations
- F6: “Avenge” kill enemy systems engaging or preparing to engage friendly systems
- F7: Air defense (AD) lethality
- F8: Support mission planning/mission rehearsal
- F9: Enable battle command and control
- F10: Enable continuous estimate of situation
- F11: Enable visualization of tactical scheme
- F12: Enable dissemination of tactical scheme
- F13: Detect presence/identify disposition of anti-tank/personnel mines, booby traps
- F14: Detect, locate other, non-mine/booby trap man-made obstacles
- F15: Enable continuous situational understanding through networked force
- F16: Facilitate automatic language translation
- F17: Enable information exchange via adaptive, integrated communications
- F18: Detect/prevent intruders/malicious software; identify points of intrusion/origin, information compromised/introduced into the network
- F19: Enable Positional Navigation (POSNAV)
- F20: Enable information management to fuse, monitor and disseminate information to support CCIR, combat action, decision-making and analysis
- F21: Establish an adaptive learning repository to build and manage a library of friendly and enemy DTLOMS and lessons learned



# FCS Functional Capabilities (Con't)



F22: Enable terrain analysis

F23: Integrate synergistic use of ISR to see the full range of operational variables

**F24: Provide combat identification to detect, locate, and identify friend, foe and noncombatants and systems**

F25: Determine what is most dangerous

**F26: Enable C2 needed to synchronize fire, maneuver and ISR**

F27: Enable sensor to shooter linkage

F28: Provide improved early warning and dissemination of threats

F29: Maneuver into and out of contact

F30: Enable decisive maneuver

F31: Enable development of situation out of contact

F32: Provide for tactical mobility

F33: Counter/neutralize/clear/mark anti-tank/personnel mines, booby traps

F34: Breach disrupting/fixing obstacles

F35: Cross gaps (i.e. streams, irrigation ditches)

F36: Enable protective countermobility and survivability support

F37: Enhance individual soldier survivability

F38: Degrade enemy detection and terminal targeting

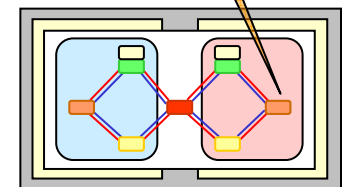
F39: Defeat/intercept enemy threats

F40: Enable blinding the enemy

F41: Provide area suppression capability

F42: Facilitate improved soldier performance

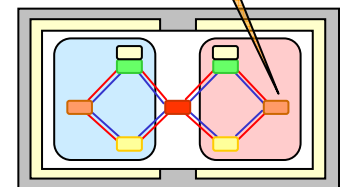
F43: Enable medical treatment and evacuation of wounded soldiers



# FCS Functional Capabilities (Con't)



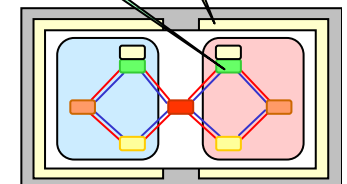
- F44: Enable reduction in the maneuver sustainment footprint and demand for replenishment
- F45: Enable organic Unit of Action sustainment
- F46: Simplified systems maintainability to reduce maintenance and replenishment burden
- F47: Water generation and replenishment
- F48: Provide capability to monitor, report and submit requests to facilitate anticipatory sustainment
- F49: Provide a means of transporting people and materiel
- F50: Dismounted forces must be self-sustaining
- F51: Provide a multi-echelon training construct
- F52: Conduct air assault operations



# FCS Architecture IPT Integrated Processes List

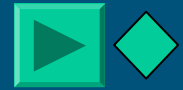


- |              |                                 |        |                                    |
|--------------|---------------------------------|--------|------------------------------------|
| IP 1:        | Battle Command                  | IP 14: | Conduct Cooperative Engagements    |
| <b>IP 2:</b> | <b>Sensors</b>                  | IP 15: | Survivability                      |
| IP 3:        | Networked Fires                 | IP 16: | Conduct Tactical Maneuver          |
| IP 4:        | Common Operating Picture        | IP 17: | Conduct Vertical Maneuver          |
| IP 5:        | Networks                        | IP 18: | Robotics                           |
| IP 6:        | A2C2                            | IP 19: | Deploy                             |
| IP 7:        | Maintenance                     | IP 20: | Intelligence Operations            |
| IP 8:        | Resupply                        | IP 21: | Information Assurance              |
| IP 9:        | Perform Air and Missile Defense | IP 22: | Establish Soldier System Interface |
| IP 10:       | Training                        | IP 23: | Interoperability                   |
| IP 11:       | Health Protection               | IP 24: | Information Management             |
| IP 12:       | Combat identification           |        |                                    |
| IP 13:       | Mobility                        |        |                                    |



# FCS Architecture

## Integrated Processes #2/24 (Sensors)

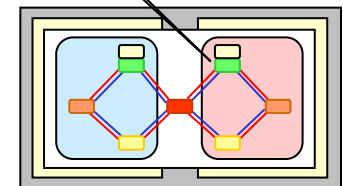


**ART 7.3.2: Evaluate Situation or Operation:** Analyze and compare the actual situation or progress of the operation against criteria of success. Highlight variances between the planned situation at that time in the operation and the current situation, and forecast the degree of mission accomplishment. (FM 6-0) (USACAC)

**ART 7.2.1: Collect Relevant Information:** Continually collect relevant information about METT-TC from the information environment by any means for processing, displaying, storing, and disseminating to support conducting (planning, preparing for, executing, and assessing) current and future operations. (FM 6-0) (USACAC)

**ART 1.3.2.2: Execute/Update the ISR Plan:** The operations officer updates the ISR plan based on information he receives from the intelligence officer. The operations officer is the integrator and manager of the ISR effort through an integrated staff process and procedures. As PIRs are answered and new information requirements arise, the intelligence officer updates intelligence synchronization requirements and provides the new input to the operations officer who updates the ISR plan. He works closely with all staff elements to ensure the unit's organic collectors receive appropriate taskings. This ISR reflects an integrated collection strategy and employment, production and dissemination scheme that will effectively answer the commander's PIR. (FM 3-90) (USACAC)

**ART 1.3.1: Perform Intelligence Synchronization:** The intelligence officer, with staff participation, synchronizes the entire collection effort to include all assets the commander controls, assets of lateral units and higher echelon units and organizations, and intelligence reach to answer the commander's PIR and IR. (FM 34-1) (USAIC&FH)



# ART 7.3.2 Task Performance Measures



## ART 7.3.2 EVALUATE SITUATION OR OPERATION

Analyze and compare the actual situation or progress of the operation against criteria of success. Highlight variances between the planned situation at that time in the operation and the current situation, and forecast the degree of mission accomplishment. (FM 6-0)  
(USACAC)

Yes/No evaluation reflects reality of the degree of mission accomplishment and forecasts the degree of mission accomplishment.

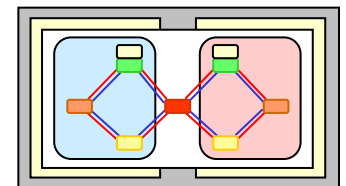
Time to evaluate progress or situation and determine type of decision.

Time to complete evaluation of situation or progress.

Percent accuracy of evaluation of situation or progress.

**Percent of accurate friendly evaluations. (OP 3.2.1, OP 5.1.11)**

**Number of opportunities or threats recognized. (OP 3.2.1, OP 5.1.11)**



# JNTC Activities

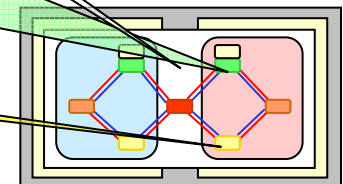


Joint or Service Exercise	Type of Event	Facilities	Level of Conflict	JTT Tasks
1st Qtr MRX	V	Virtual	SASO	TA 3.2.6; TA 5.2.1; TA 5.5.1
Red Flag	H	Nellis	MTW	TA 3.2.4; TA 5.2.1; TA 5.6; TA 6.5
1st Qtr BGIE	H	WRC	MTW	TA 5.2.1; TA 6.5
TF05	V	Virtual	MTW	TA 3.2.7; TA 5.2.1
CTC	H	WRC	MTW	TA 3.2.2; TA 3.2.6; TA 3.3; TA 4.2; TA 5.2.1
JTFEX 05-1	H	WRC	MTW	TA 3.2.4; TA 3.3; TA 5.2.1
2nd Qtr MRX	V	Virtual	SASO	TA 3.2.1; TA 3.2.6; TA 4.2; TA 5.2.1; TA 6.3
JRF (Int)	I	Nellis/AW	MTW	TA 3.2.1; TA 3.2.2; TA 3.2.3; TA 3.2.4; TA 3.2.7; TA 5.6
3rd Qtr BGIE	H	WRC	MTW	TA 3.2.7; TA 5.2.1; TA 5.6; TA 6.5
3rd Qtr MAWTS	H	29 Palms	MTW	TA 3.2.2; TA 5.2.1
SF05	V	EUC	GWOT	TA 3.2.1; TA 5.2.1; TA 7.1
RS (Int)	I	WRC	MTW	TA 3.2.7; TA 5.2.1; TA 6.3; TA 6.5
4th Qtr CTC/AW	H	WRC	MTW	TA 1.1.1; TA 3.2.2; TA 5.2.1
4th Qtr CAX	H	29 Palms	MTW	TA 3.2.1; TA 5.2.1; TA 5.5.1; TA 6.2
Cope Thunder	H	PARC	MTW	TA 3.2.1; TA 3.2.3; TA 5.2.1; TA 6.2
UE FD	V	SOU	GWOT	TA 3.2.1; TA 5.2.1; TA 6.2

Type of Event

Vertical  
Integrated  
Horizontal

V  
I  
H





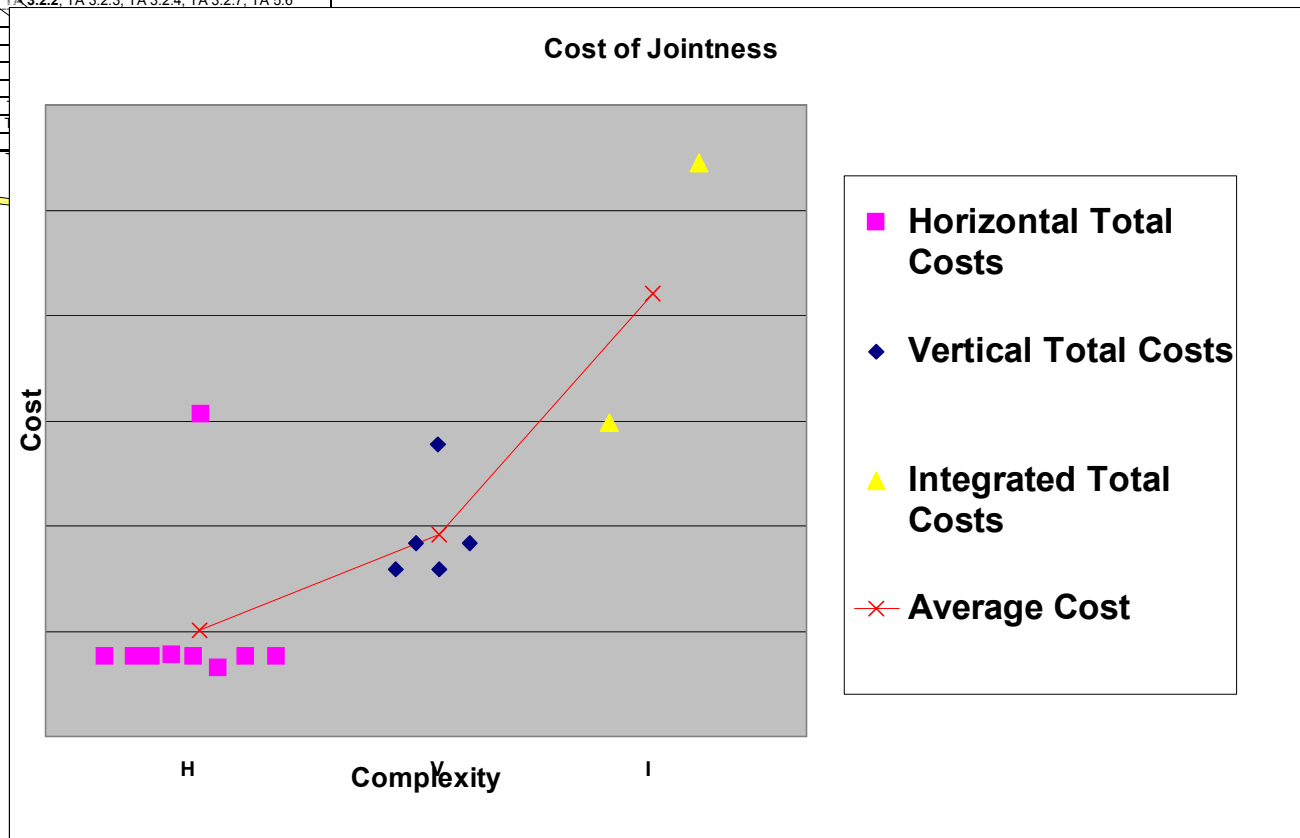
# JNTC Cost Drivers



## JNTC Activities

	Type of Event	Location	Venue	Tasks
1st Qtr MRX	V	Virtual	SASO	TA 3.2.6; TA 5.2.1; TA 5.5.1
Red Flag	H	Nellis	MTW	TA 3.2.4; TA 5.2.1; TA 5.6; TA 6.5
1st Qtr BGIE	H	WRC	MTW	TA 5.2.1; TA 6.5
TF05	V	Virtual	MTW	TA 3.2.7; TA 5.2.1
CTC	H	WRC	MTW	TA 3.2.2; TA 3.2.6; TA 3.3; TA 4.2; TA 5.2.1
JTFEX 05-1	H	WRC	MTW	TA 3.2.4; TA 3.3; TA 5.2.1
2nd Qtr MRX	V	Virtual	SASO	TA 3.2.1; TA 3.2.6; TA 4.2; TA 5.2.1; TA 6.3
JRF (Int)	I	Nellis/AW	MTW	TA 3.2.2; TA 3.2.3; TA 3.2.4; TA 3.2.7; TA 5.6
3rd Qtr BGIE	H	WRC	MTW	
3rd Qtr MAWTS	H	29 Palms	MTW	
SF05	V	EUC	GWOT	
RS (Int)	I	WRC	MTW	
4th Qtr CTC/AW	H	WRC	MTW	
4th Qtr CAX	H	29 Palms	MTW	
Cope Thunder	H	PARC	MTW	
UE FD	V	SOU	GWOT	

5/23/2004





# DRC Analysis of WRC Capabilities to JCAS/JCID



A	WRC Facilities				
	B	C	D	E	F
	NTC, Ft Irwin, CA	Nellis AFB, NV	MCAGCC, 29 Palms, CA	Naval Station San Diego, CA	WSMR, NM
1	<b>Level 3 Required Capabilities</b>				
2	4	1	4	2	-1
3	4	1	4	0	1
4	4	1	4	1	1
5	4	1	4	2	1
6	4	1	4	0	1
7	4	1	4	0	1
8	-1	1	4	0	1
9	-1	1	4	0	1
10	-1	1	4	0	1
11	-1	-1	1	1	1
12	1	1	1	1	1
13	1	1	1	1	1
14	1	1	1	1	1
15	1	1	1	1	1
16	1	1	1	1	1
17	1	1	1	1	1
18	1	1	1	1	1
19	1	1	1	1	1
20	1	1	1	1	1
21	1	1	1	1	1
22	1	1	1	1	1
23	4	1	4	1	1
24	-1	1	4	0	1
25	4	1	4	0	1
26	4	1	4	0	1
27	7	-1	1	1	1
28	4	-1	2	1	1
29	4	1	4	0	1
30	-1	-1	-1	-1	-1
31	-1	-1	-1	-1	-1
32	-1	-1	-1	-1	-1
33	-1	-1	-1	-1	-1
34	-1	-1	-1	-1	-1
35	-1	-1	-1	1	-1
36	-1	-1	1	1	1
37	4	1	4	1	1
38	4	1	4	1	1
39	4	1	4	1	1
40	4	1	4	1	1
41					
42	0 = Null				
43	1 = Live				
44	2 = Live and Virtual				
45	3 = Live, Virtual, and Constructive				
46	4 = Live and Constructive				
47	5 = Virtual				
48	6 = Virtual and Constructive				
49	7 = Constructive				
50	-1 = Unknown				

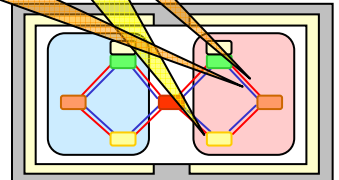
**Enable positive target identification at all levels of visibility**

-1      -1      -1      -1

**Enable positive shooter identification of friend, foe, non-combatants and systems at all levels of visibility**

-1      -1      -1      1      -1

0 = Null	3 = Live, Virtual, and Constructive	6 = Virtual and Constructive
1 = Live	4 = Live and Constructive	7 = Constructive
2 = Live and Virtual	5 = Virtual	-1 = Unknown

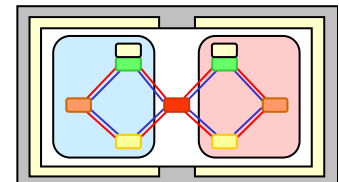


# JNTC Provided WRC Facilities and Capabilities

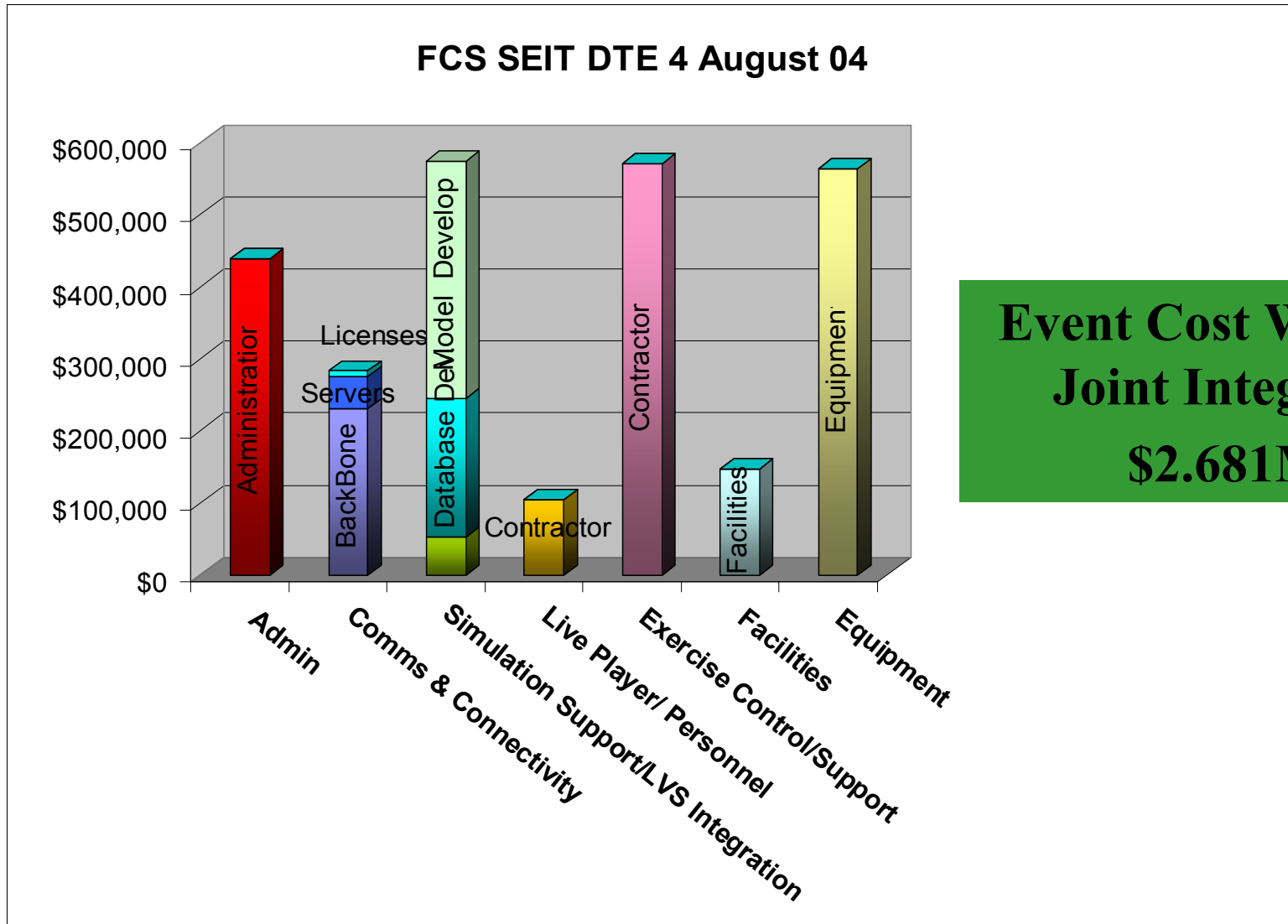


Range	NTC, Ft Irwin, CA	Nellis AFB, NV	MCAGCC, 29 Palms, CA	Naval Station San Diego, CA	WSMR, NM
<b>WRC Provided Capability</b>					
Aviation resources available to integrate fixed wing Close Air Support (CAS) w/ground maneuver plan	4	1	4	0	1
USAF/USMC/USN resources available to support tactical airpower control training	4	1	4	0	1
Ability to integrate doctrinally sound, well-resourced OPFOR into exercise event	4	1	4	1	1
Maneuver / targetry instrumentation adequate for engagement feedback / AAR collection	1	1	4	1	-1
Adequate staff of observer / controller cadre certified to service & joint standards	1	1	1	7	1
State of the art After Action Review (AAR) data collection technical resources	4	-1	4	-1	-1
Adequate AAR development & presentation facilities	1	-1	1	-1	1
Adequate ground maneuver area suitable for integrating tactical maneuver in a joint exercise scenario	1	-1	4	0	1
Ground direct-fire / artillery range capabilities adequate to support integrated joint scenario	1	-1	1	0	1
Adequate naval maneuver area suitable for integrating tactical maneuver in a joint exercise scenario	1	0	7	1	0
Naval gunfire/ missile firing range capabilities adequate to support integrated joint scenario	0	0	7	1	1
Adequate littoral maneuver area suitable for integrating tactical maneuver in a joint exercise scenario	0	0	7	0	0
Adequate rotary wing airspace suitable for integrating tactical maneuver in a joint exercise scenario	4	1	4	0	1
Rotary wing firing range capabilities adequate to support joint exercise scenario	1	-1	1	0	1
Adequate fixed wing airspace suitable for integrating tactical maneuver in a joint exercise scenario	4	1	4	1	1
Fixed wing firing range capabilities adequate to support joint exercise scenario	1	-1	1	1	1
Technical capability to integrate strategic intel feed into joint exercise	7	-1	-1	-1	-1
Overall training environment adequate to support joint exercise maneuver expectations	4	1	4	0	1
Models & simulations integration into training environment available to realistically stimulate C <sup>2</sup> and ISR systems	7	-1	7	-1	-1
Technical capability to stimulate digital C <sup>2</sup> systems	1	-1	-1	-1	-1
Technical capability to simulate higher / joint / coalition C4ISR systems in support of joint exercise scenario (engagements)	-1	-1	-1	-1	-1
Exercise Control SOPs / TTPs / construct adequate to joint exercise requirements	4	-1	4	-1	-1
Human / technical event analysis capability	1	1	1	1	-1
Aerial Port of Debarkation (APOD) capabilities	4	-1	4	1	1
Sea Port of Debarkation (SPOD) capabilities	1	1	4	1	1
Rail head facilities	0	0	7	1	0
Technical capability to rapidly conduct JCAS Battle Damage Assessment (BDA) assessment / feedback	1	-1	-1	1	1
Technical capability to observe collaborative mission <b>planning</b>	4	1	-1	0	1
Technical capability to observe collaborative mission <b>rehearsal</b>	-1	-1	-1	-1	-1
Technical capability to observe Enroute Mission Planning and Rehearsal System (EMPRES) capability	-1	-1	-1	-1	-1
Technical ability to integrate Joint Surveillance Target Attack System (JSTARS) [live / virtual] inputs into exercise event	-1	-1	-1	-1	-1
Technical ability to integrate Unmanned Aerial Vehicle (UAV) inputs into exercise events	4	-1	-1	-1	-1
Technical capability to integrate computer-based exercise simulations into joint exercise	4	-1	-1	1	1
Rotary / fixed wing aircraft support infrastructure	7	-1	7	-1	-1
Rotational unit equipment fleet	1	1	1	1	-1
"Link 16" integrated air and ground display feed stimulation capability	1	0	-1	0	0
	-1	-1	-1	-1	-1

All values are NOTIONAL



# ATEC Provided FCS Test Event Cost



# References

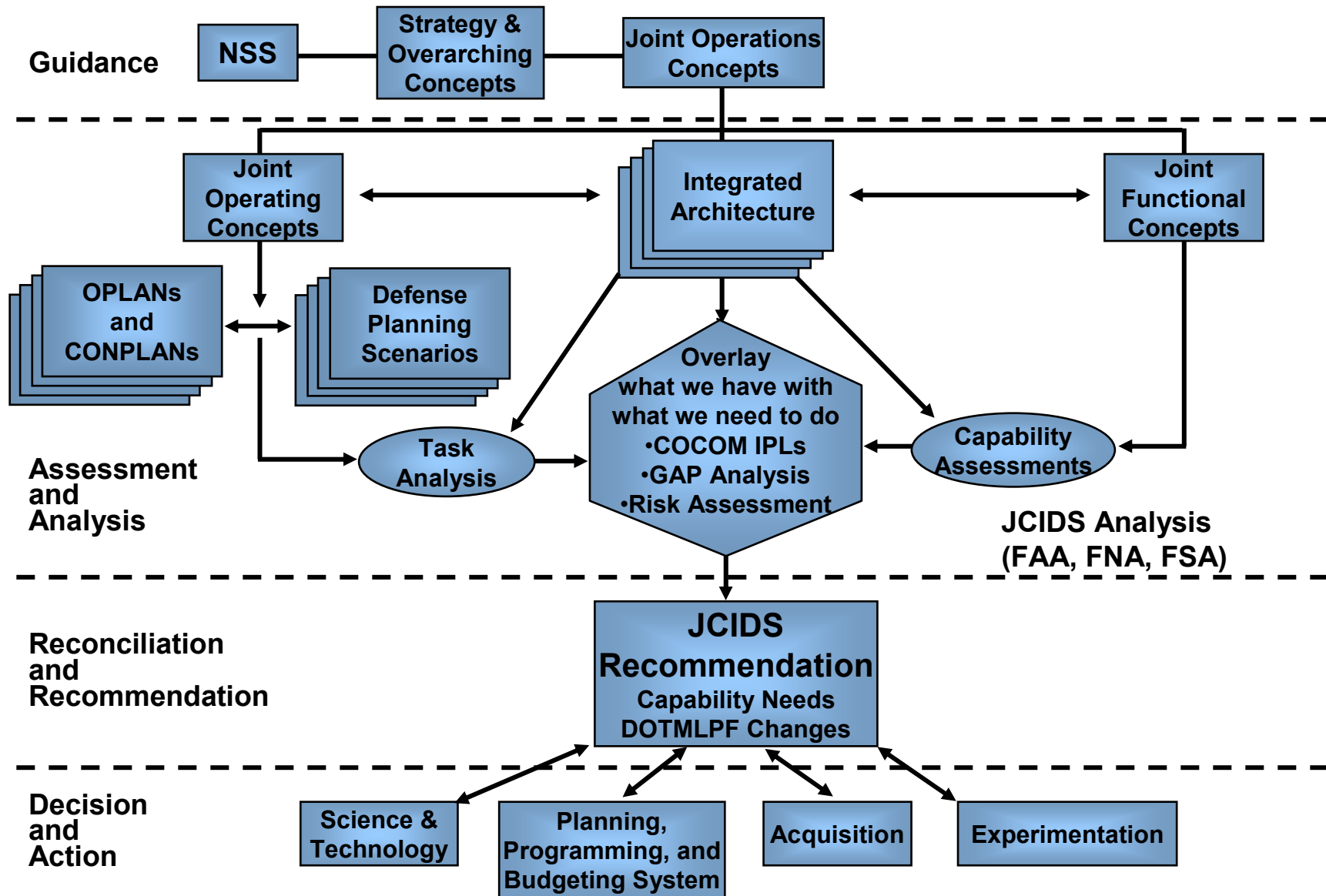
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# Definitions

**Joint Close Air Support (JCAS):** air action by fixed- and rotary-wing aircraft against hostile targets that are in close proximity to friendly forces and that require detailed integration of each air mission with the fire and movement of those forces. JP 3-09.3

**Joint Combat Identification (JCID):** the process of attaining an accurate characterization of unknown detected objects to the extent that high confidence, and timely application of military options and weapon resources can occur. CID is used for force posturing, command and control, situational awareness as well as shoot, no-shoot employment decisions. TA 6.5 (UJTL), JP 3-52, JP 3-56.1

# CJCSI 3170 (Signature Version)







**To ensure that the Department of Defense (DoD) has the test and evaluation (T&E) infrastructure required to develop, test, and evaluate the warfighting systems needed to prevail in increasingly complex battlefield environments R&R provides:**

- **Policy and oversight for the DoD T&E infrastructure (people, processes, and facilities);**
- **Investment for new DoD T&E infrastructure;**
- **Technical and resource information to assist DOT&E systems assessment; and**
- **Customer-friendly support services to the Services and to the Office of the Director of Operational Test and Evaluation.**

# JCAS/JCID Testing Requirements



Tasks and performance measures associated with the conduct and employment of JCAS/JCID

**DRC Analysis: JCAS Required Capability:** **Enable positive target identification** at all levels of visibility

**DRC Analysis: JCID Required Capability):** **Enable positive identification** of friend, foe, non-combatants and systems at all levels of visibility

**UJTL: OP Task 5.1.11** **Provide positive identification** of friendly forces within the JOA

**Performance Measures:** - Minutes to confirm identify

- % of positive ID false negatives (friendly identified as enemy)

- % of positive ID false positives (enemy identified as friendly)

**FCS: FCS Functional Capabilities:**

- **Provide combat ID** to detect, locate, and identify friend, foe, and noncombatant systems

- **Enable C2** to synchronize fire, maneuver and ISR

**AUTL: ART 7.3.2, Evaluate Situation or Operation:**

**Performance Measures:** - % of accurate friendly evaluations

- # of opportunities or threats recognized

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## Systems

[Create New](#)

Show

Acronym	Long Name	Live	Virtual	Constructive	Type	Description
<a href="#">5D</a>	Demand Driven Direct Digital Dissemination	Yes	No	No	Intelligence	5D is a se dissemina give image direct acc data receiv collections collected a
<a href="#">A2G</a>		Yes	No	No	[Not Applicable]	
<a href="#">AALPS</a>	Automated Aircraft Load Planning System	Yes	No	No	Command and Control	The Autom System (A based exp users in th planning a loads for a It ha ...
<a href="#">AARS</a>	Advanced Airborne Radar System	Yes	No	No	Surveillance and	The AARS

# Study Team Analysis of JCAS/JCID Testing Facilities



WRC Facilities	NTC, Ft Irwin, CA	Nellis AFB, NV	MCAG CC, 29 Palms, CA	Naval Station San Diego, CA	WSMR, NM
<b>Level 3 Required Capabilities</b>					
Enable Force Application	4	1	4	2	-1
Enable Force Protection	4	1	4	0	1
Enable Logistics Support	4	1	4	1	1
Develop & Maintain Battle Space Awareness via Common Operating Picture (COP)	4	-1	4	2	1
Enable development of integrated JCAS / ground maneuver plan	4	1	4	0	1
Enable Joint Close Air Support (JCAS) Command & Control (C2) needed to synchronize JCAS and ground maneuver	4	1	4	0	1
Enable rapid detection of friend, foe, non-combatants, and systems at all levels of visibility	-1	-1	-1	-1	1
Enable target location at all levels of visibility		-1	4	-1	1
Enable positive target identification at all levels of visibility	-1	-1	-1	-1	-1
Enable target designation at all levels of visibility	-1	-1	-1	1	-1
Request JCAS	1	1	1	1	1
Approve JCAS	1	1	1	1	1
Enable JCAS collaborative mission planning	-1	-1	-1	-1	-1
Enable taskings for Intelligence, Surveillance, reconnaissance (ISR) platforms	1	1	1	1	1
Provide task-organized, trained, and equipped teams to facilitate the coordination of air, artillery, and naval surface fires	0	0	0	0	-1
Enable information exchange via interoperable communications (visual / voice / digital)	-1	-1	-1	-1	-1
Enable collaborative mission rehearsal	-1	-1	-1	-1	-1
Provide JCAS aircraft	0	1	0	0	1
Enable Suppression of Enemy Air Defenses (SEAD) planning & execution	4	1	4	0	1
Provide task-organized, trained, and equipped teams to facilitate the terminal control of air, artillery, and naval surface fires	-1	1	-1	0	-1
Enable sensor to shooter linkages	1	1	1	1	1
Conduct JCAS attack	4	1	4	0	1
Scale effects to focus precisely in support of ground maneuver	-1	1	-1	0	-1
Enable JCAS Battle Damage Assessment (BDA)	4	1	4	0	1
Conduct air Intelligence, Surveillance, and Reconnaissance (ISR)	4	1	4	1	1
Enable national and theater signals intelligence (SIGINT) integration	7	-1	-1	1	-1
Develop and maintain battle space awareness via Common Operating Picture (COP)	4	-1	4	2	1
Detect and report Close Air Support (CAS) targets and formations	4	1	4	0	1
Enable real-time information exchange via interoperable communications (visual / voice / digital)	-1	-1	-1	-1	-1
Enable collaborative mission planning	-1	-1	-1	-1	-1
Enable collaborative mission rehearsal	-1	-1	-1	-1	-1
Enable combat detection of friend, foe, non-combatants and systems at all levels of visibility	-1	-1	-1	-1	1
Rapid initial "target detection to positive identification"	-1	-1	-1	-1	-1
Enable positive shooter identification of friend, foe, non-combatants and systems at all levels of visibility	-1	-1	-1	1	-1
Enable integration of Unmanned Aerial Vehicle (UAV) ISR for Positive Hostile ID (PHID)	1	-1	1	1	1
Enable sensor to shooter linkages	1	1	1	1	1
Conduct forward area Command and Control (C2) of aircraft	1	-1	1	-1	-1
Enable AWACS / E2C aircraft handoff to Forward Area Controller (FAC) and Joint Terminal Attack Controller (JTAC)	1	1	1	1	-1
Provide Battle Damage Assessment (BDA)	4	1	4	-1	1

All values are NOTIONAL

0 = Null
1 = Live
2 = Live and Virtual
3 = Live, Virtual, and Constructive
4 = Live and Constructive
5 = Virtual
6 = Virtual and Constructive
7 = Constructive
-1 = Unknown

# Challenge

- Employment of
  - Precision Engagement,
  - Net-Centric Warfare, and
  - Un-Manned Combat Platforms
- To Defeat Conventional and Unconventional Warfare Opponents
  - With Time/Location Sensitive Exposure,
  - In Population Centers and Cultural Landmarks, and
  - In Complex Physical Environments
- Introduces Critical Joint, Service, and Agency Interdependences within and across Warfare Areas.

# Approach

- The Missions and Means Framework evaluates alternative families of DOTMLPF solutions to these complex issues using:
  - Top-Down Decomposition to Identify Interdependencies,
  - Execution/Adjudication to Determine Capabilities/Limitations,
  - Bottom-Up Effects Traceability to Determine Mission Impact, and
  - Planning/Re-Planning to Adapt Behavior to Warfare Outcomes.

# Relationship to T&E

- Top-Down Decomposition to Identify Interdependencies
  - Determines what needs to be represented, how well.
  - Prioritizes what needs to be measured, with what fidelity
- Execution/Adjudication to Determine Capabilities/Limitations
  - Provides the Operational Context for measurement and assessment.
- Bottom-Up Effects Traceability to Determine Mission Impact
  - Links cause and effect to establish “So What?”
- Planning/Re-Planning to Adapt Behavior to Warfare Outcomes.
  - Links the Art of War to the Science of Test & Evaluation by providing and Objective Structure for stating the Subjective Military Judgments.

# Sample Army Task Set Applied to OT Model

