Application of Mission Level System Engineering Concepts in the Support of Major Acquisition Programs

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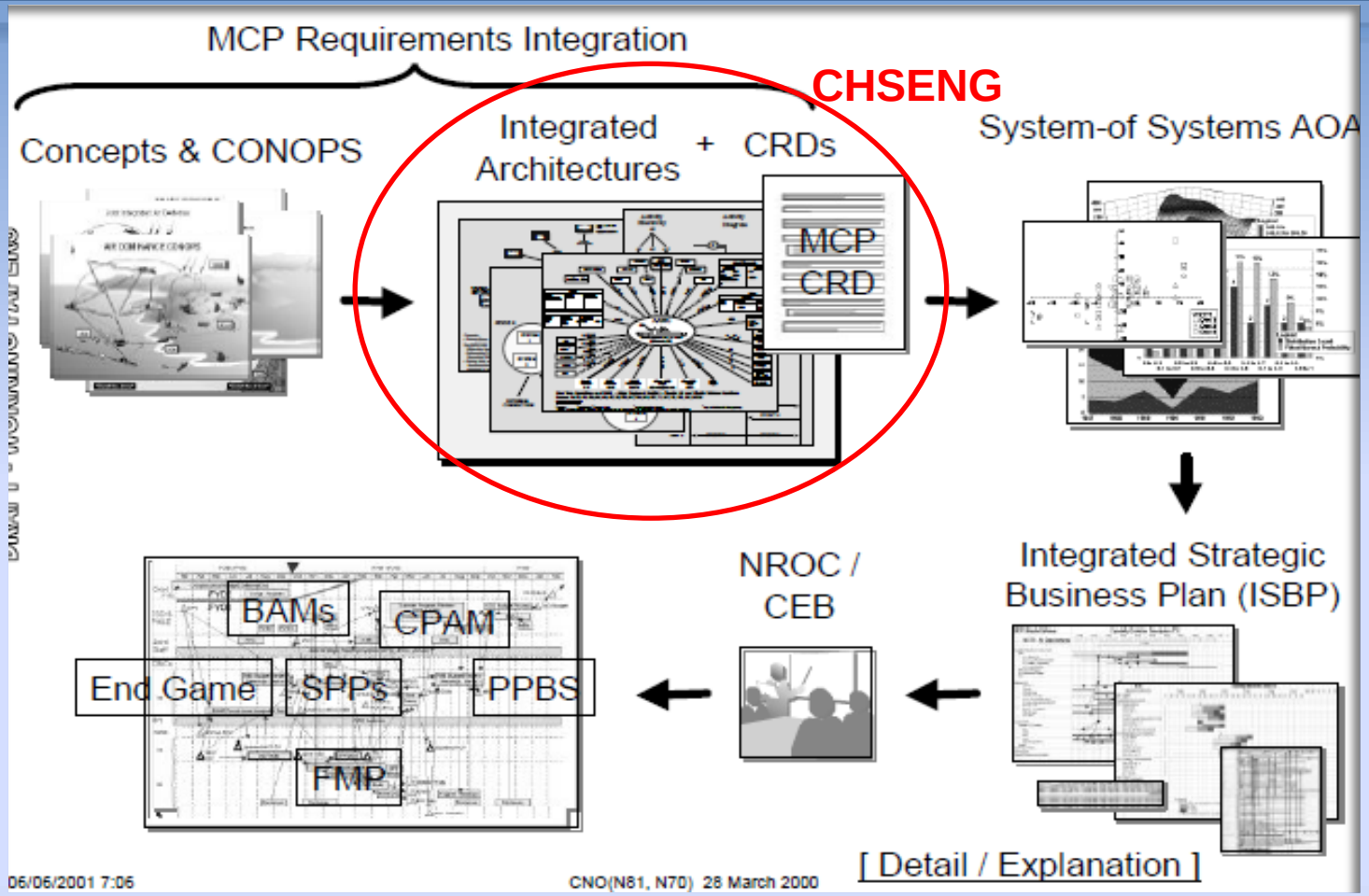
Presented to:
NDIA Annual SE Conference

October 27, 2011

Mission Engineering at CHSENG

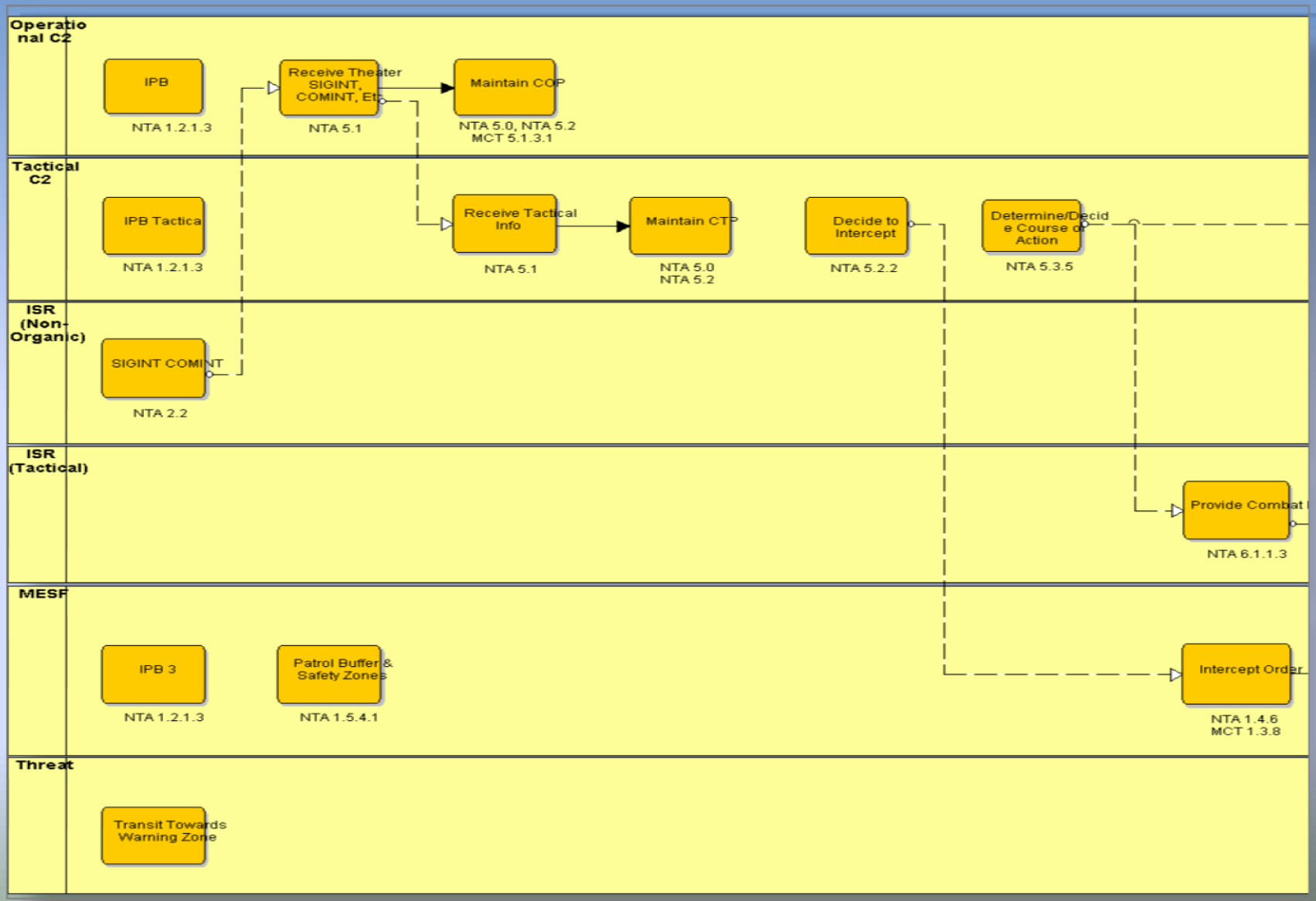
- DASN (RDTE) applies approximately $4M a year directly to the implementation of Mission Engineering
- Nearly all of this money goes to the various Warfare Centers to support Mission Thread development using the DoDAF framework.
- We ensure we are congruent with the efforts of the Joint Mission Thread team, the DoN EA team, and with M&S initiatives as funded by Navy Modeling and Simulation office.

Key Elements of the MCP Planning Process

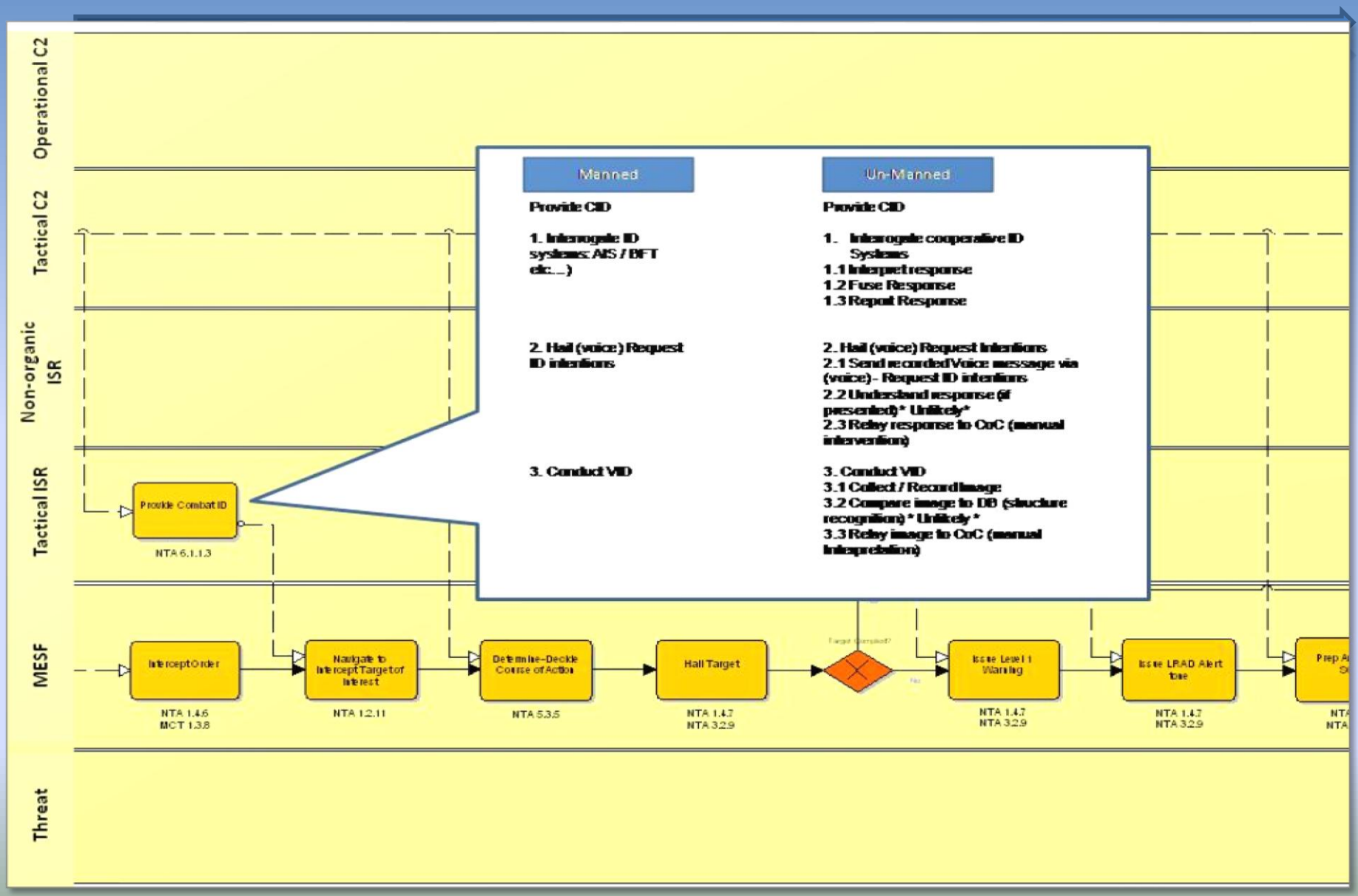


Since 2001- CHSENG has been trying to implement the Mission Capability Package Planning Process

UXS CFT Mission Thread for Trident Warrior 11



Functional Decomposition



Metrics to Support Data Collection

Capability Evolution of AMN in Trident Warrior (TW)

TW 09	TW 10	TW 11
Single USV autonomy	Two USVs - Cooperative autonomy	Two USVs – Cooperative and Sliding autonomy
Preset mission behaviors	Preset mission behaviors	Preset mission behaviors with operator interface to allow "on the fly" mission modifications
UNCLAS COP MDA DS COI (publish and subscribe)	UNCLAS COP – APAN (coalition) Classified Tactical Picture – Link 16	Link 16 classified CTP
Special built USV	Converted Fleet 11M RHIB to autonomous USV	Any mix of USVs
C2: operational level, MOC	C2: tactical level, expeditionary C2	C2: tactical level, expeditionary C2
Missions: Riverine patrol and Port Security	Missions: HVU escort, Fixed Oparea / Expeditionary Base Force Protection	Missions: SPOD / GOPLAT Force Protection w/ non-lethal weapons
Comms: cell phone modem	Comms: Navy tactical LOS mesh radios	Comms: Navy tactical LOS mesh radios with extended range using UAS comms relay
AIS receive only on USV	AIS transceiver; extend AIS as AIS relay for ships at sea	AIS transceiver; extend AIS and EO for Combat ID
No common controller	No common controller	Common Payload Controller and Vehicle Controller

METRICS
percent of cooperative unmanned vehicle communications that resulted in intended vehicle actions
percent of successful USV maneuvers to unplanned waypoint after receiving the on the fly message
number of packets sent vs number of packets received intact
All of the above metrics
percent of units are in communication with commander throughout planning and execution.
Number of Friendly branches/sequels formerly closed (not feasible or acceptable) become feasible or acceptable due to friendly nonlethal engagements.
range of comms via UAS relay
number of AIS packets sent vs number of packets received intact
ratio: number of launches executed/number of launches requested

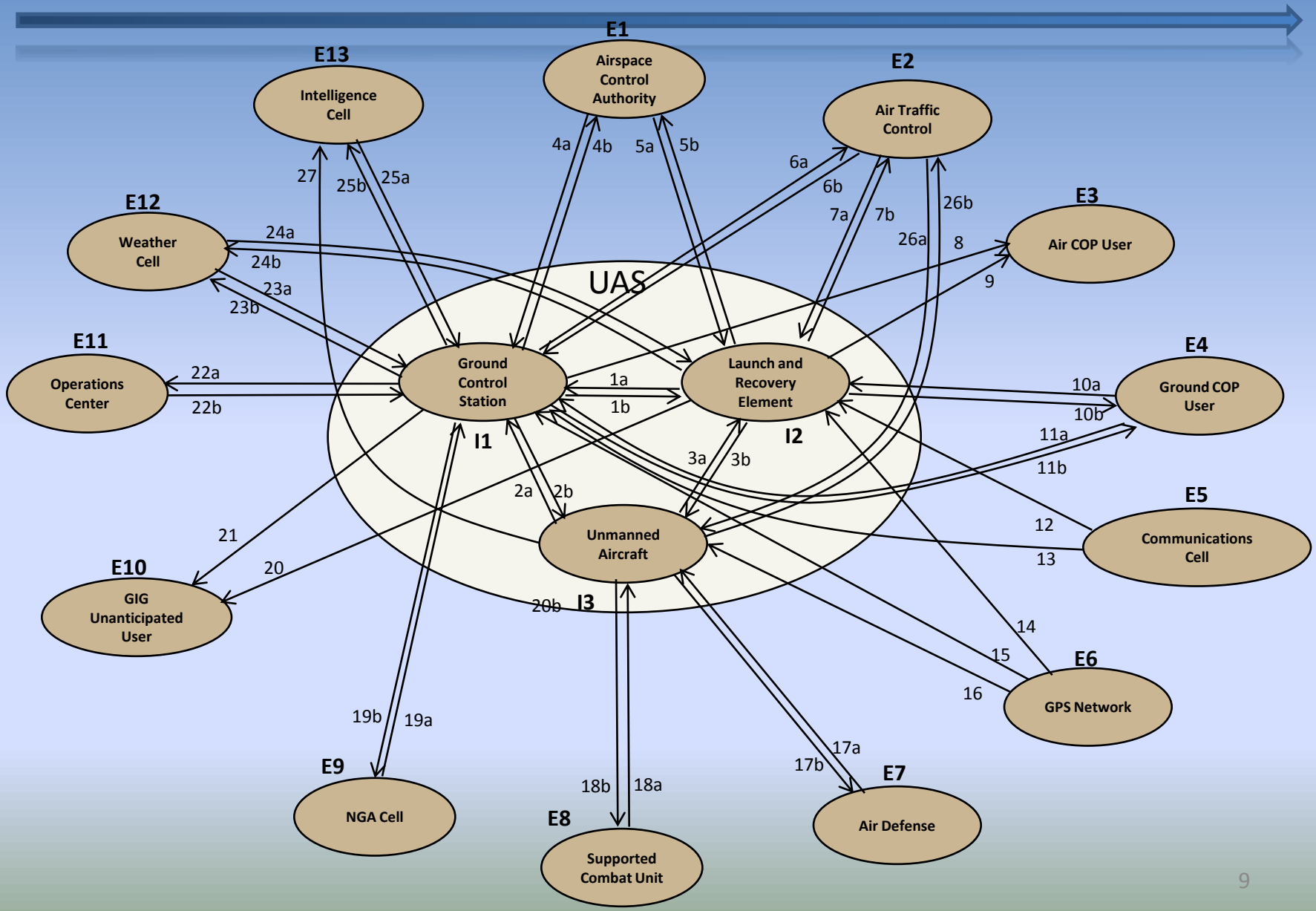
What the team learned from this process

- TW 11 Mission Thread
  - Potential to provide earlier threat alert 24/7
  - Unmanned vehicles likely need a lethal weapon to provide a continuum of timely responses
  - Significant impact to current Rules of Engagement and Tactics,Techniques, Procedures
  - USV Self-protect and anti-tamper considerations
  - We need NTA's (Universal Naval Task List) written specifically for unmanned vehicles because the manned vehicles NTA's didn't provide the right metrics

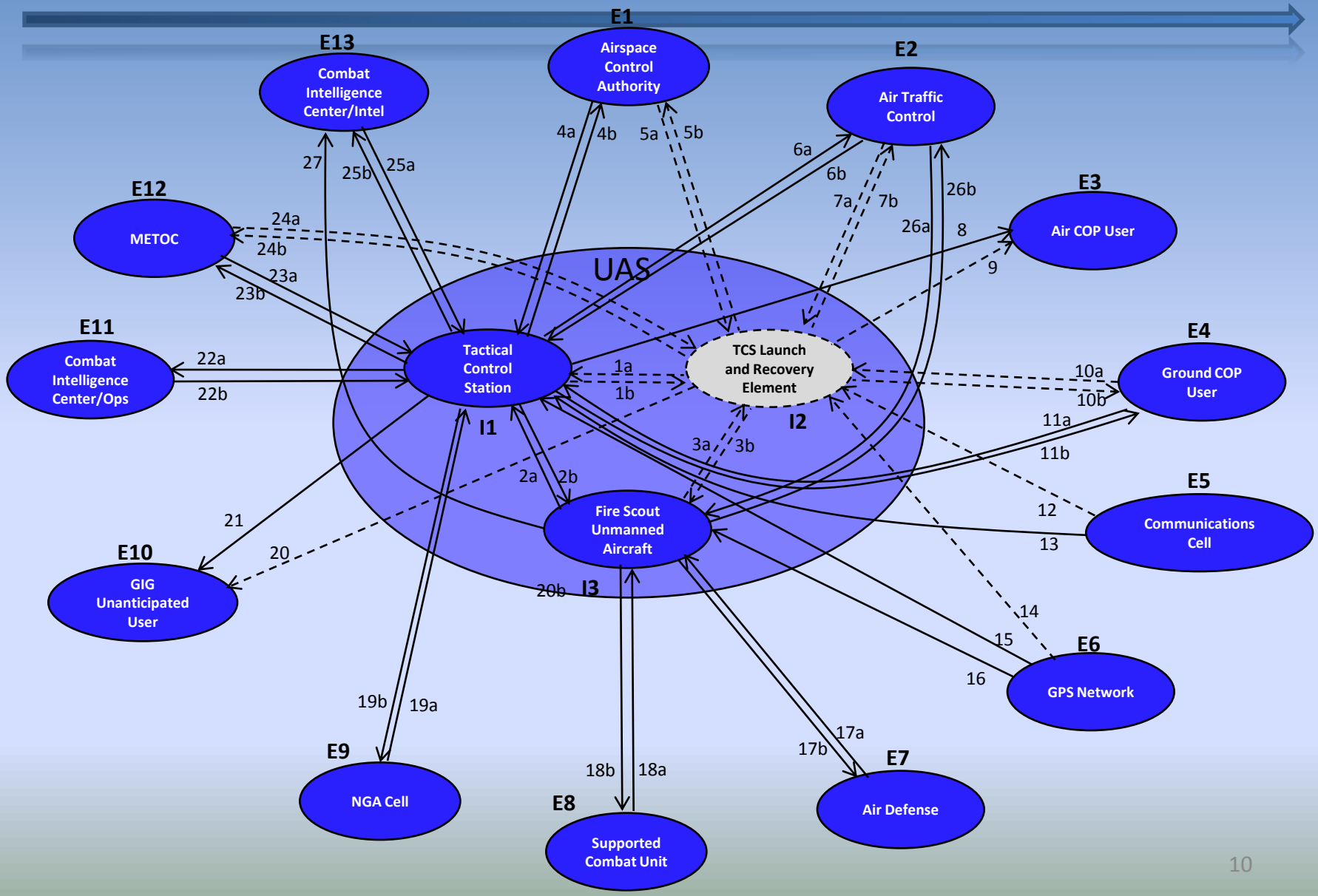
Operational Nodes- A View Across UAS

Generic	Ground Control Station (GCS)	Launch and Recovery element (LRE)	Unmanned Aircraft	Operation Center	Intelligence Cell	Airspace Control Authority	Air Traffic Control	Weather Cell	Supported Combat Unit	GPS Network	Air COP Users	Ground COP Users	GIG Unanticipated Users
USAF Global Hawk	Global Hawk MCE	Global Hawk LRE	Global Hawk Unmanned Aircraft	Global Hawk Operations Center	DCGS-AF	GHOC/ CAOC	Air Traffic Control	Weather Cell	Supported Combat Unit	GPS Network	Air COP Users		GIG Unanticipated Users
USAF Reaper	Reaper GCS	Reaper LRE	Reaper Unmanned Aircraft	Squadron Operations Center	DCGS-AF	SOC/ CAOC	Air Traffic Control	Weather Cell	Supported Combat Unit	GPS Network	Air COP Users		GIG Unanticipated Users
USAF Predator	Predator GCS	Predator LRE	Predator Unmanned Aircraft	Squadron Operations Center	DCGS-AF	SOC/ CAOC	Air Traffic Control	Weather Cell	Supported Combat Unit	GPS Network	Air COP Users		GIG Unanticipated Users
USN Fire Scout	Fire Scout GCS		Fire Scout Unmanned Aircraft	Combat Info Center	Combat Info Center	Airspace Control Authority	Air Traffic Control	METOC	Supported Combat Unit	GPS Network	Air COP Users		GIG Unanticipated Users
USA Gray Eagle	Gray Eagle GCS	Gray Eagle LRE	Gray Eagle Unmanned Aircraft	Division Tactical Operations Center	Division Tactical Exploit System	AC2 Cell	Air Traffic Control	Weather Cell	Supported Combat Unit	GPS Network	Air COP Users	Ground COP Users	GIG Unanticipated Users
USA Shadow	Shadow GCS	Shadow LRE	Shadow Unmanned Aircraft	Brigade Tactical Operations Center	Brigade S-2	ADAM/ BAE Cell	Air Traffic Control	Weather Cell	Supported Combat Unit	GPS Network		Ground COP Users	GIG Unanticipated Users
USMC Shadow	Shadow GCS	Shadow LRE	Shadow Unmanned Aircraft	Combat Operations Center	?	Combat Operations Center	Air Traffic Control	Weather Cell	Supported Combat Unit	GPS Network		Ground COP Users	GIG Unanticipated Users
USMC Raven	Handheld GCS		Raven Unmanned Aircraft	Platoon/ Company HQ	Platoon/ Company HQ	Cell/COC	Air Traffic Control	Weather Cell	Supported Combat Unit	GPS Network			
USA Raven	Handheld GCS		Raven Unmanned Aircraft	Platoon/ Company HQ	Platoon/ Company HQ	ADAM/ BAE	ADAM/ BAE	Weather Cell	Supported Combat Unit	GPS Network			

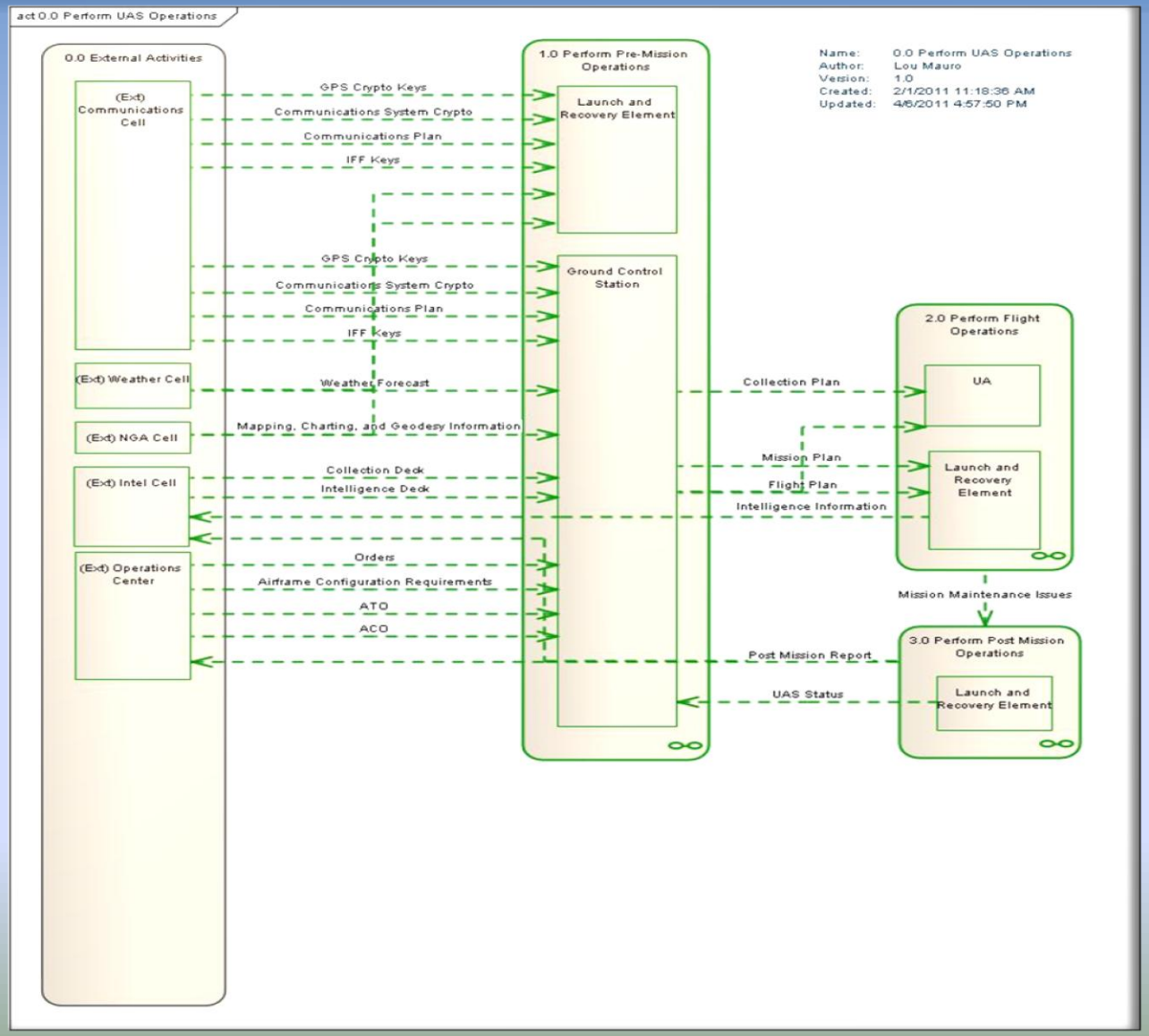
Generic OV-2 For UAS



Generic OV2 applied to Navy Fire Scout



OV-5B for Generic UAS Operations



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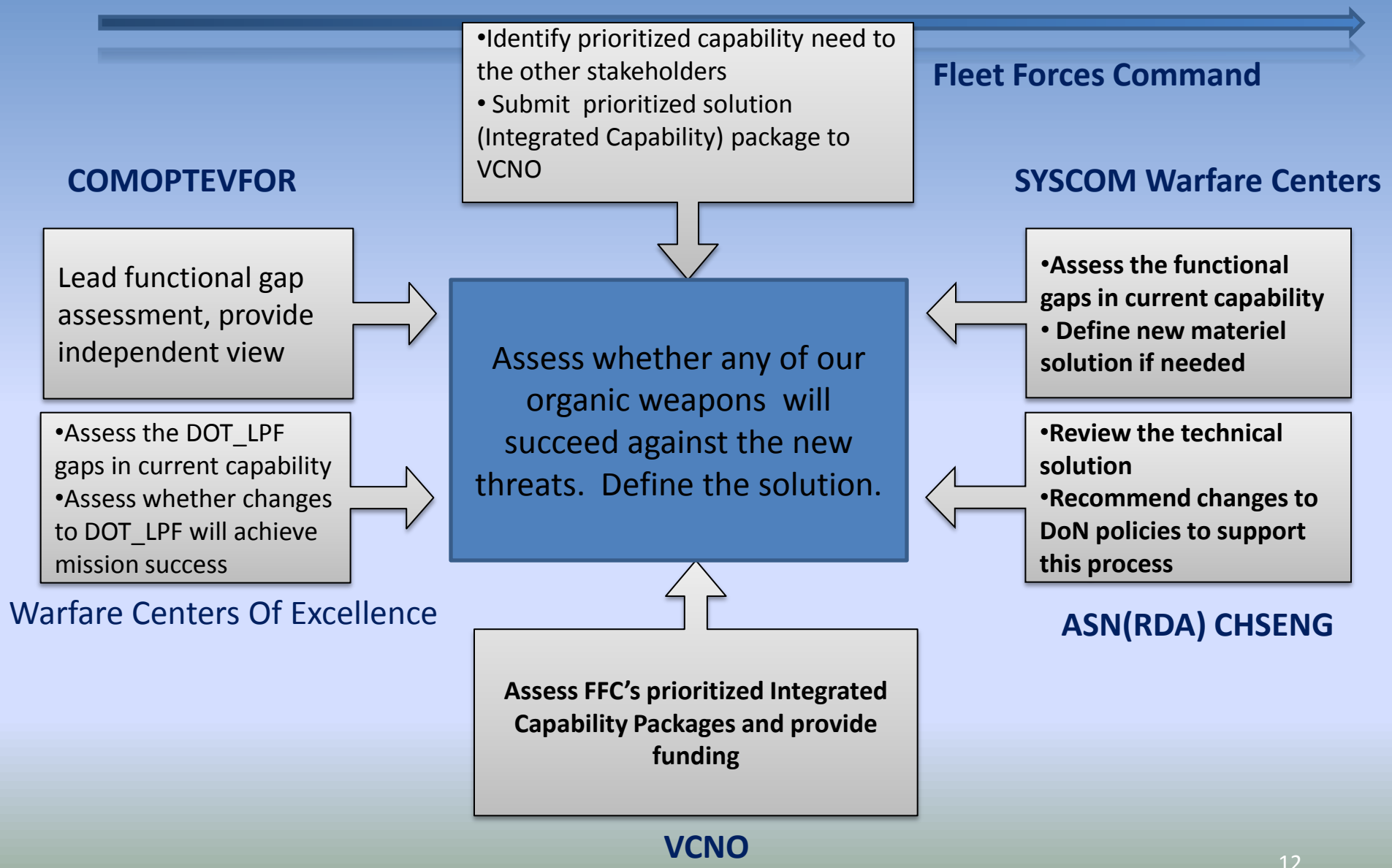

Reducing the Babel

- Mission threads should be able to be utilized by the Systems Engineering community to define performance requirements, the T&E community to create test procedures, the training community to evaluate sailor performance, and the SoS community to define the synergy of the SoS.
- A very important element for achieving this utility is the use of common syntax and semantics.
- Threads are being developed right now that are not using common syntax and semantics, which is resulting in the inability to interface these threads with other threads.
- Common syntax and semantics is available on the DoN EA wiki site https://www.intelink.gov/wiki/DONEA
  - Common Operational Activity List
  - Joint Common System Function List
  - Common System List
  - Common Performer List
  - Universal Naval Task List
  - Universal Joint Task List