



PEO IWS & PEO C4I Vision Brief

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Combat System (CS) and Command & Control (C2) Systems are Not Currently Well Integrated



- Combat system interface to GCCS-M is currently defined by a point-to-point fixed message interface (WS 19702/1)
 - Difficult to change on Aegis platforms
 - Interface never implemented on SSDS platforms
- Very limited set of data is provided
 - Filtered subset of combat system tracks and COP tracks
 - Ability for operators to remotely log into GCCS-M applications
 - Never implemented ability to access reference databases



Objectives of Presentation

- Describe the vision we have for integrating combat system and C4I systems, services and data in a seamless architecture
 - Maximize information transparency between applications running on combat systems networks and those on C4I networks
 - Minimize application design complexity by defining interoperable middleware services in each domain
 - Integrated information assurance-in-depth architecture
- Explain how sharing data and services between CS and C2 applications can reduce timelines for plan-do-assess-replan cycle and allow operators to exploit available data to achieve new capabilities



Outline of Presentation



- **Warfighting/Operational Vision**
- **Integrated Architecture Vision**
- **Extending the CS-C2
Integrated Architecture Vision**
- **Summary**



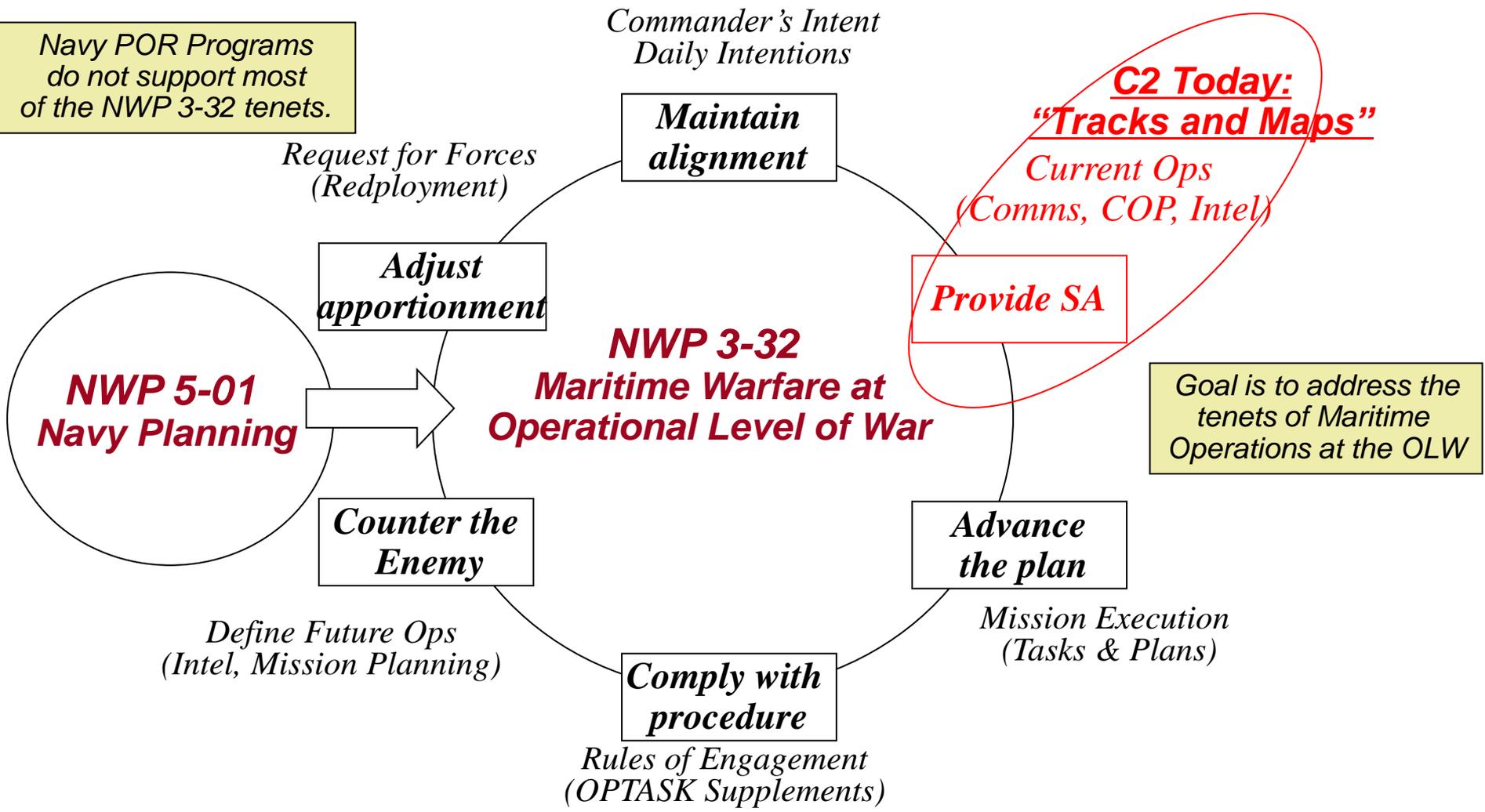
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Maritime C2: Where are we now?

Navy POR Programs do not support most of the NWP 3-32 tenets.



COMMANDERS DEMAND EXPANSION OF THE RANGE OF C2 TOOLS

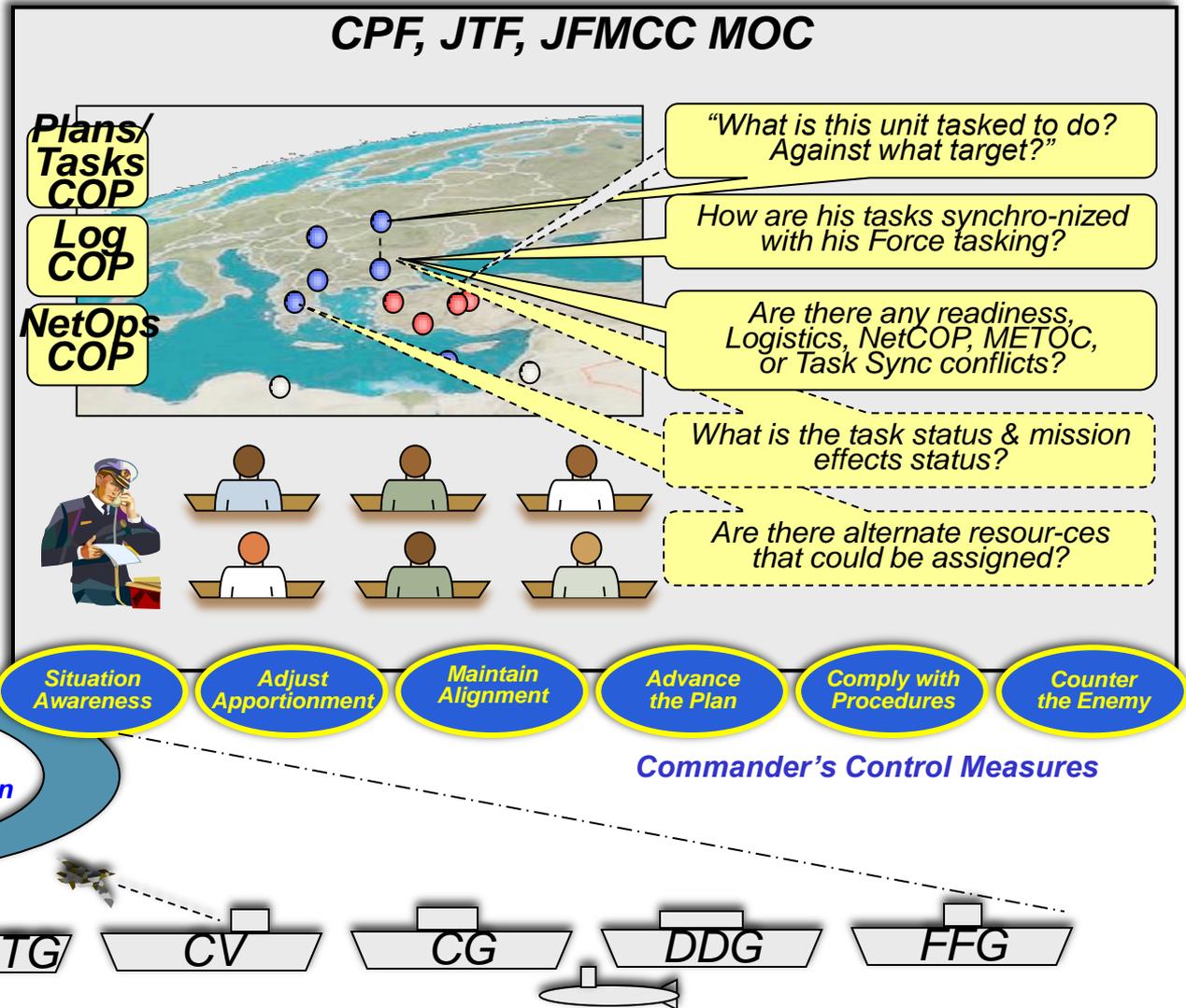
Synchronizing the World of Maritime C2

C2 Objective

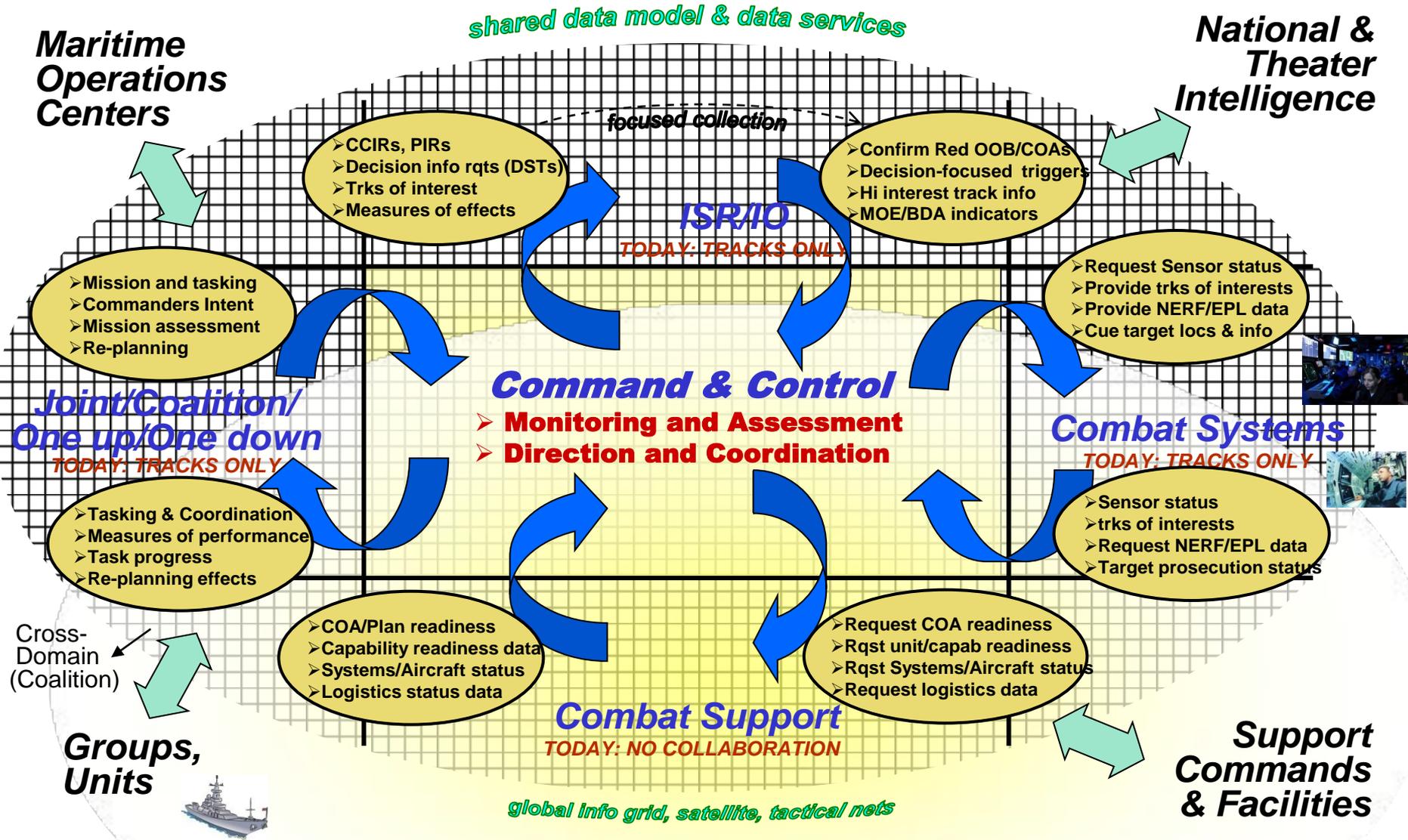
- Produce a shared situation display that includes not just force/unit locations but force/unit tasks, task status, and progress toward achieving overall objectives.

... or, in other words, ...

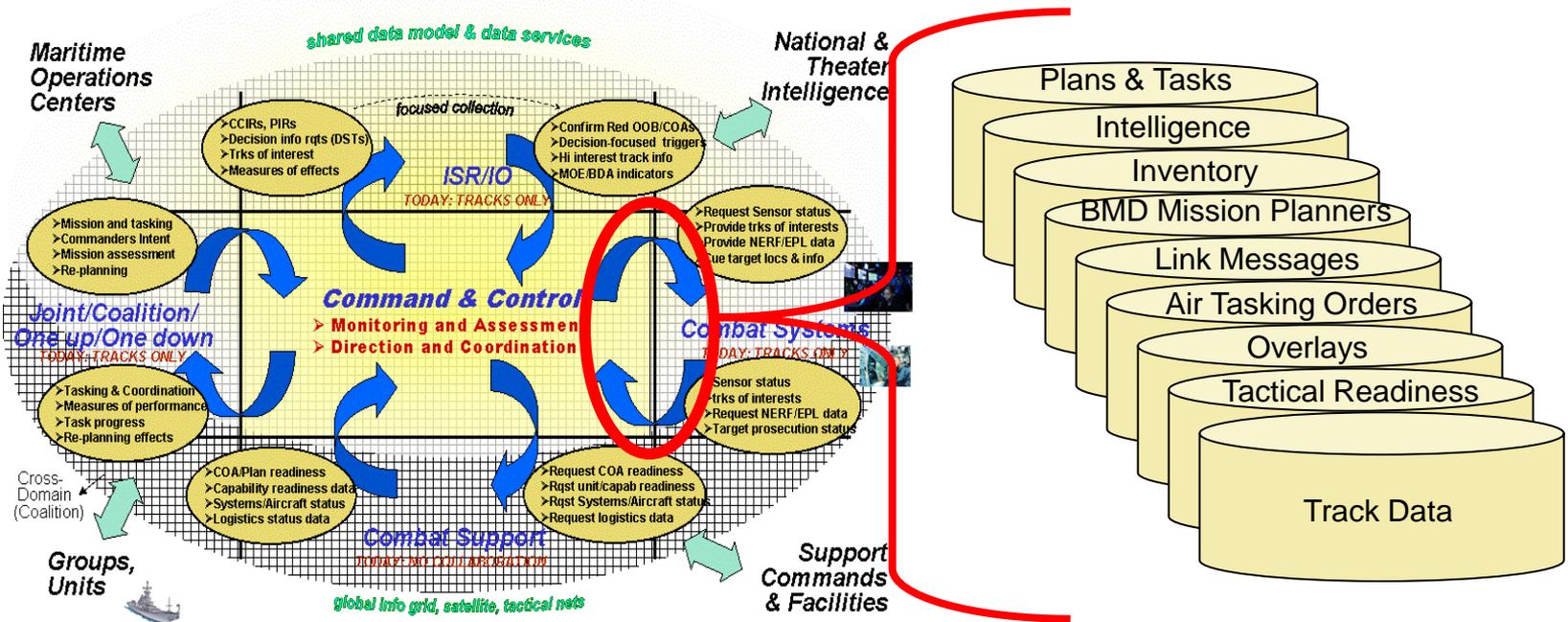
- Move our Maritime C2 systems from “Who, & Where?” to “Who, What, When, Where, Why, & How?”



Establish C2 Relationships and Strategy for Deployment of Capabilities

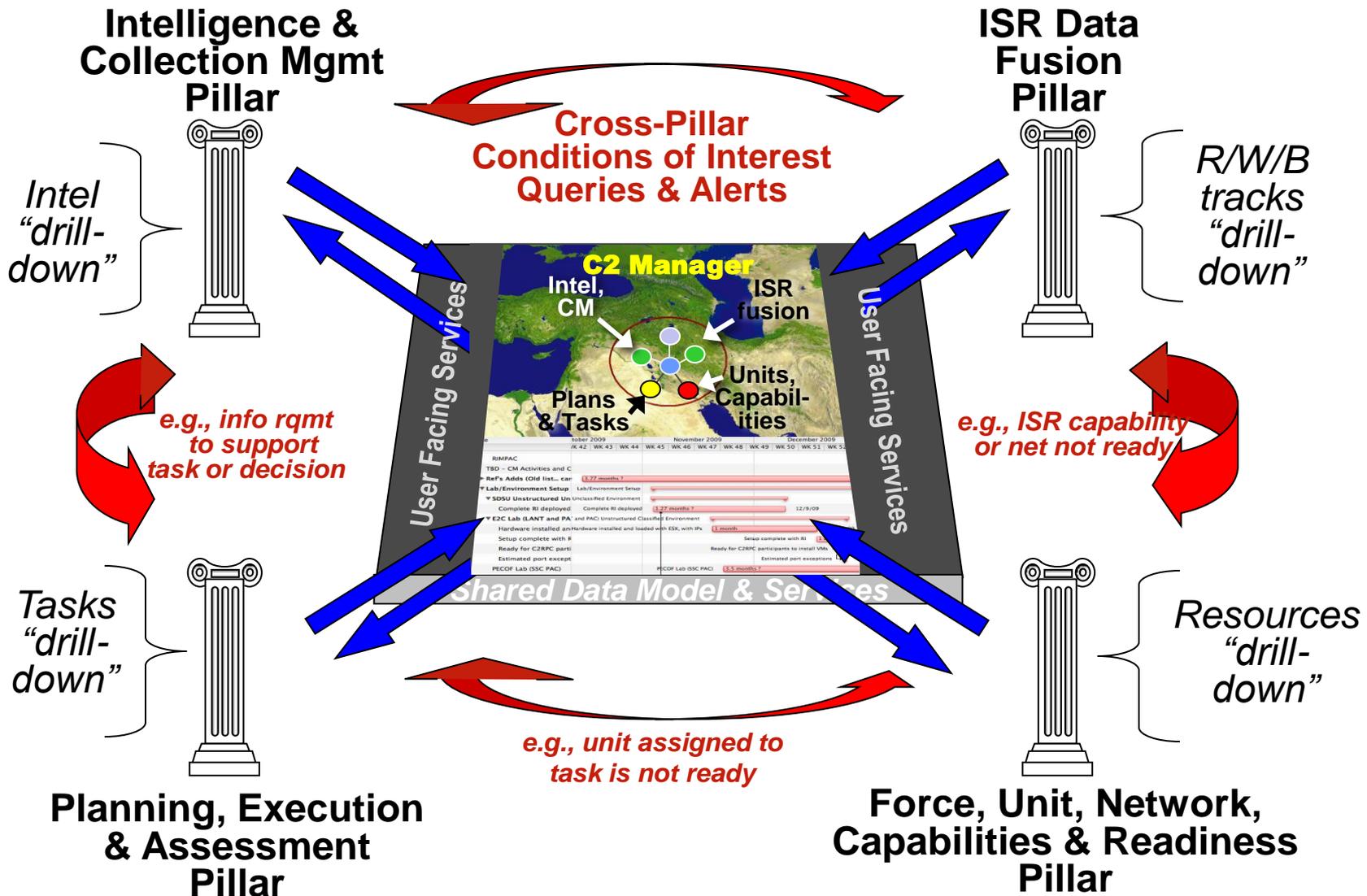


C2/CS Envisioned Relationship

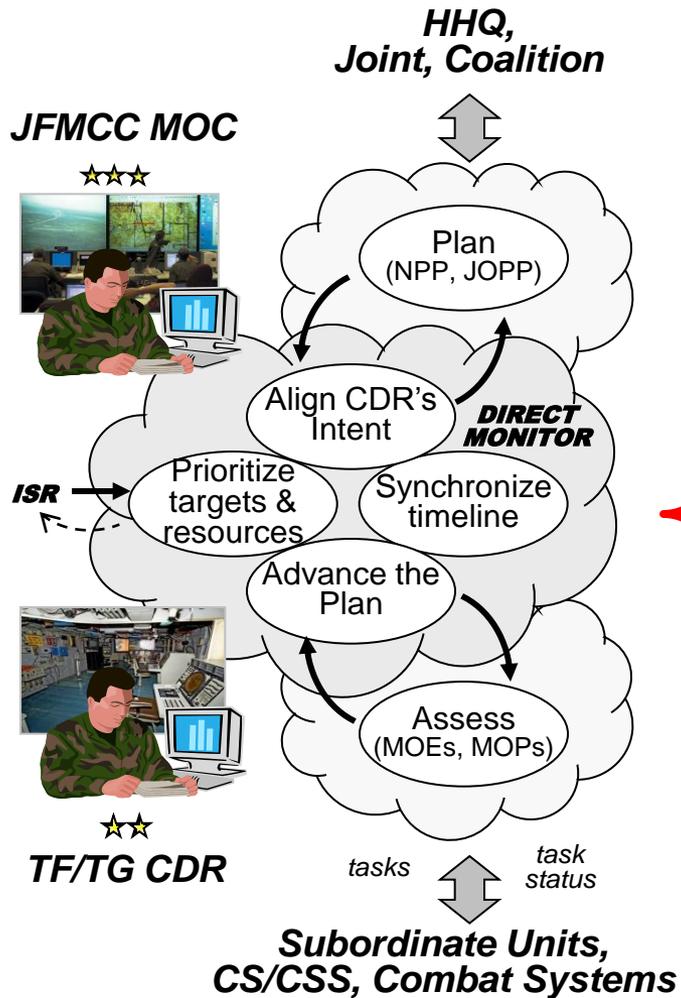


PMW 150 is developing a C2 Architecture Description Document (ADD) to serve as the same functionality as IWS ADD

Functional Pillars of Maritime C2

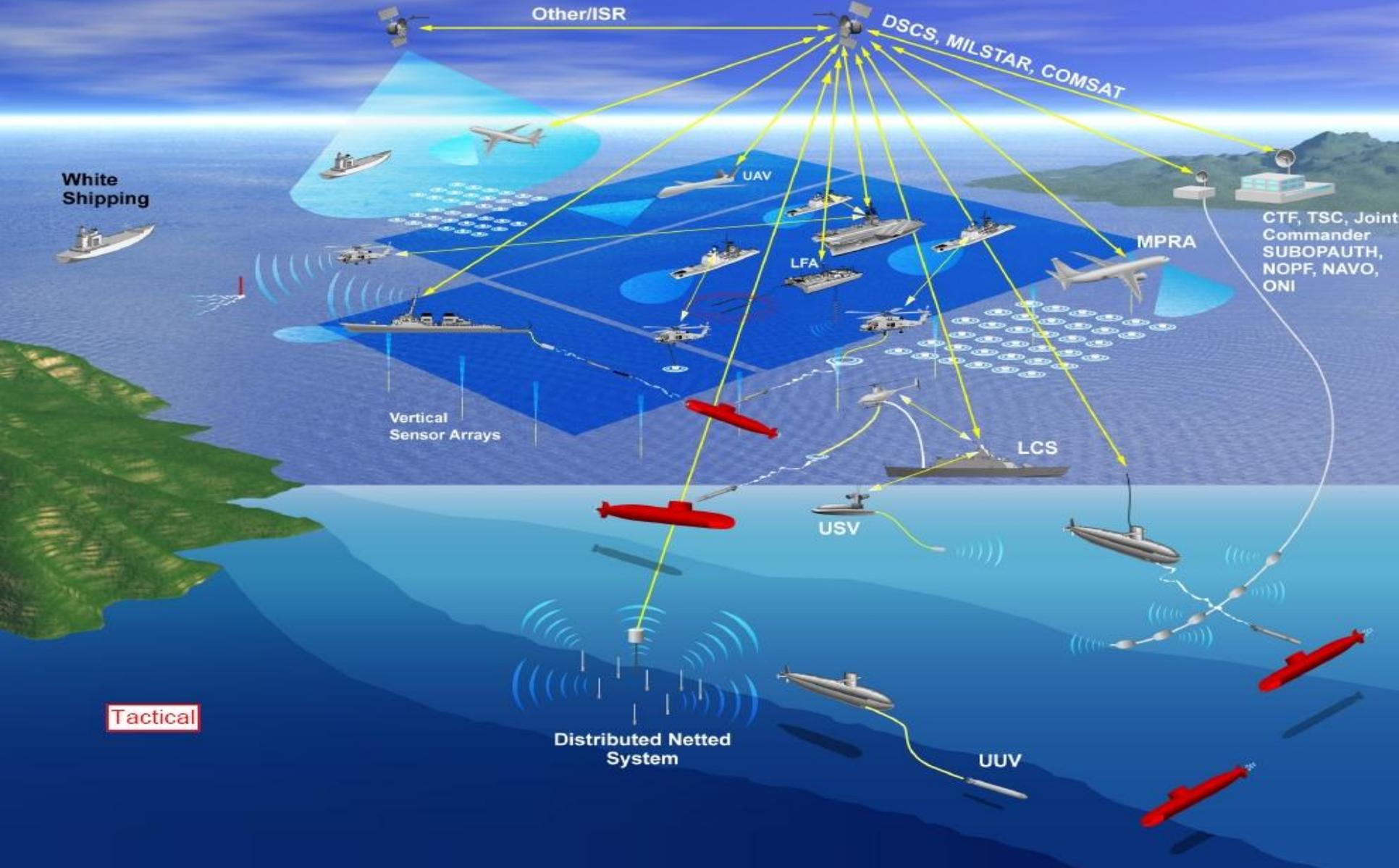


Unifying Maritime Missions into a Navy Mission Planner View



- Ballistic Missile Defense
- Intelligence Collection
- Maritime Interdiction Operations (MIO)
 - Law Enforcement Operations
 - Visit, Board, Search and Seizure
 - Blockade
- UnderSea Warfare (USW)
 - Anti-Submarine Warfare (ASW)
- Mine Warfare (MIW)
 - Mine Hunting
 - Mine Clearance
 - Offensive Mining
- Anti-Surface Warfare (ASUW)
- Amphibious Operations
- Strike Operations Cruise missile
 - Manned Aircraft
 - Naval Fires
- Humanitarian Assistance / Disaster Relief (HA/DR)
 - Non-combatant Evacuation Operations (NEO)
- Protection of Shipping at Sea / Freedom of Navigation

OV-1 High Level Operational Concept



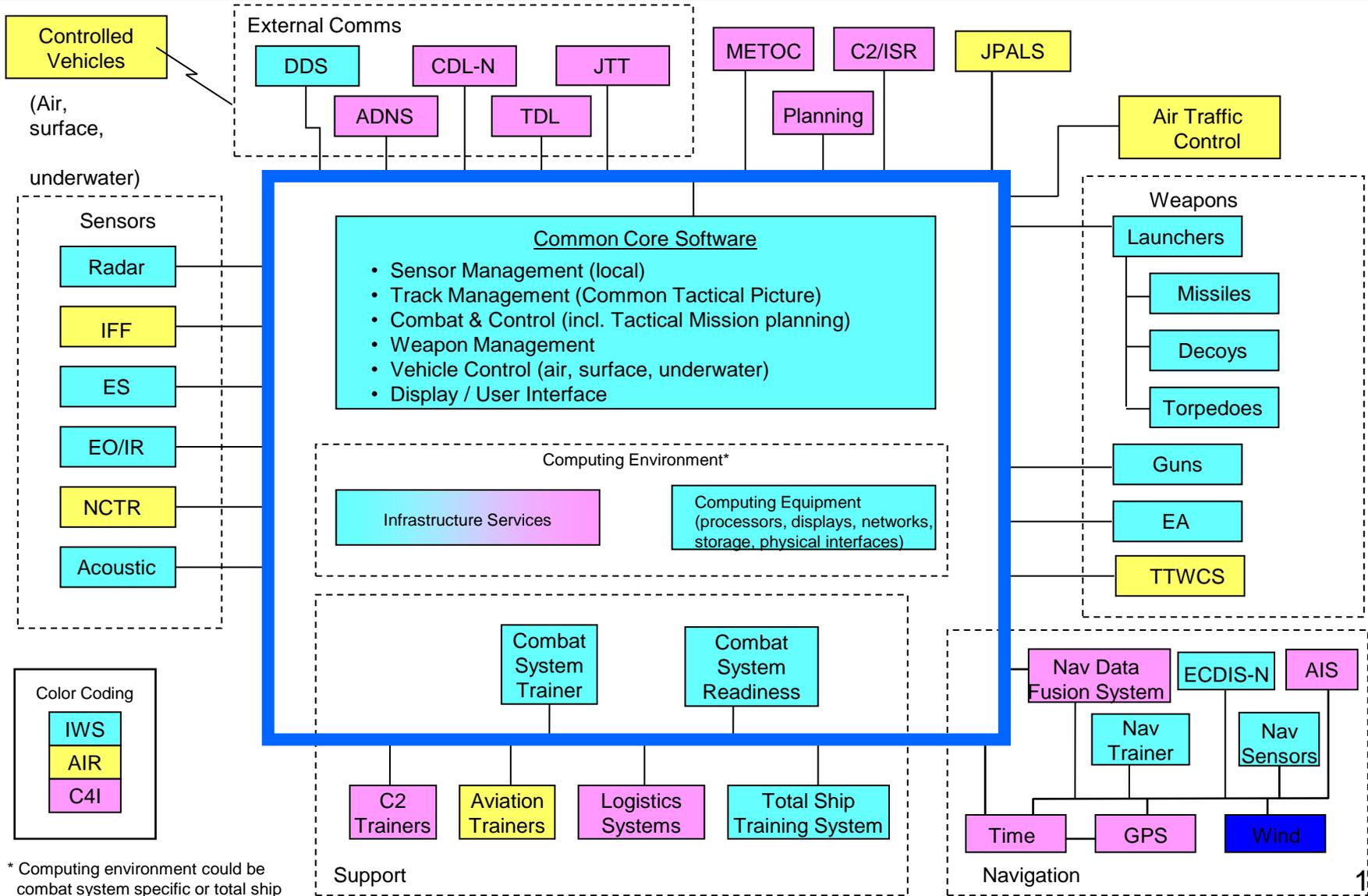


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Surface Combat System Network-Based Architecture

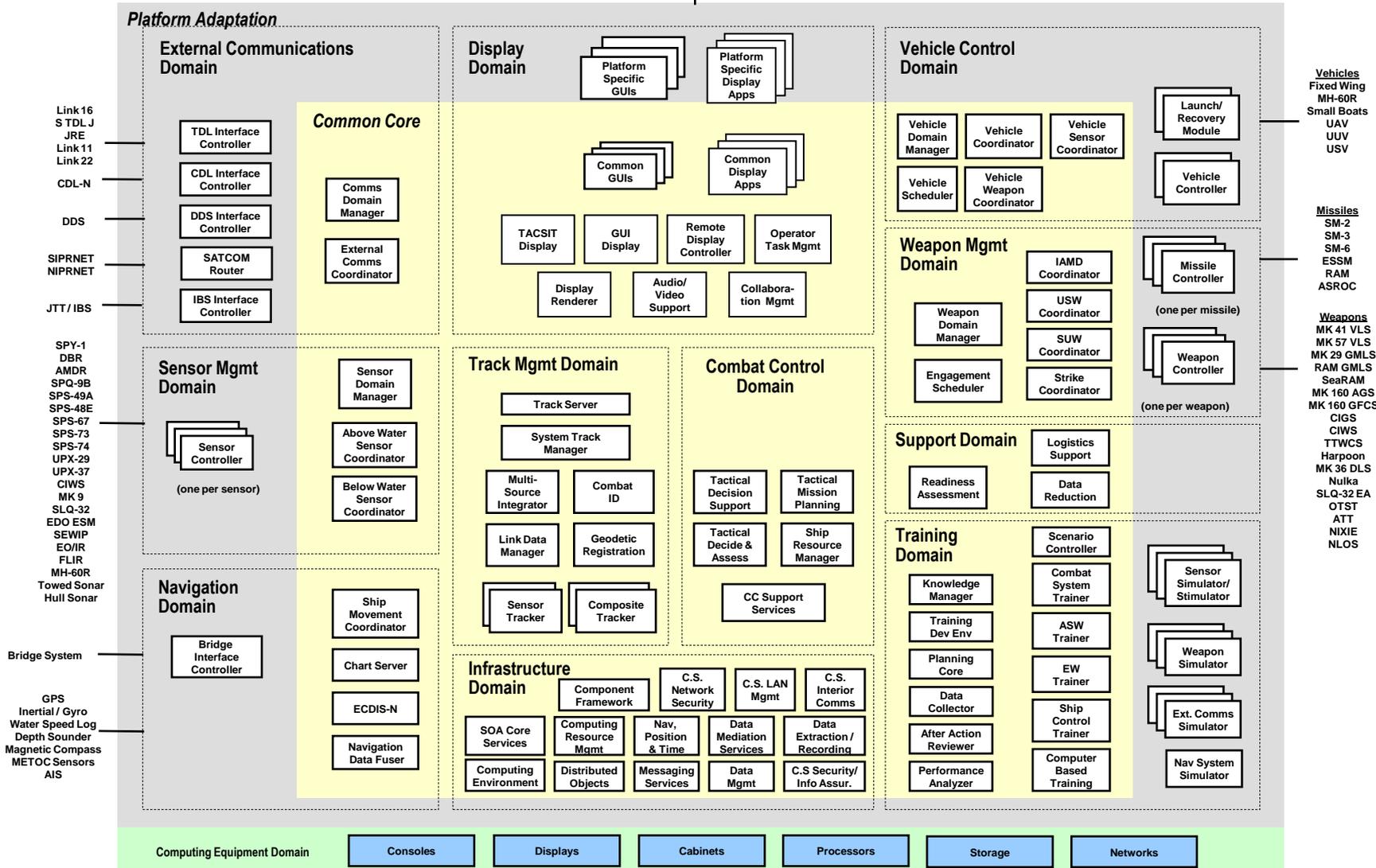




Surface Combat System Top Level Objective Architecture

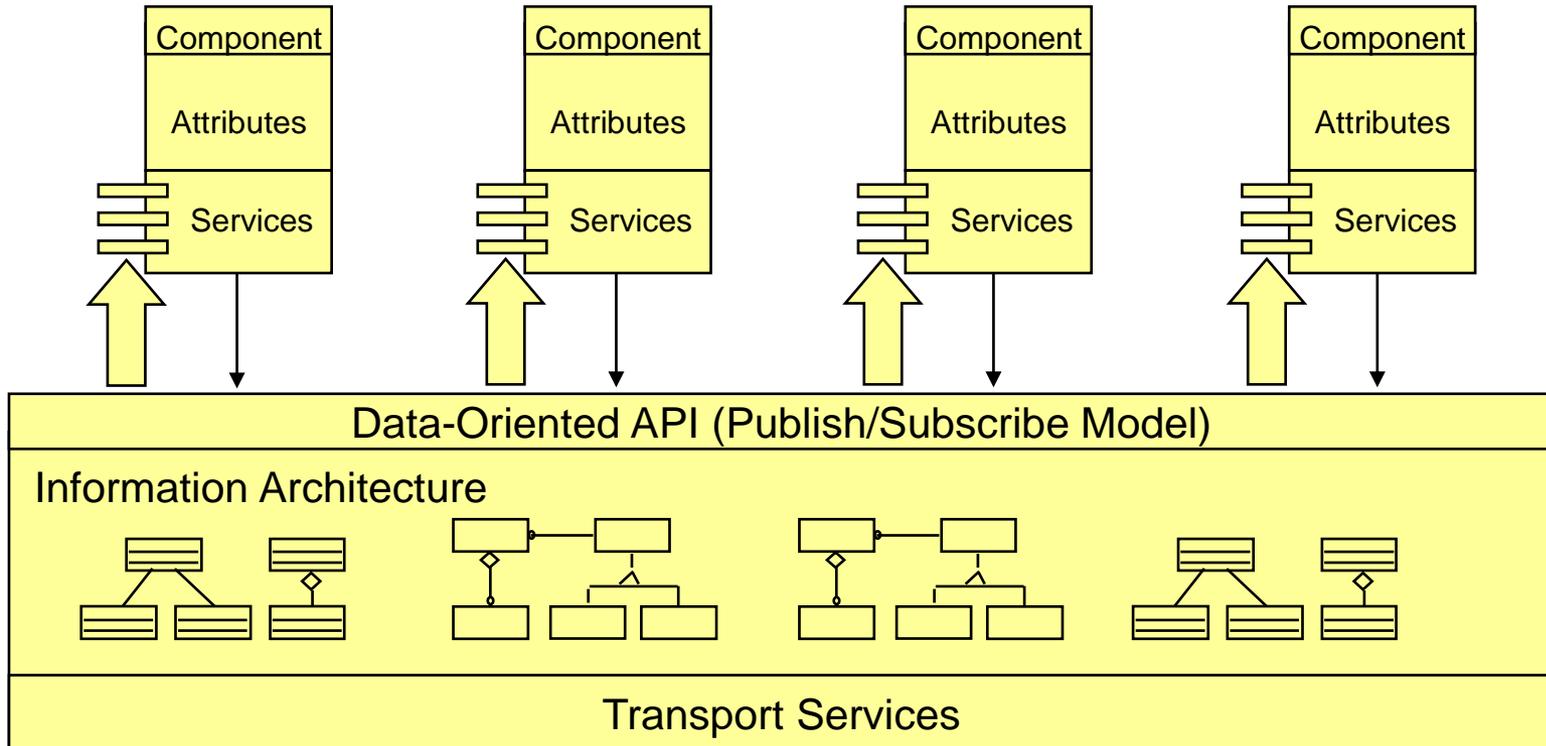


Operational Command & Control
GCCS, NECC, NCCT



Information-Oriented Architecture Is Key to Defining Reusable, Extensible Components

- Define a common data model and information standard
- Component-to-network interfaces, not component-to-component
- Component interfaces are coordinated* and authenticated**
- Expose information and post for any authorized subscriber to access
- Producers of information don't have to be aware of consumers



*Coordinated = fully-specified IDD, Gov't CM via ICWG

**Authenticated = interface compliance test before acceptance 16



How C2, ISR Systems Are Built Today & How They Can be Built In The Future



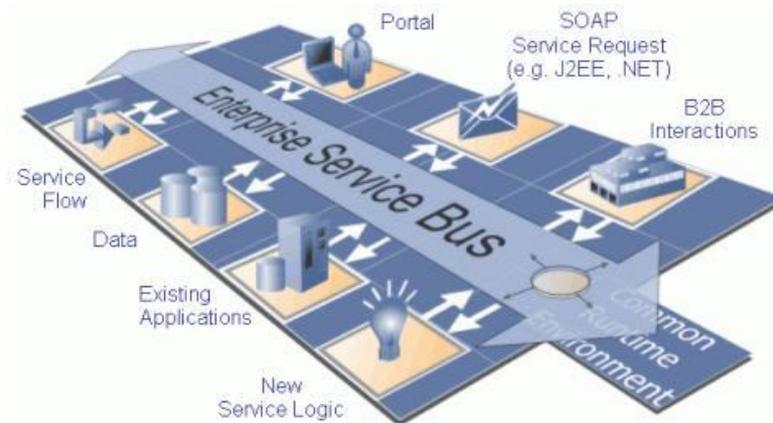
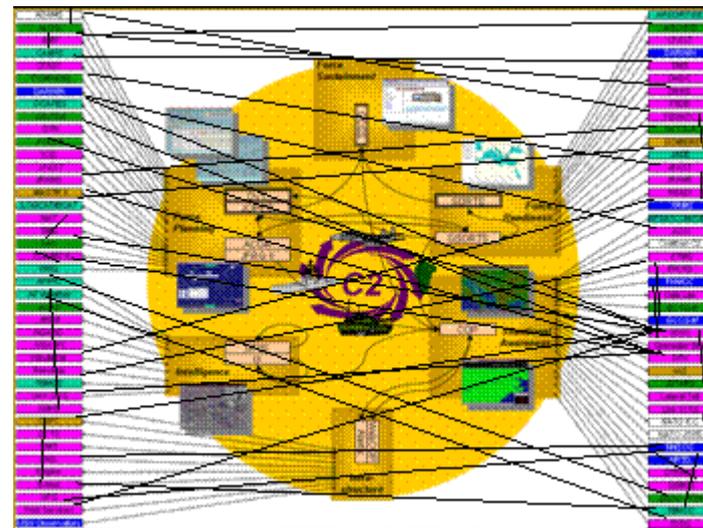
CLIENT SERVER ARCHITECTURES

- Each link is a tightly engineered point-to-point connection
- Typical n^2 problem ($n = \#$ of connections) : More point-to-point connections means LOTS OF life-cycle time and costs
- *Programs* are the centers of gravity, and all data is stored within them
- Each connection must be designed, built, tested, and maintained

SERVICE ORIENTED ARCHITECTURES

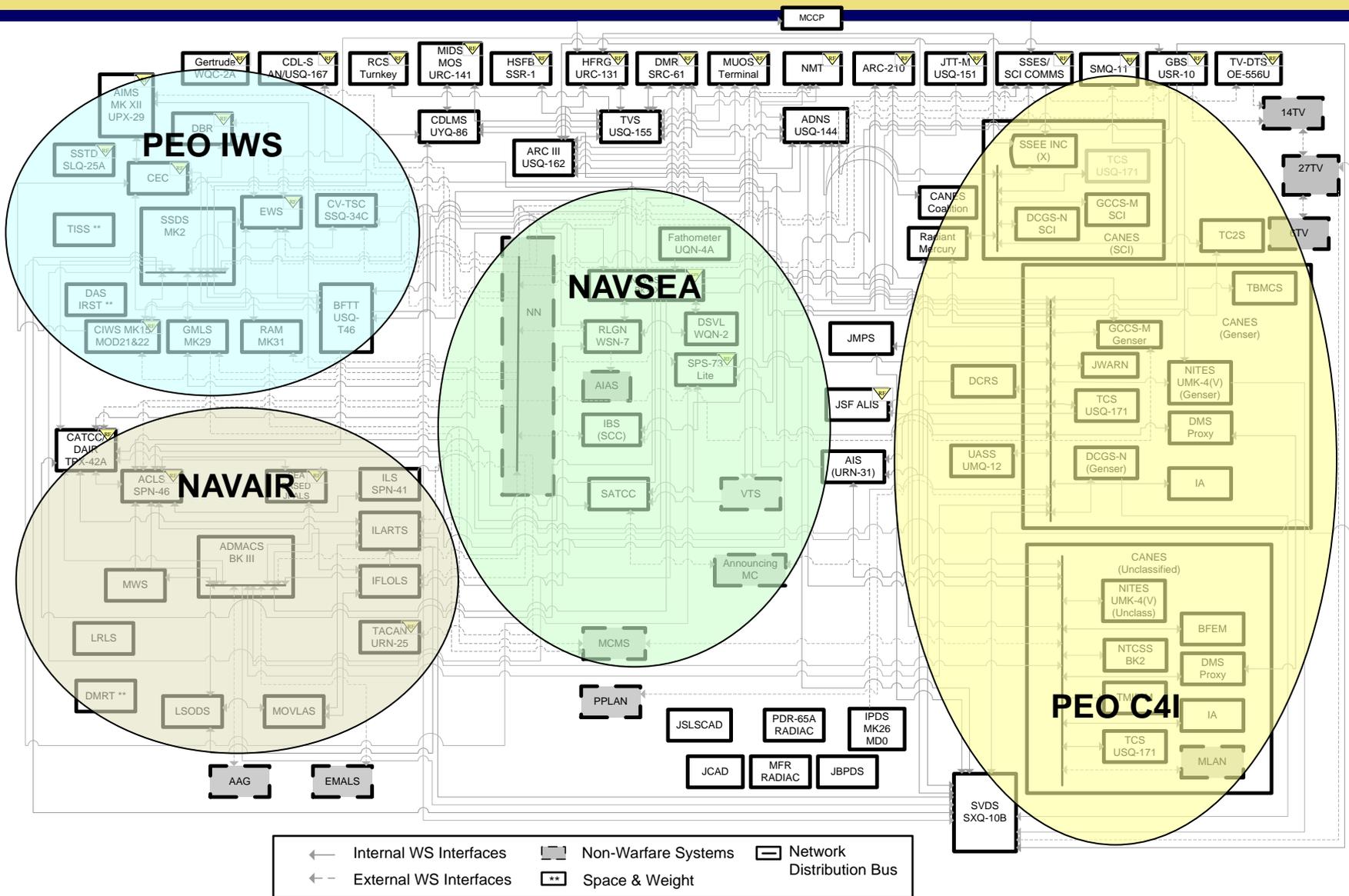
- Less connections; Each program connects to a central "bus" (..the enterprise service bus)
- Relatively FAR FEWER connections, much less life-cycle time and cost
- *Data Sources* are the centers of gravity, all data is stored within data enclaves
- Focus is task or operational function

Typical C2, ISR, IO, etc Applications



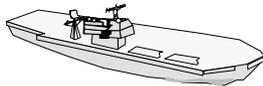
Today's Shipboard Environment

(Direct interfaces, unique solutions, weak cross-domain integration)

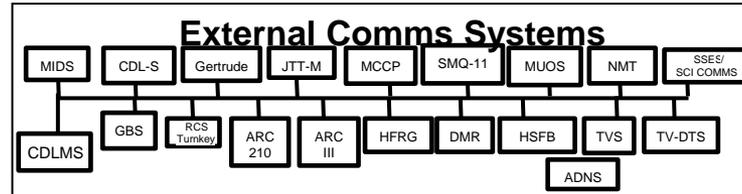


Desired Shipboard Environment

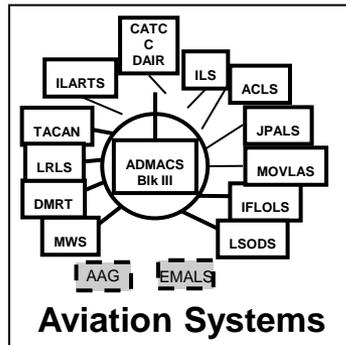
(Networked interfaces, common/interoperable solutions, significant cross-domain integration)



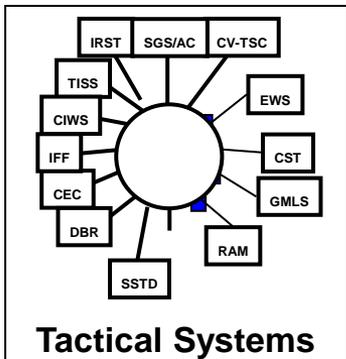
PLATFORM



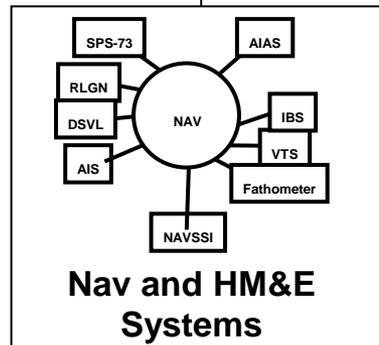
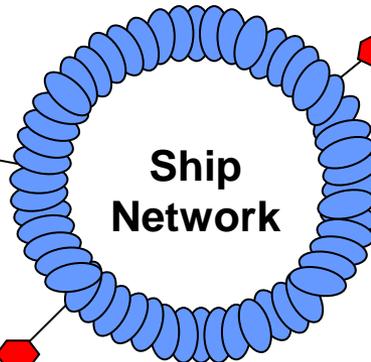
Functional Enclave



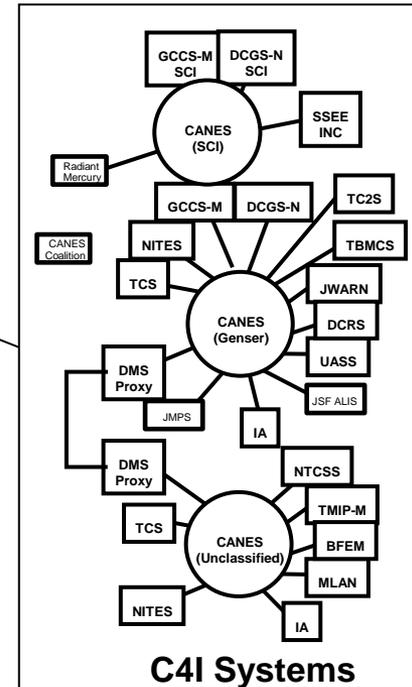
Functional Enclave



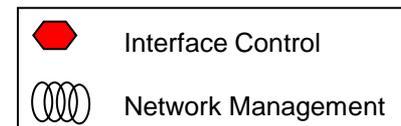
Functional Enclave



Functional Enclave

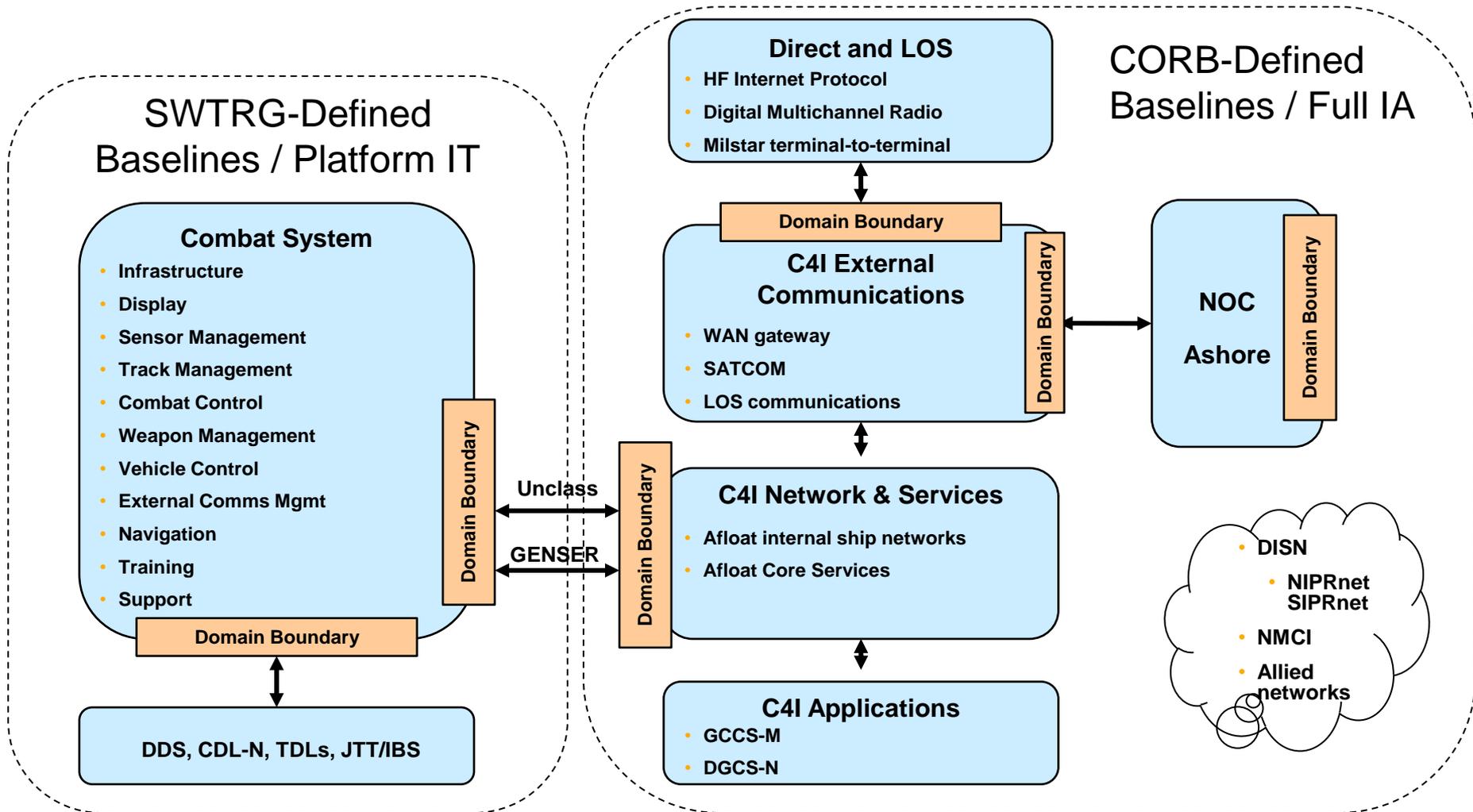


Functional Enclave





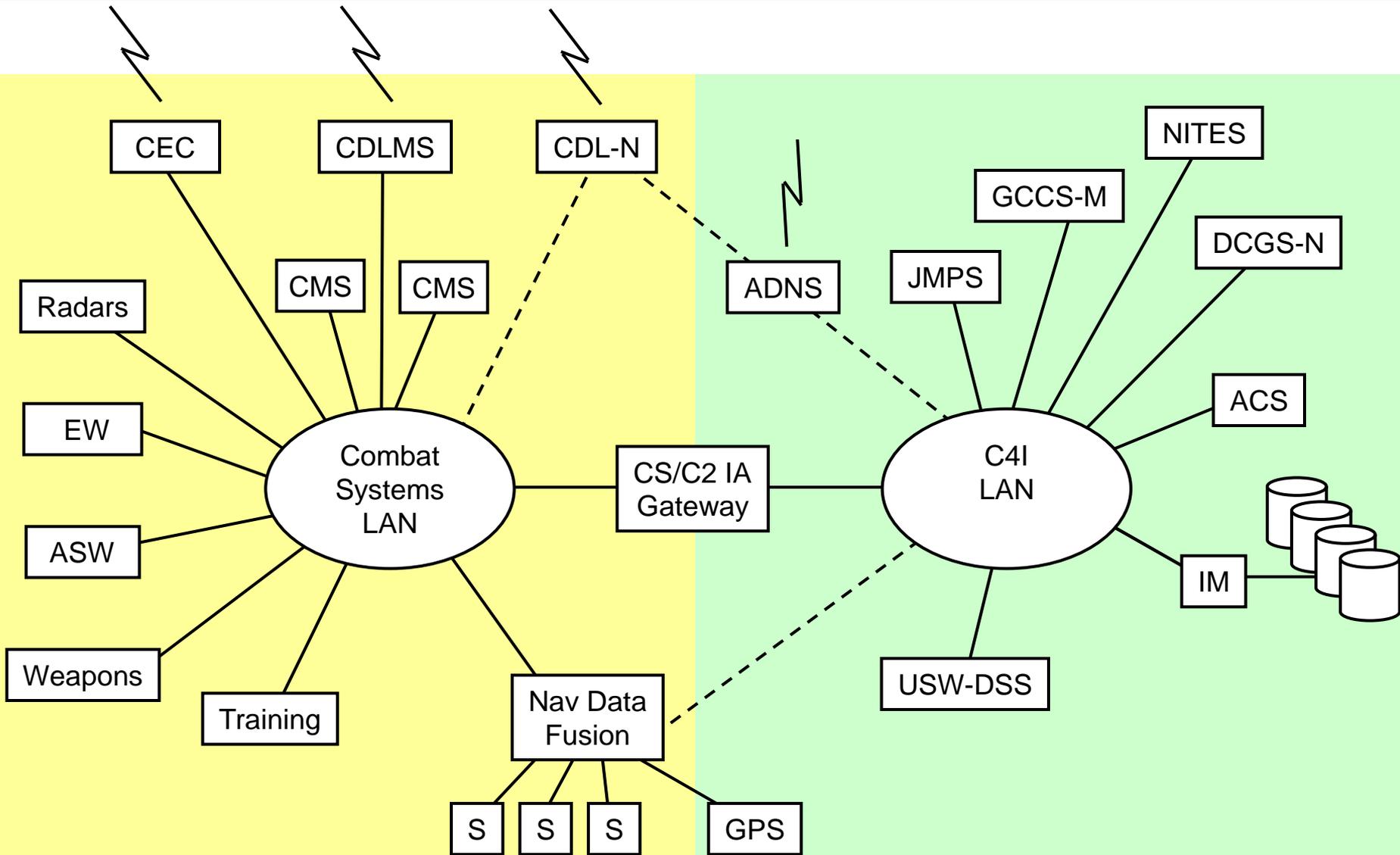
CANES Services supports CS data exchange with C2 Applications (whether onboard and offboard)



Information Assurance is a Significant Hurdle to Resolve!



Integrated Architecture Concepts (Physical Interconnect View)





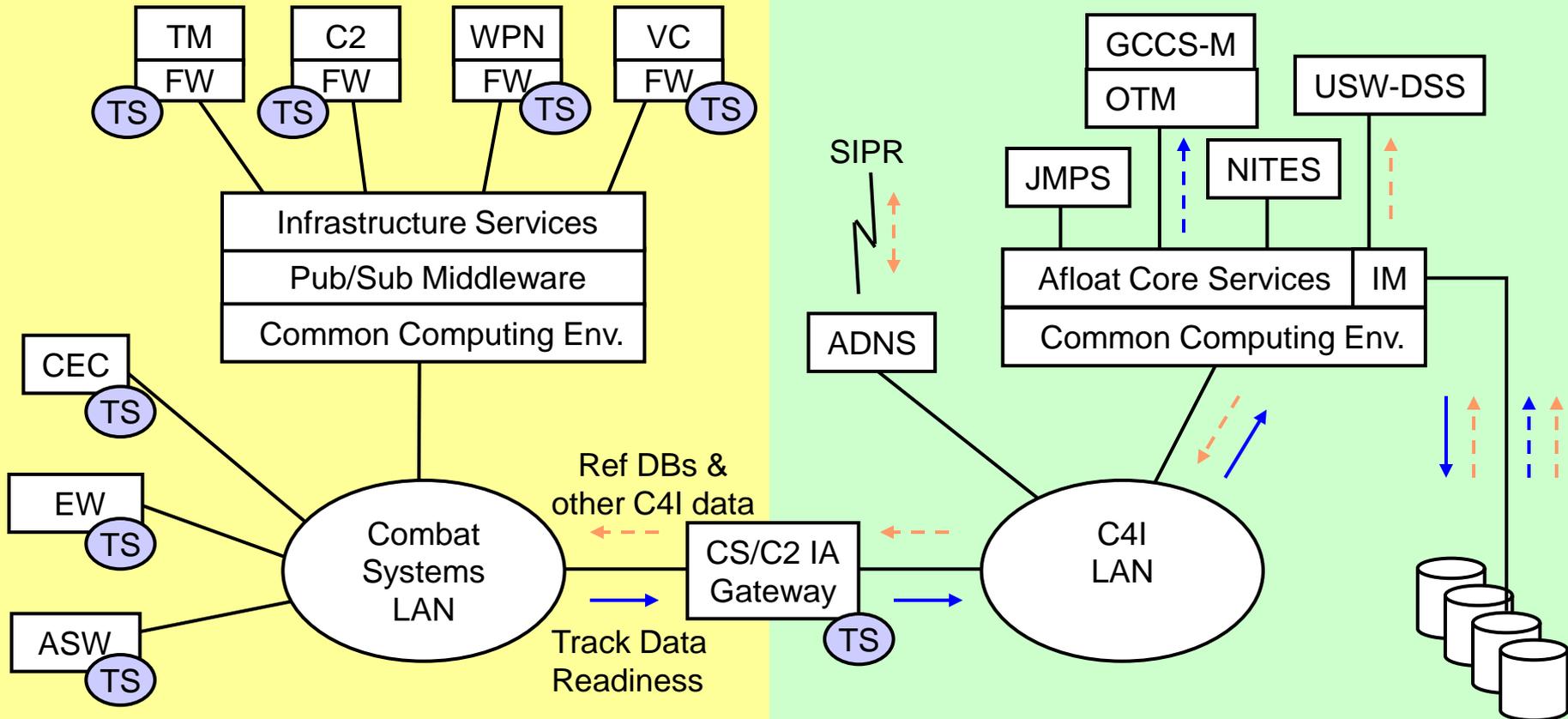
Integrated Architecture Concepts (Logical Interconnect View)



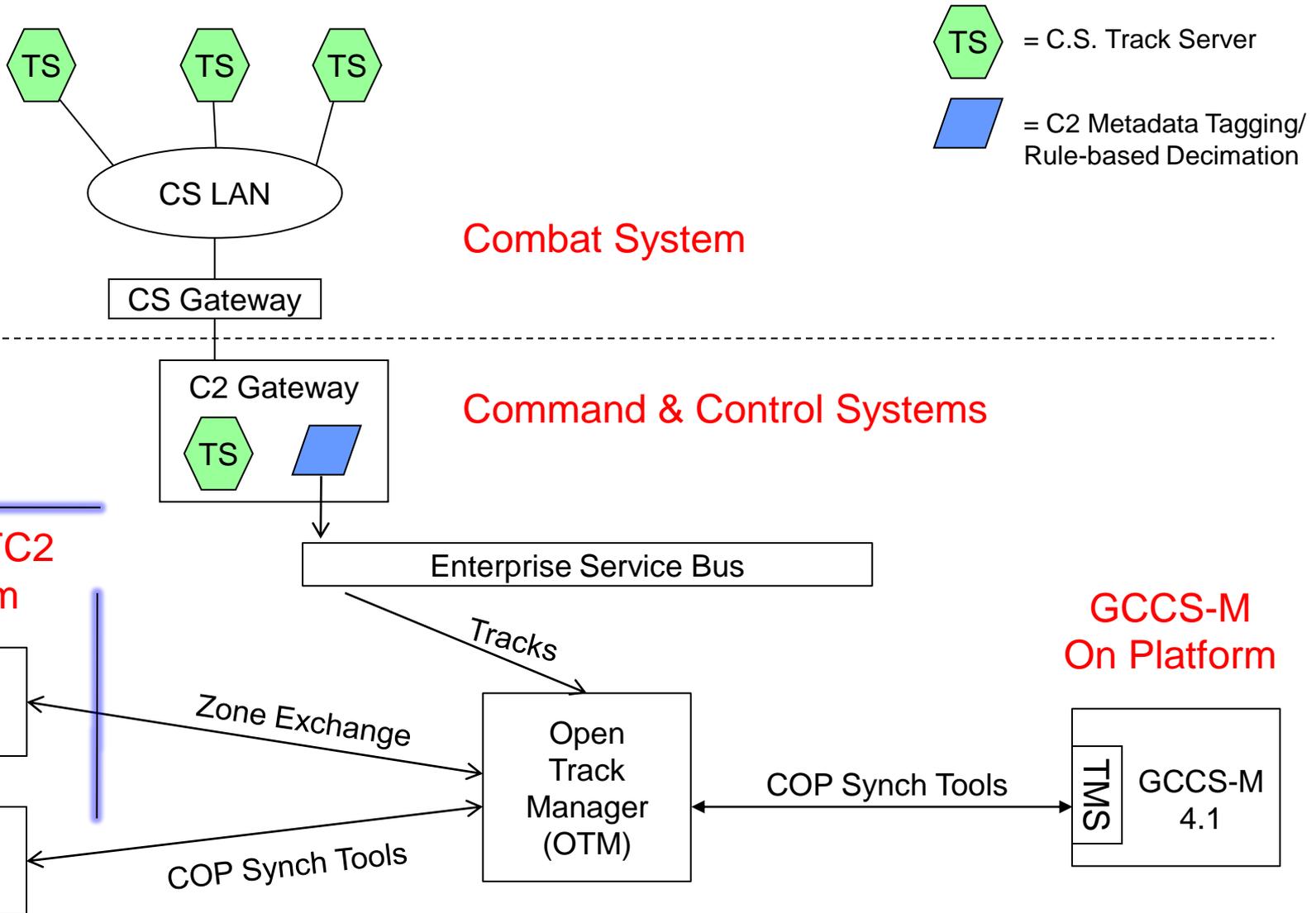
→ = Pub/Sub msgs

- - → = SOA Services

(TS) = Track Server



Goal for CVN 78 C.S. Integration with GCCS-M

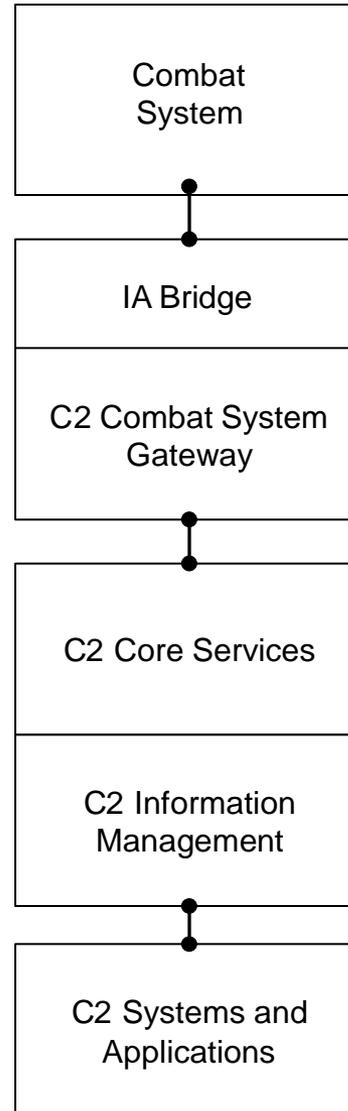




ONR Limited Technical Experiment Operational Node Description



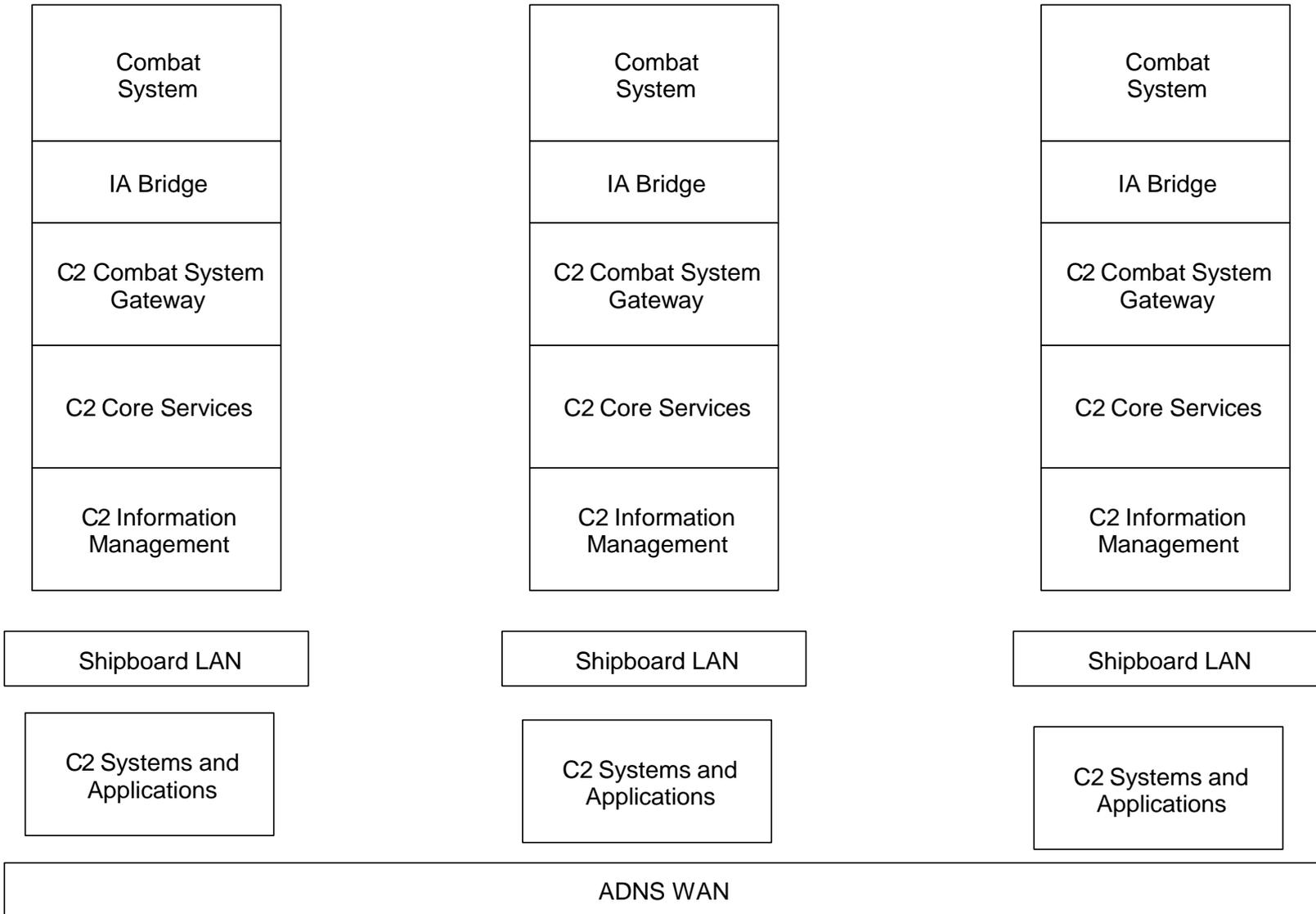
- ONR LTE developing architectural approaches and technology to:
 - Maximize information transparency between applications running on combat systems networks and those on C4I networks
 - Minimize application design complexity by leveraging middleware services in each domain



- CS will publish messages IAW common data model (tracks and readiness data) and MH-60R video
- Enclave boundary/isolation
- Host-to-host authentication and encryption (2-way SSL)
- IC-ISM tags will be added to CS data model to support access control on C2 side
- C2 metadata will be added on C2 side based on CS DDS topics to allow discovery
- GUID and pedigree standards needed
- Decimation of track data will occur on C2 track server client side



ONR LTE Multi-Operational Nodes



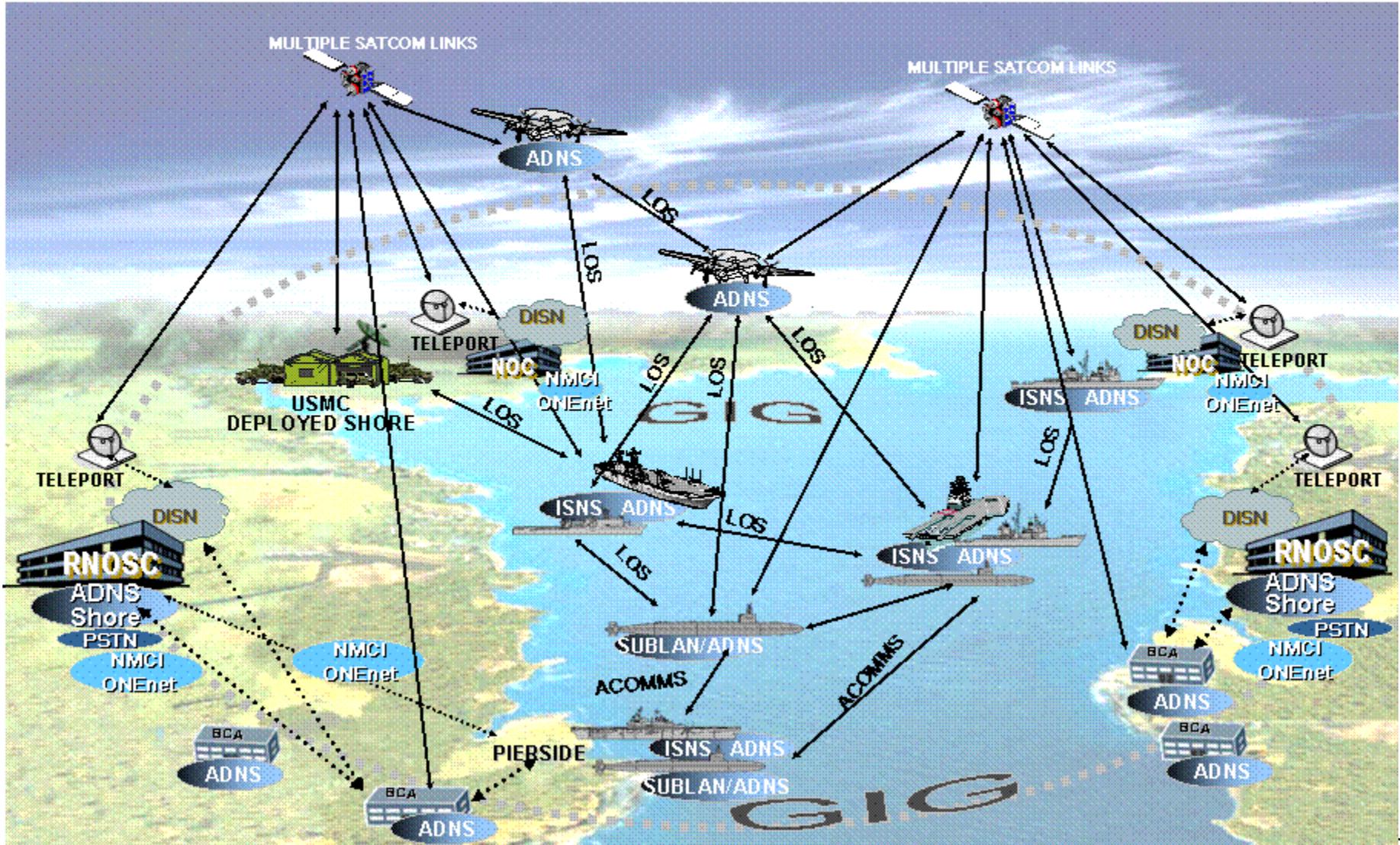


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Automated Digital Networking System (ADNS) OV-1





Automated Digital Networking System (ADNS)

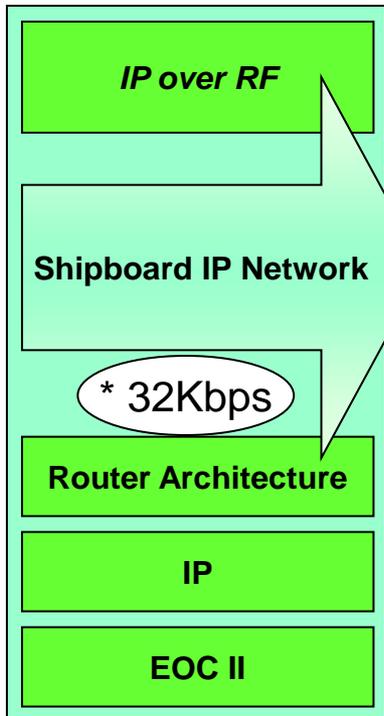


- **ADNS is the WAN for the Navy**
 - Deployed Mobile Networking for ships, submarines, aircraft, and shore stations
- **Enclave independent**
 - SIPR, NIPR, JWICS, CENTRIXS, NSAnet, other
- **RF path independent**
 - SATCOM
 - Line of Sight (LOS)
- **The ADNS Program ties together hardware, software, links and services to provide a mobile Wide Area Network (WAN)**
 - Network Routing Configurations/Architecture
 - Security posture (to conform with DOD requirements)
 - Connectivity of RF comms paths
 - Terrestrial Entry Points (NOC / NCTAMS)
 - LAN interfaces (platform dependent)

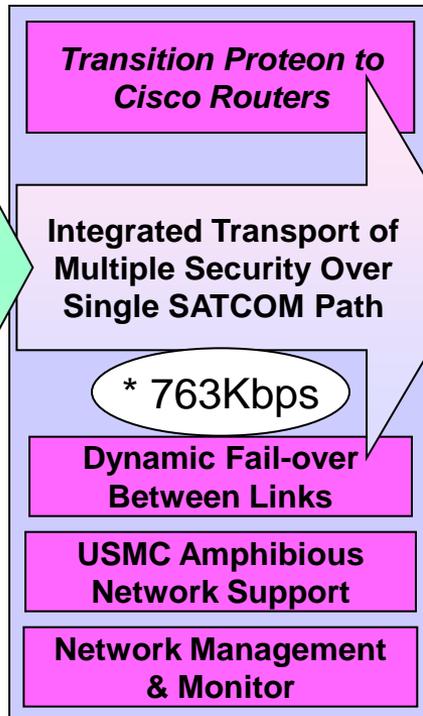


ADNS Evolutionary Development

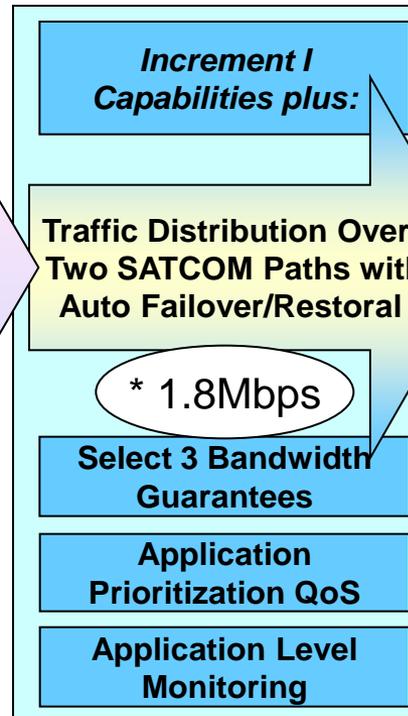
Pre-Increment I 1988-1997



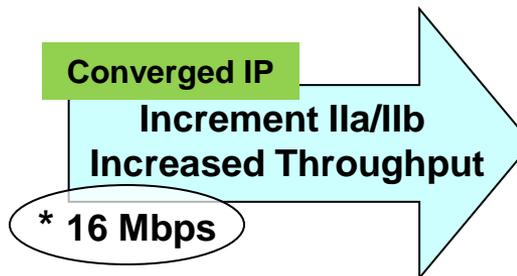
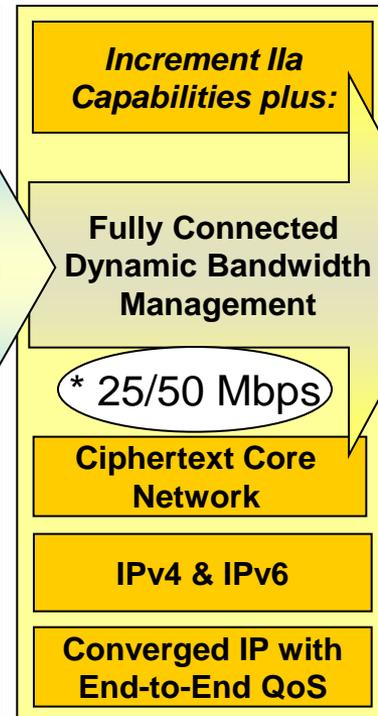
Increment I 1997-2005 (FOC)



Increment II 2004-2010 (FOC)



Increment III 2009-2017 (FOC)



*** Planned Aggregate**

Information Dominance



CNO's Unifying Vision and Guiding Principles

Vision - "Pioneer, field and employ game-changing capabilities to ensure Information Dominance over adversaries and Decision Superiority for commanders, operational forces and the nation"

□ First Principles Include:

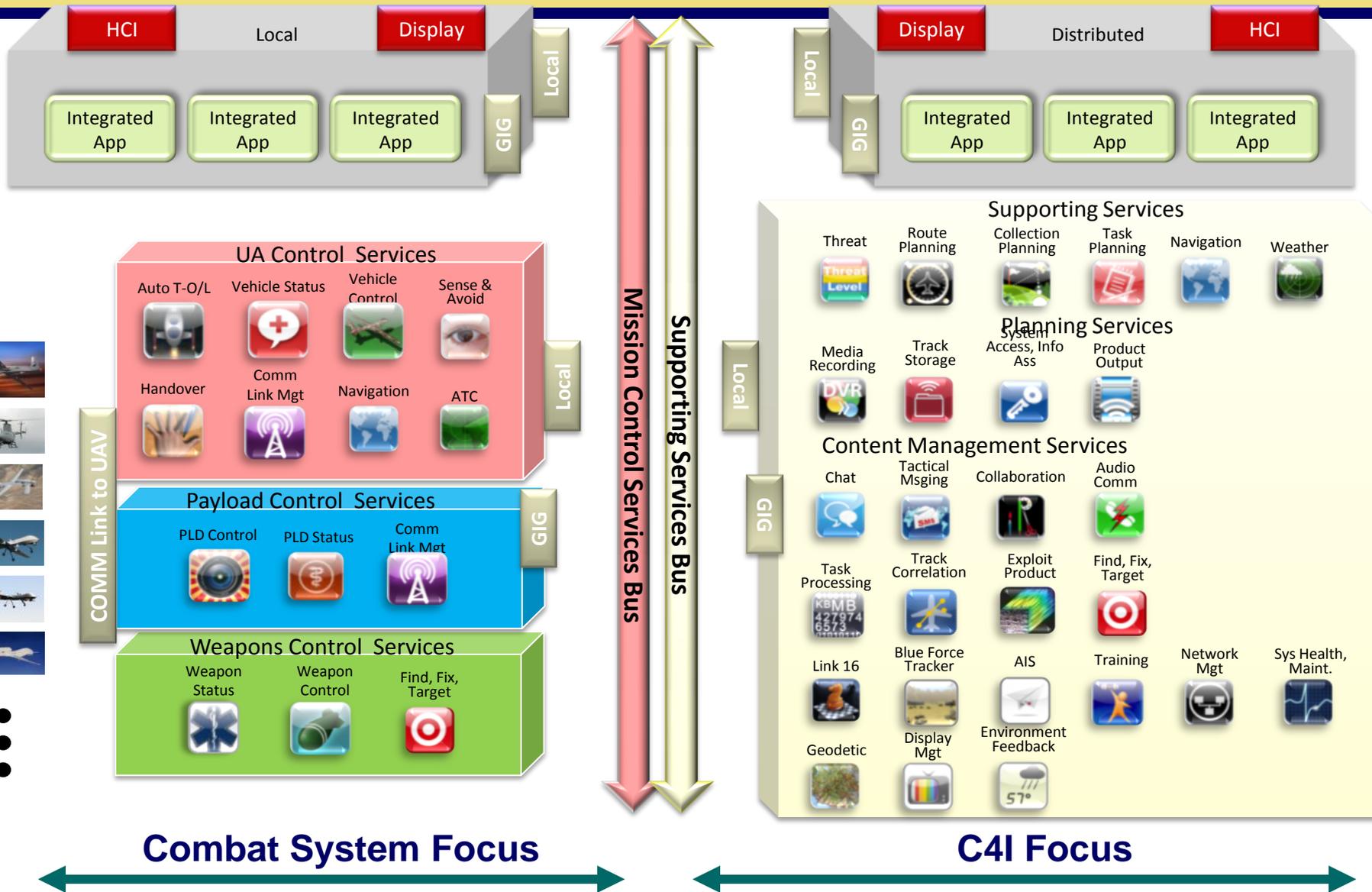
- ✓ Every platform is a sensor
- ✓ Every sensor is networked
- ✓ Build a little; test a lot
- ✓ Spiral development/acquisition
- ✓ Plug-n-play sensor payloads
- ✓ Reduce afloat/airborne manning
- ✓ Transition to remoted, automated
- ✓ Collectors dynamically tasked
- ✓ One operator controls multiple platforms
- ✓ Emphasize UAS and autonomous platforms
- ✓ UAS's increasingly sea-based
- ✓ Data discoverable and accessible
- ✓ Missions drive requirements
- ✓ Commonality in interfaces, data links and control stations
- ✓ Every shooter capable of using target data derived from any sensor

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Reference: Information Dominance – A Vision for the U.S. Navy, CNO, 12/18/09



Notional Joint UAS Control Segment Software Framework



LOI 1-5 Relationship

Level 1: Indirect receipt or transmission of UA related payload data.

Not just EO/IR full motion video or still imagery. Includes; ISAR, Tracks, and other sensors' products.

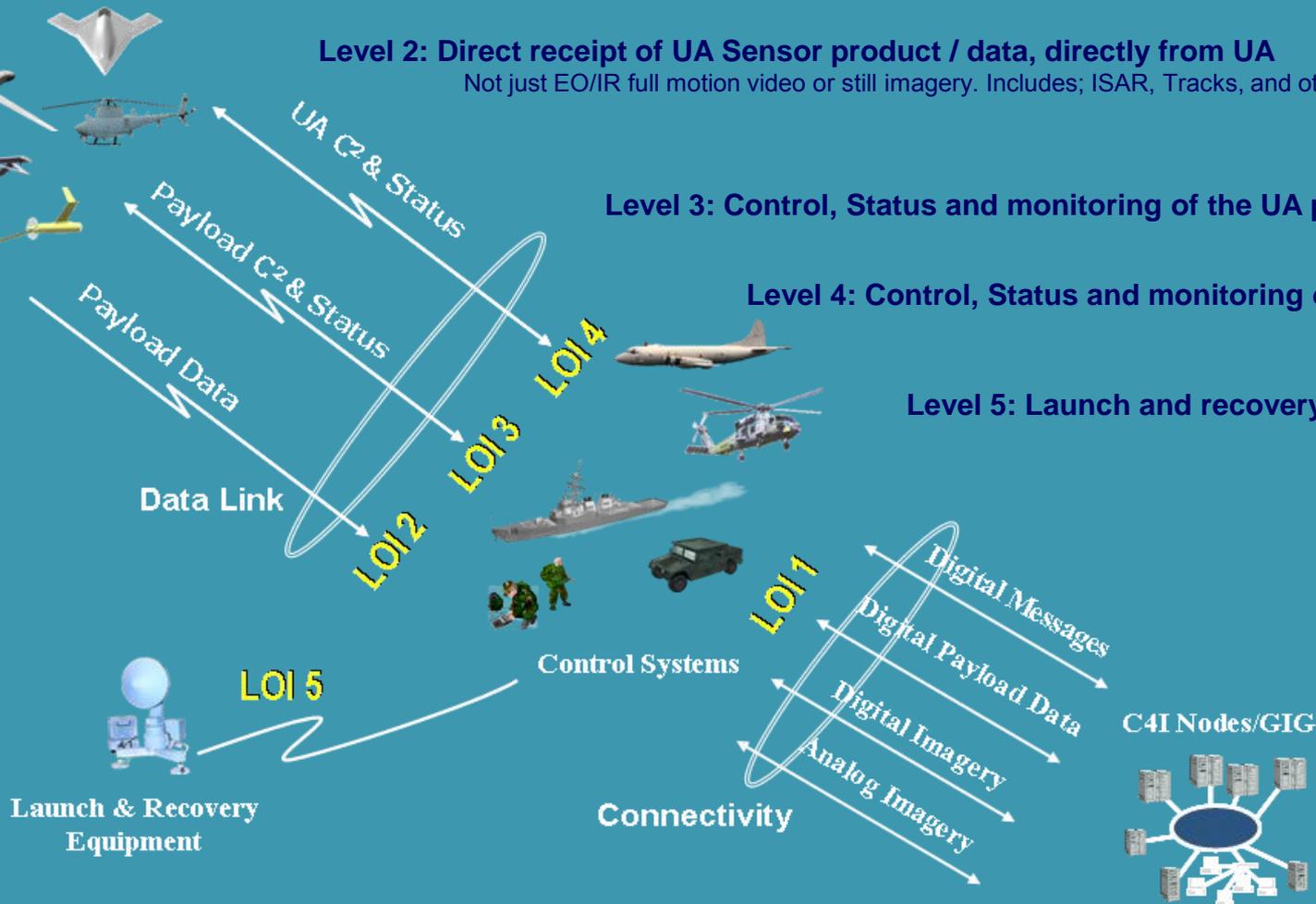
Level 2: Direct receipt of UA Sensor product / data, directly from UA

Not just EO/IR full motion video or still imagery. Includes; ISAR, Tracks, and other sensors' products.

Level 3: Control, Status and monitoring of the UA payload

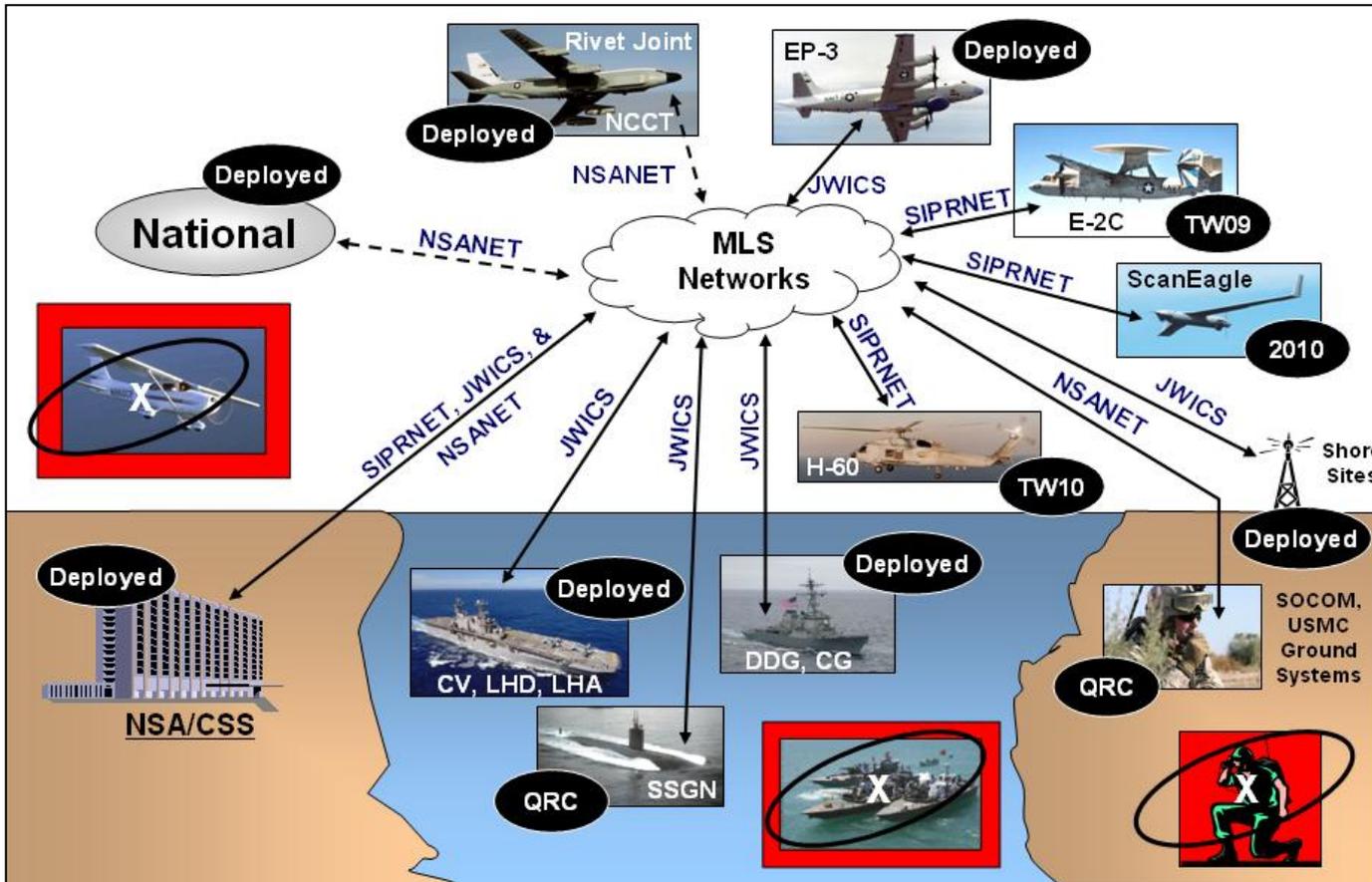
Level 4: Control, Status and monitoring of the UA

Level 5: Launch and recovery functions



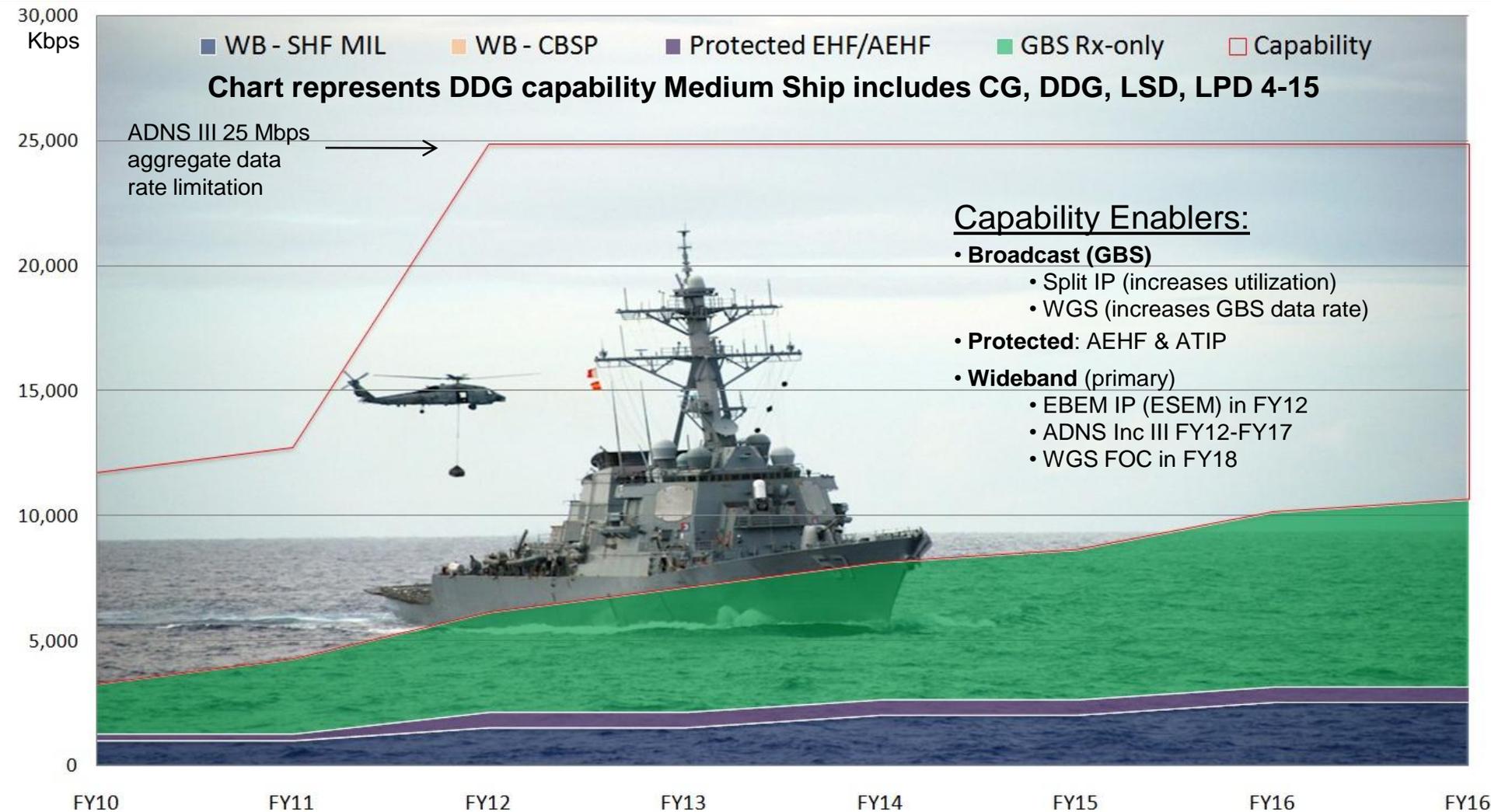
Example

Hostile forces Integrated Targeting Service (HITS) Purpose - Precision COMINT geolocation





SATCOM Migration Data Rates - Medium Ship



Incremental upgrades to terminals, networks, & on-orbit assets result in increased data rates and utilization. Data rates limited by COCOM allocations and Commercial Lease funding



Outline of Presentation



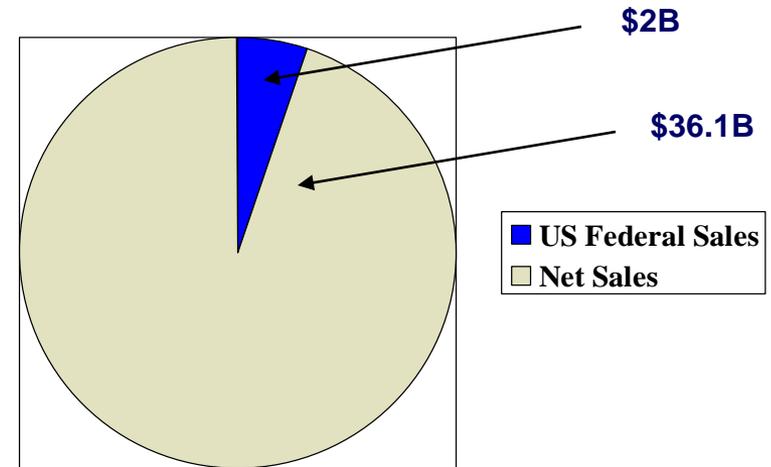
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IT Spending Trends

Information Technology :
“Gartner raises 2010 global IT spend forecast. It expects the global IT industry to return to growth in 2010 and grow 3.3% to \$3.3 trillion”

- **Reference:**
<http://www.livemint.com/2009/10/20233740/Information-Technology--Gartn.html>

Example



Reference: Cisco's Annual Report 2009
http://www.cisco.com/web/about/ac49/ac20/about_cisco_annual_reports.html

We need the ONR S&T to solve our Navy Unique challenges

Remember IA





Summary

- The vision for integrating combat system and C4I systems, services and data will:
 - Maximize information transparency between applications running on combat systems networks and those on C4I networks
 - Minimize application design complexity by defining interoperable middleware services in each domain
- By sharing data and services between CS and C2 applications can reduce timelines for plan-do-assess-replan cycle and allow operators to exploit available data to achieve new capabilities