Outpacing the Competition: A Systems Engineering Challenge

24 October 2017

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NDIA Systems Engineering Conference

Presented By:

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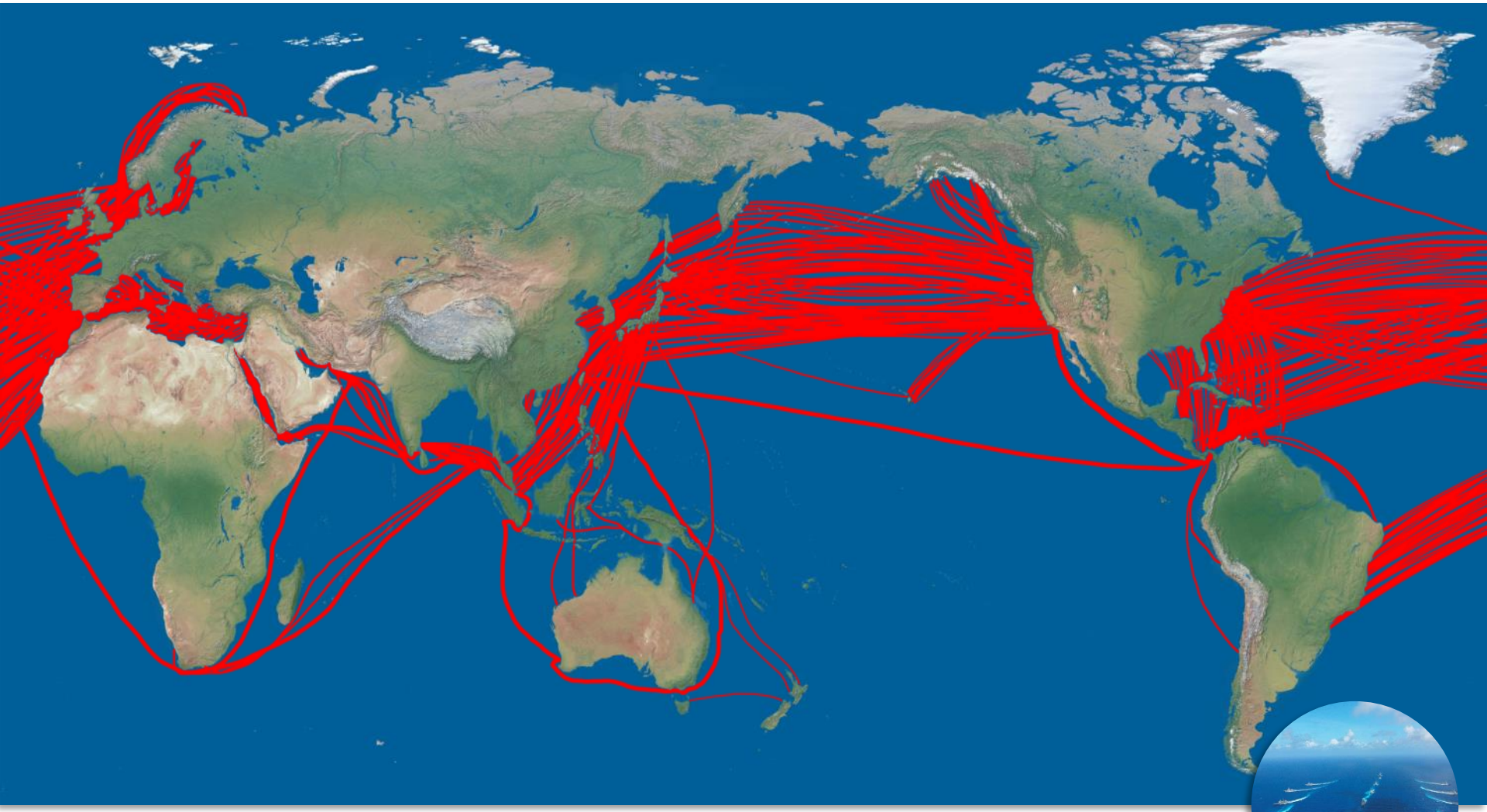
Day in the life of an SE dealing with PMs

Framing the Challenge

Life Has Been Good!

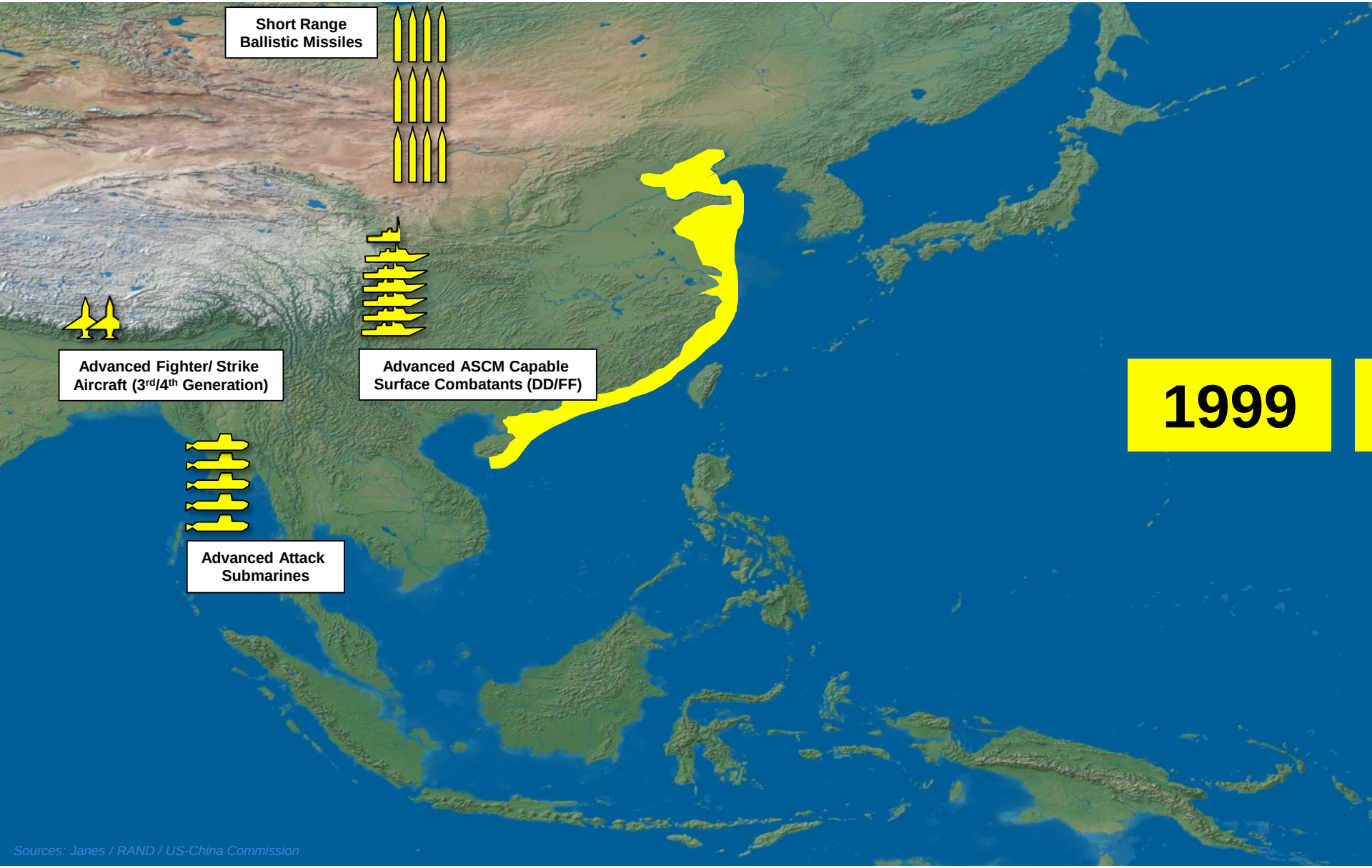
Sea Lanes Remain the Lifeblood of Our Economy



90% of global trade by **volume** / **70%** of global trade by **value**
98% of telecoms traffic

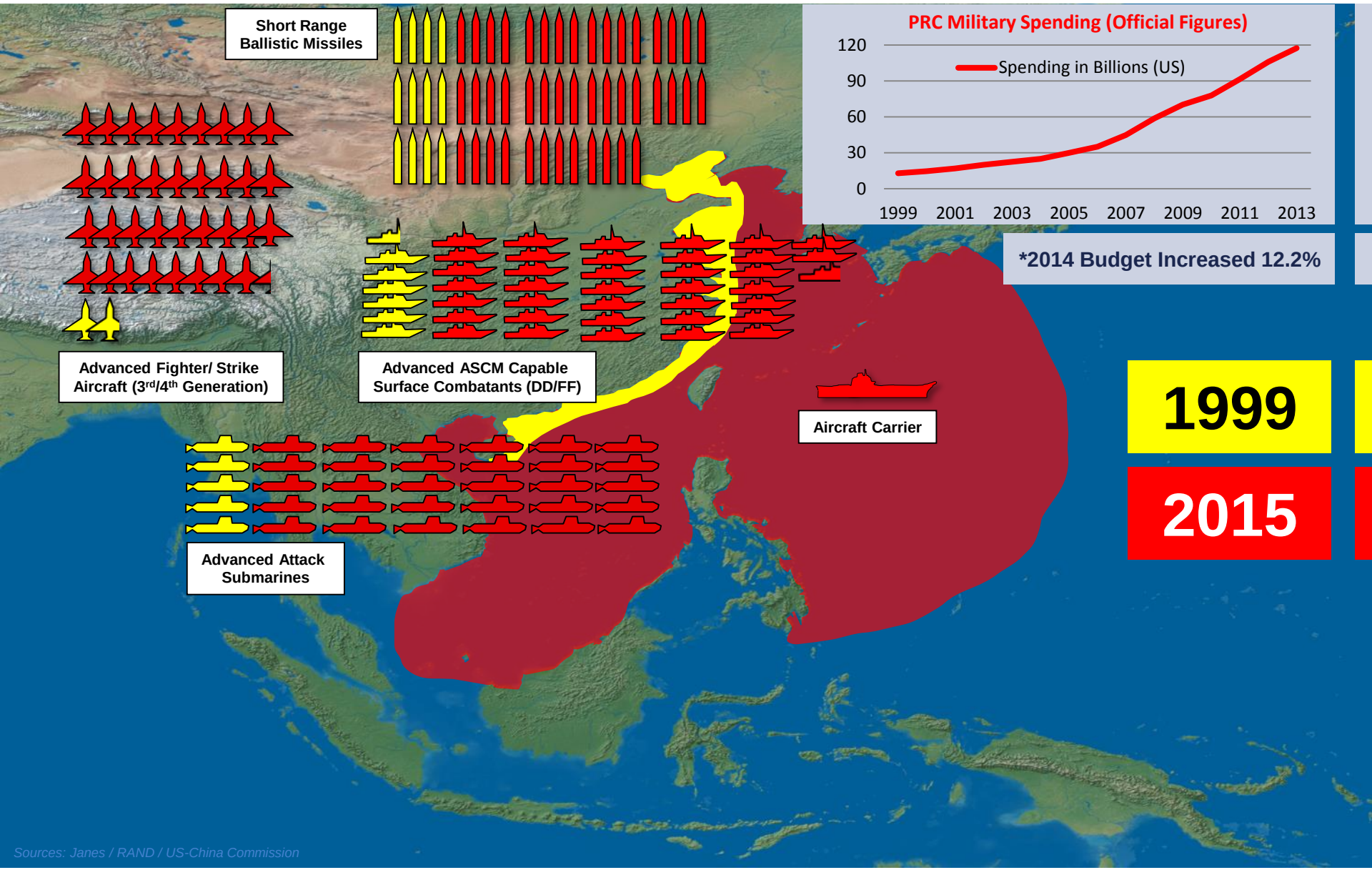
Competition is Back

Changing Environment



Sources: Janes / RAND / US-China Commission

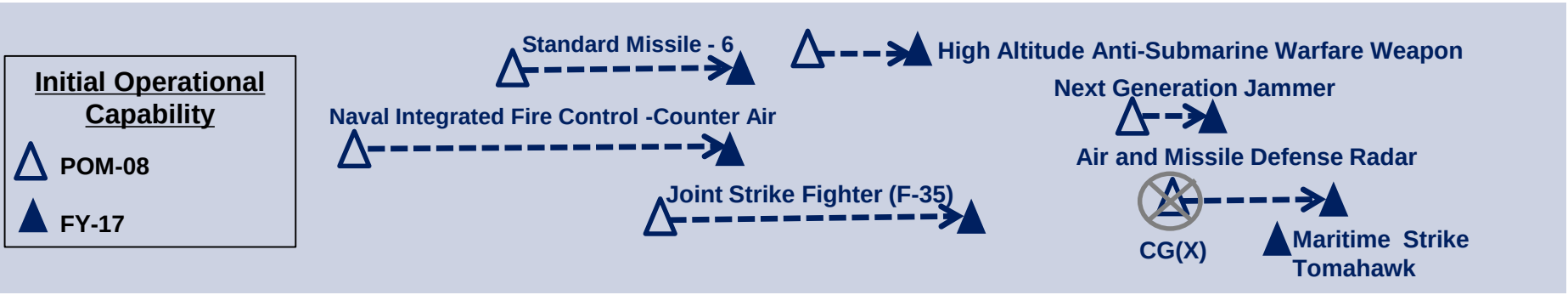
Changing Environment



Sources: Janes / RAND / US-China Commission

USN and PLA(N) Capability Fielding Trends

We're Slower!



USN Warfighting Advantage has Steadily Eroded

CNO's Challenges to all Flag/SES

5 Key Points

- Must be competitive ➡ Existential Threat ➡ No #2
- Think Strategically ➡ Critical Thinking

- Going Digital

- Outcome / Product Oriented ➡ Vice Process
- Sense of Urgency ➡ Should be <u>Uncomfortable</u>

"If It's Not Making the Fleet More Lethal – Stop Doing It!"

NAVAIR Response

Commander's Intent – *Remains Unchanged*

- Increase Speed of New Capabilities to Fleet
- Increase Readiness

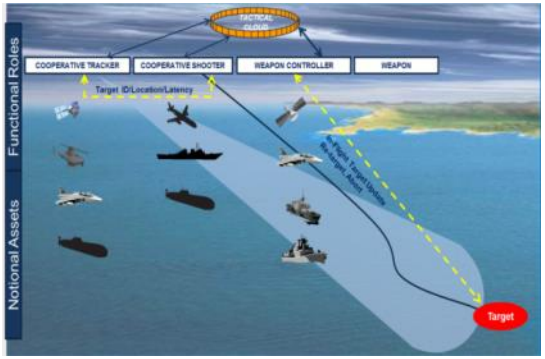
Strategic Initiatives – *Focus on Speed*

- Capabilities Based Acquisition – *Rapid delivery of integrated capabilities*
- Sustainment Vision 2020 – *Predictive, integrated sustainment operations*
- Digital Business Operations – *Integrated business systems "apps" at the desktop*

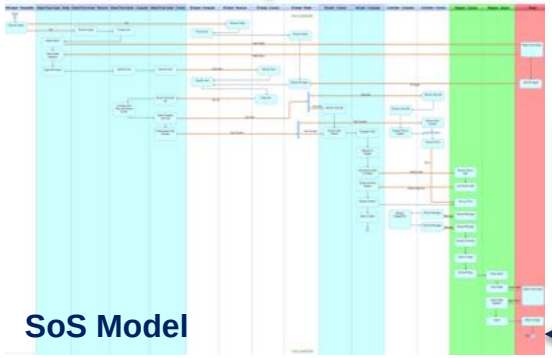
Accelerating delivery of fully integrated capabilities which are designed, developed, and sustained in a Model Based Digital Environment
IS a Systems Engineering challenge

Capabilities Based Acquisition

Digital Thread Enables Rapid Delivery of Integrated Capabilities

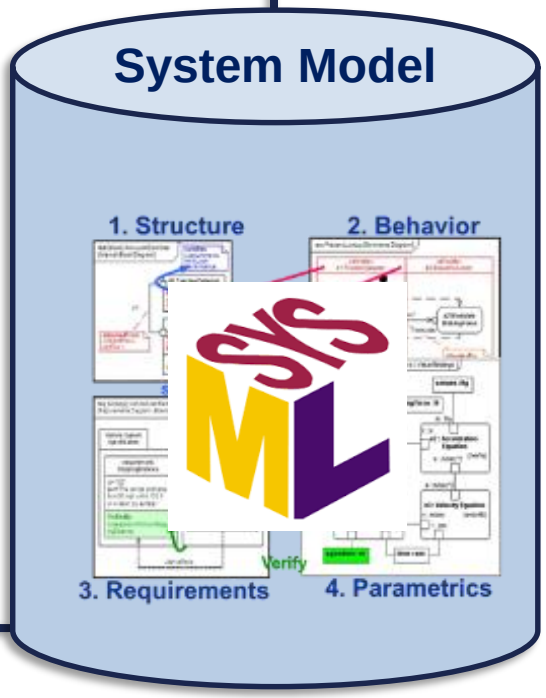


Integrated Warfare Analysis establishes CONEMPS, Effects-Chains, required attributes



CONEMPS and Effects Chains are modeled at the System of Systems (SoS) level

System models form "Constructive" basis for LVC M&S environment



Systems are developed in a Model-Based environment (SE Transformation)

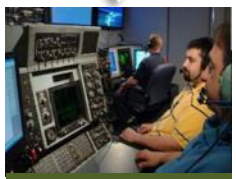
Enabling Capabilities-Based T&E

Constructive	Virtual	Live

DIGITAL MODELING

HARDWARE IN THE LOOP

FLIGHT TEST



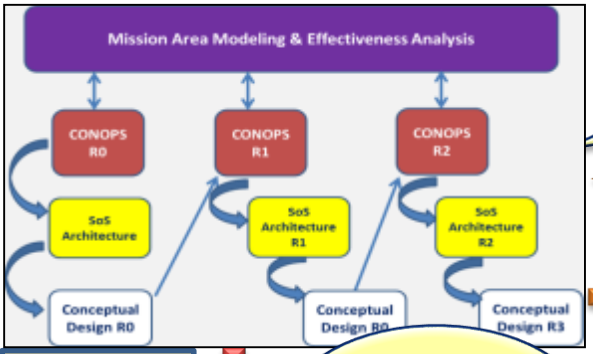
INTEGRATION LABORATORY

INSTALLED SYSTEMS TEST FACILITY

LVC-based training required for Fleet integrated ops

Digital Linkage

SET Framework



Mission Effectiveness optimization

Re-balance as required

Right-size CDD – very few KPPs, all tied to mission effectives

CDD

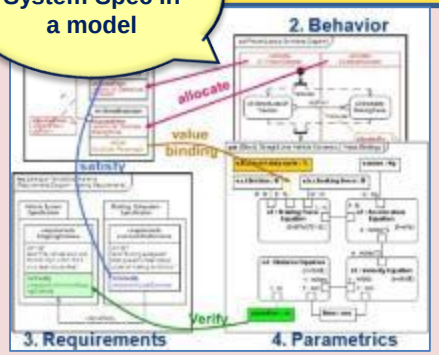
Instantiate System Spec in a model

Instantiate and validate design in models

Elimination of paper CDRL artifacts and large-scale design reviews

Continuous insight/oversight via digital collaborative environment and interaction with the Single Source of Truth

Single Source of Truth



- Mechanical Design Models
- Electrical Design Models
- Software Design Models
- Testing Methods & Models

Analysis Tools

Design & Manufacture Release

Integration Events

Integrated Test Vehicle #1

Move rapidly to mfg. Substantiation and insight via modeling environment

MDAO*/SET-BASED DESIGN

** Multi-Disciplinary Analysis & Optimization*

V5.0

Execution Framework

ELEMENT 1
Effectiveness Analysis
CDD optimization

Link 1

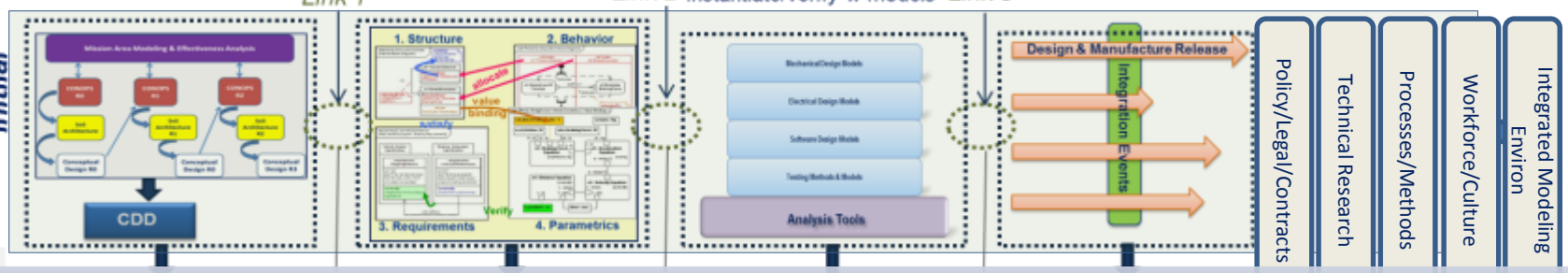
ELEMENT 2
Instantiate Spec in
System Model

ELEMENT 3
Develop Initial Balanced Design
via MDAO/SBD
Link 2 Instantiate/verify w models

Link 3

ELEMENT 4
Design & Mfg Release
Collaborate via IDE

Functional Areas



Policy/Legal/Contracts

Technical Research

Processes/Methods

Workforce/Culture

Integrated Modeling Environ

SET Task Framework

Enablers

Jaime Guerrero, SET Lead — **David Meiser, SET Action Officer**

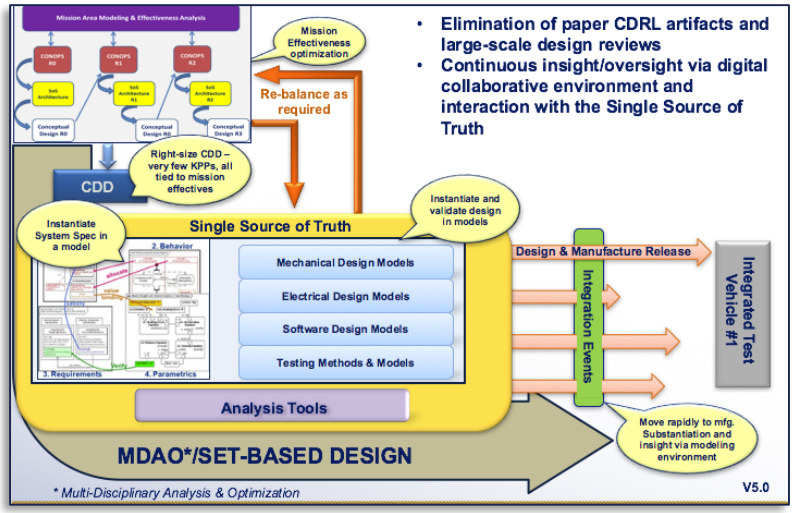
Element 1 | Element 2 | Element 3 | Element 4

- **SET Research Team** *(Blackburn)*
- **Modeling Env'nt Team** *(Fields)*
- **Workforce/Culture Team** *(Carlson)*
- **Process & Methodology Team** *(Chamberlain/Polakovics)*
- **Policy, Contract, Legal Team** *(Vacant)*
- **SET Framework Links** *(S. Raley)*

Each Element requires work in the 5 Functional Areas in order to reach "Full Maturity"

Surrogate System Experiment

- Simulate Execution of SET Framework
- Use UAV scenario developed in SERC models
  - Combine SysML models already in development – requirements, with functional and logical views
  - Use MDAO of parametrics for some KPPs
    - Consider NATO example
    - Characterize objectives and thresholds
  - Create a model-based contract simulating RFP / SOW
- Use commercial organization to simulate industry organization
  - Refinement of SysML models to reflect corrections / innovations with physical allocation views
  - Integrate with multi-physics-based Initial Balanced Design
  - Simulate continuous virtual reviews and derive new objective measures for assessing maturing design
- Simulate source selection based on dynamic models and simulations



Industry-Government Partnership

- SET applies to both Government and Industry

- Government must reassess its role in the acquisition process and the methods for executing that role
  1. Criteria for gov't involvement / oversight (not every decision)
  2. If involved, must be on developer's timeline
  3. Must bring value to the decision – not just positional authority

- Industry must fully leverage advances in HPC-enabled models and participate in establishing a collaborative, integrated digital environment which enables continuous interaction

For More Information, Contact:

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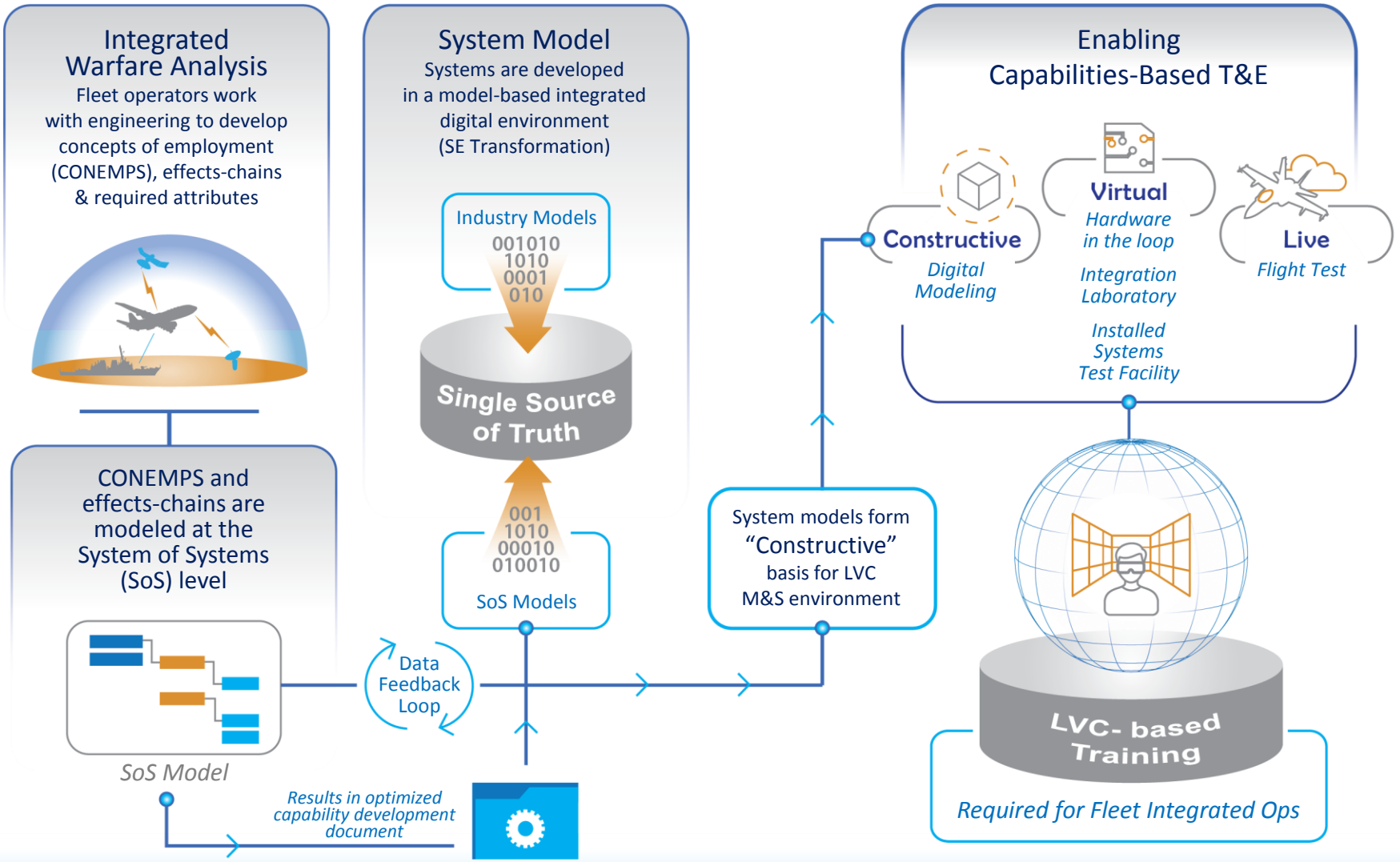
NAVAL AIR SYSTEMS COMMAND

Capabilities Based Acquisition



Integrated Digital Environment accelerates delivery of operationally relevant capabilities

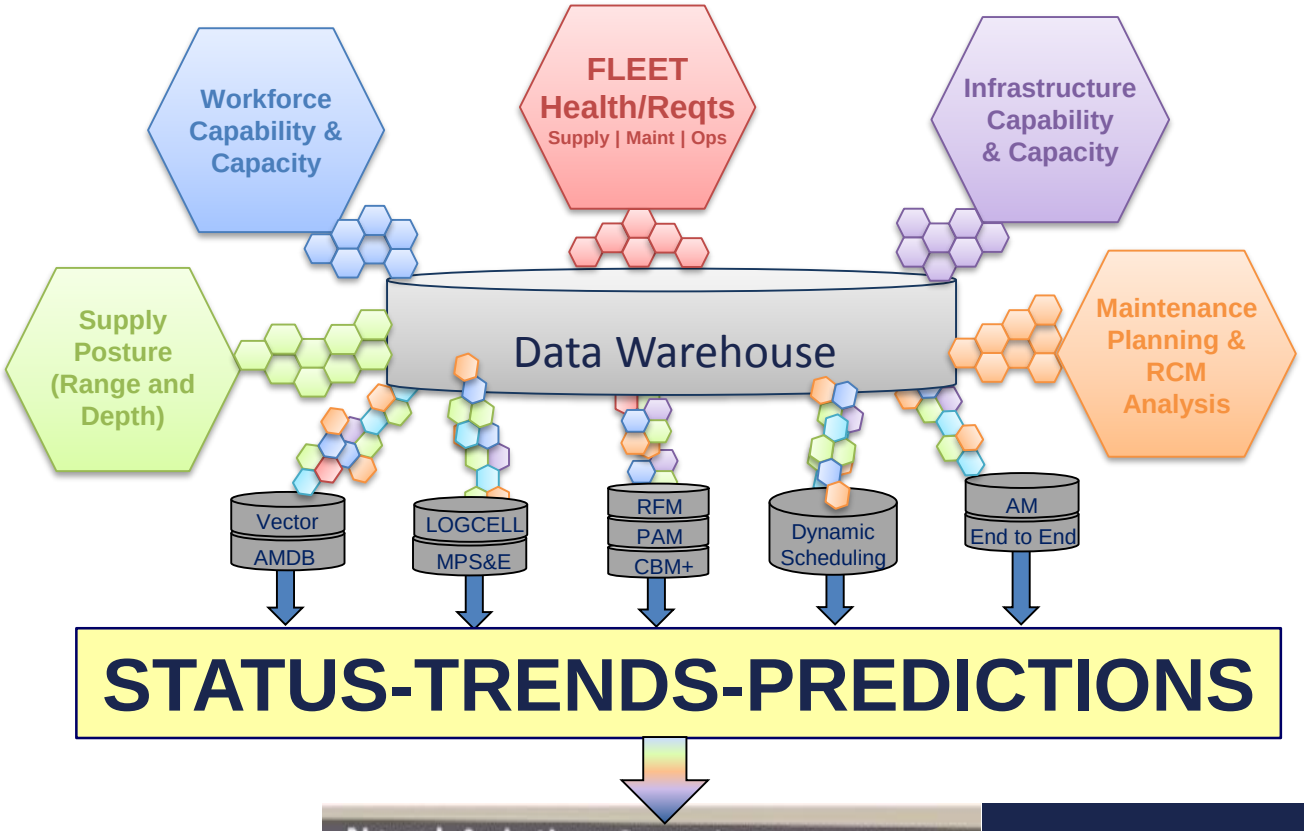
Sustainment Vision 2020 – What it Looks Like

RAW DATA

APPLICATIONS / TOOLS

ANALYSIS

FLEET DECISIONS FLEET SUPPORT



Universal Information
Faster Decision Making
Predictive Sustainment Planning
Reduced Cost
Increased Readiness

Optimization and Prioritization of Resources to Meet Fleet Needs…
Maintenance Planning
Supply Support
Workforce
Facilities

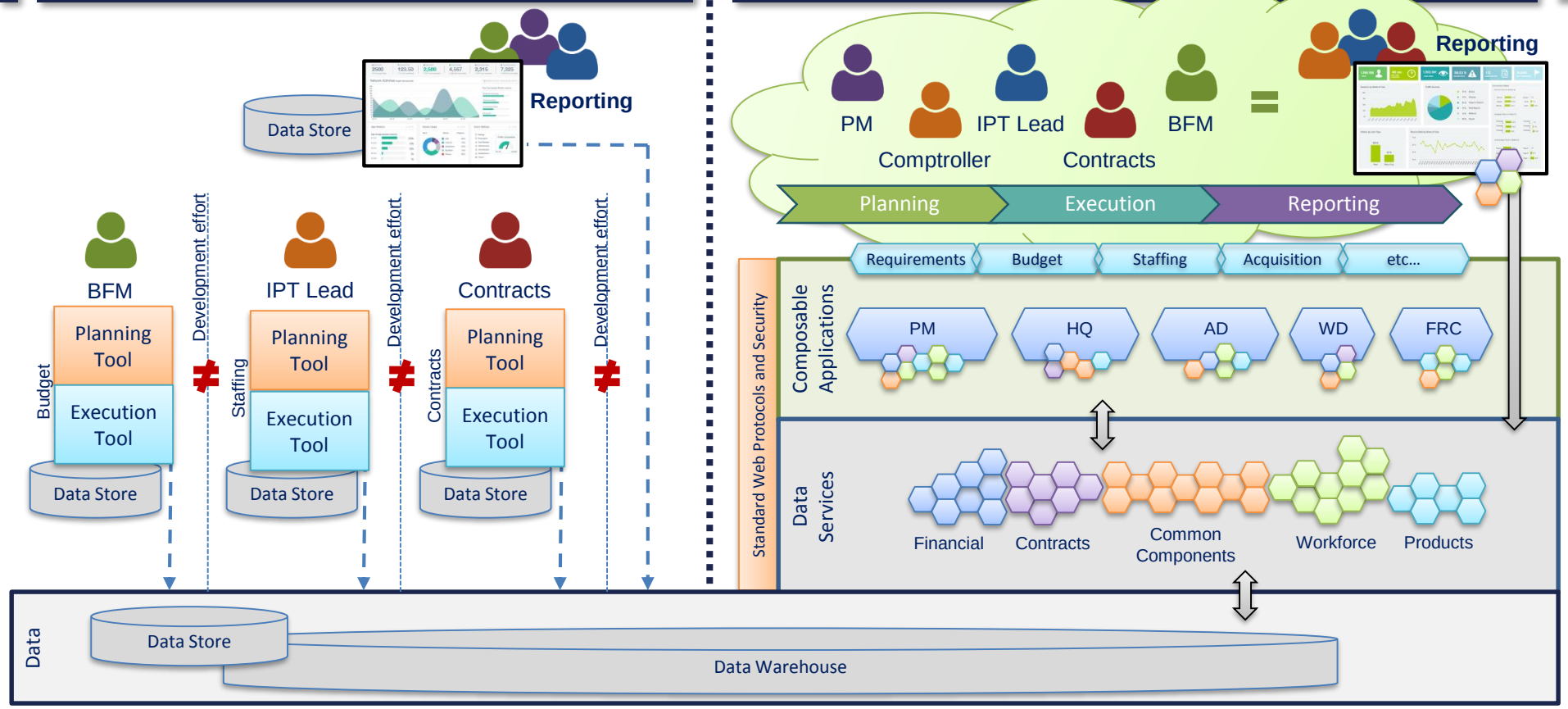
Digital Transformation: Business Operations

Today: Monoliths in Silos

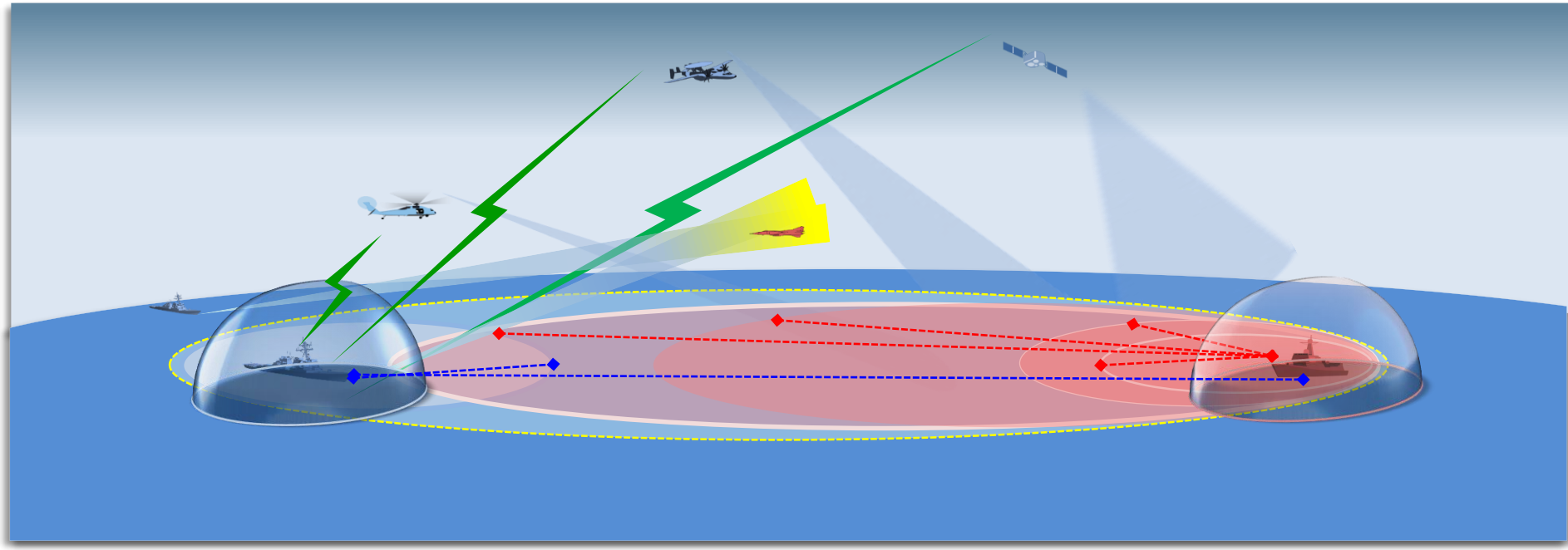
- Applications built in silos
- Data duplicated in tools causing manual re-entry
- Data locked in tools preventing ease of re-use
- Application changes slow and costly
- Functionality duplicated across tools causing inconsistencies and difficulty in coordinating business process changes
- Can't tailor to support unique process across business units
- Similar functionality reinvented over and over again at great cost

Tomorrow: The Composable Business

- Infrastructure enables tailored applications while maintaining consistent core business rules and data
- Applications "composed" from reusable services
- Consistency of Data and Business Rules across Business Operations
- Agility in supporting rapid Business Process changes
- Lightweight services with short development lifecycle
- Individual Services "owned" by Authoritative Competency



USN vs PLA(N) Capability Fielding



We’re Being Out-Sticked

USN Warfighting Advantage Against PLA(N) has Steadily Eroded