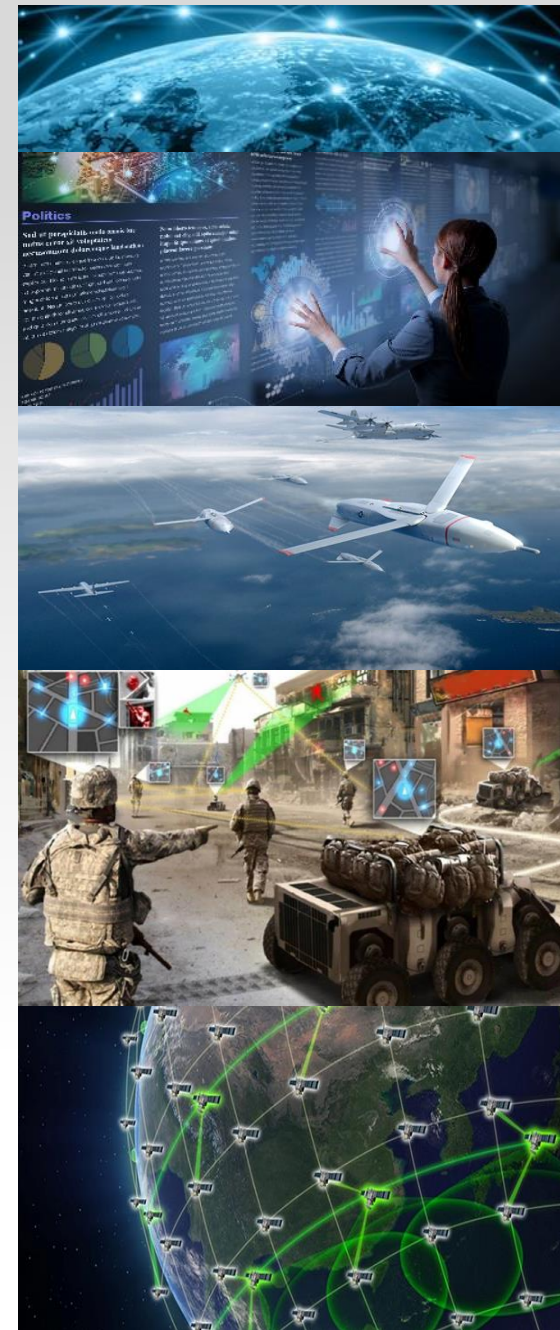




Mission Focused Engineering

Mr. Dean Ridgely

Chief Engineer, Space & Missile Defense,
Engineering, OUSD(R&E)





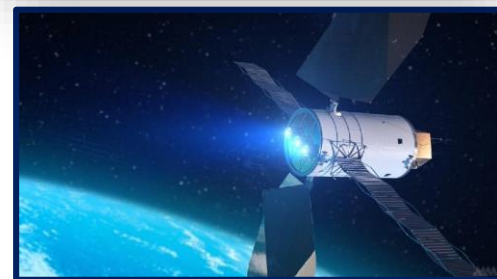
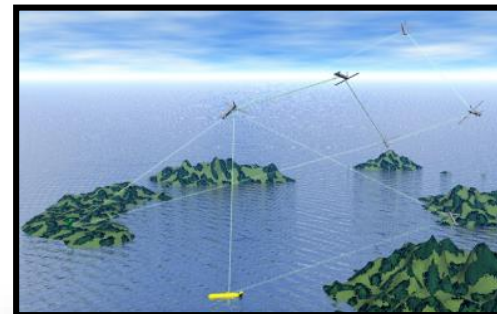
USD(R&E) Mission

■ Ensure Technological Superiority for the U.S. Military

- Set the technical direction for the Department of Defense (DoD)
- Champion and pursue new capabilities, concepts, and prototyping activities throughout the DoD research and development enterprise

■ Bolster Modernization

- Pilot new acquisition pathways and concepts of operation
- Accelerate capabilities to the Warfighter



“Our mission is to ensure that we, if necessary, reestablish and then maintain our technical advantage.”

– Under Secretary Griffin, April 2018

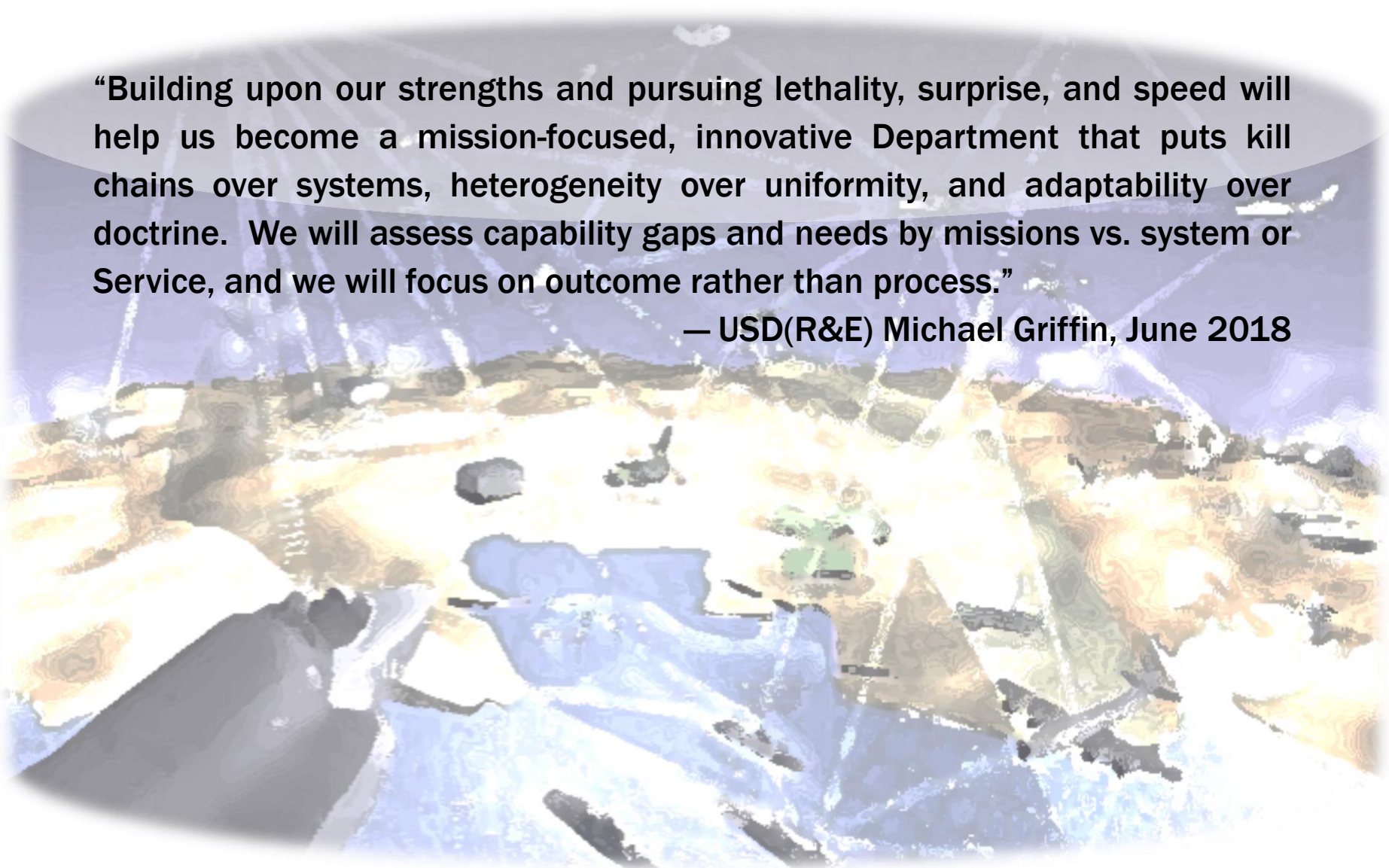


The Challenge



“Building upon our strengths and pursuing lethality, surprise, and speed will help us become a mission-focused, innovative Department that puts kill chains over systems, heterogeneity over uniformity, and adaptability over doctrine. We will assess capability gaps and needs by missions vs. system or Service, and we will focus on outcome rather than process.”

— USD(R&E) Michael Griffin, June 2018





Congressional Push to Change

MISSION INTEGRATION MANAGEMENT



CONGRESS FOUND LACKING:

- Mission-based input to requirements process, concept assessment, portfolio management
- Demonstrations/experiments for compelling challenges and opportunities
- Management of major system interfaces (Title 10, Sec 2446c, Modular Open Systems Approach [MOSA])
- Technical infrastructure for engineering analysis, data, modeling, and simulation
- Ability to compose systems of systems on demand
- Stovepiped Concepts of Operations (CONOPS) and Operational Plans (O-Plans); lack of coordination

R&E MISSION ENGINEERING APPROACH:

- ➡ ▪ Mission-based solution analytics (concept through deployment)
- ➡ ▪ Mission blueprint(s) to guide technology maturation, prototypes, exercises
- ➡ ▪ Modular design based on mission growth enabled by MOSA strategy
- ➡ ▪ Ecosystem to share/reuse tools, data, modeling, and analytics
- ➡ ▪ Research and new automated tools to trace/reroute system interdependencies
- ➡ ▪ Partner with Joint Staff and Combatant Commanders on CONOPS, Concepts of Employment (CONEMPS), and O-Plans

Portfolio management focused on DoD's missions, rather than programs

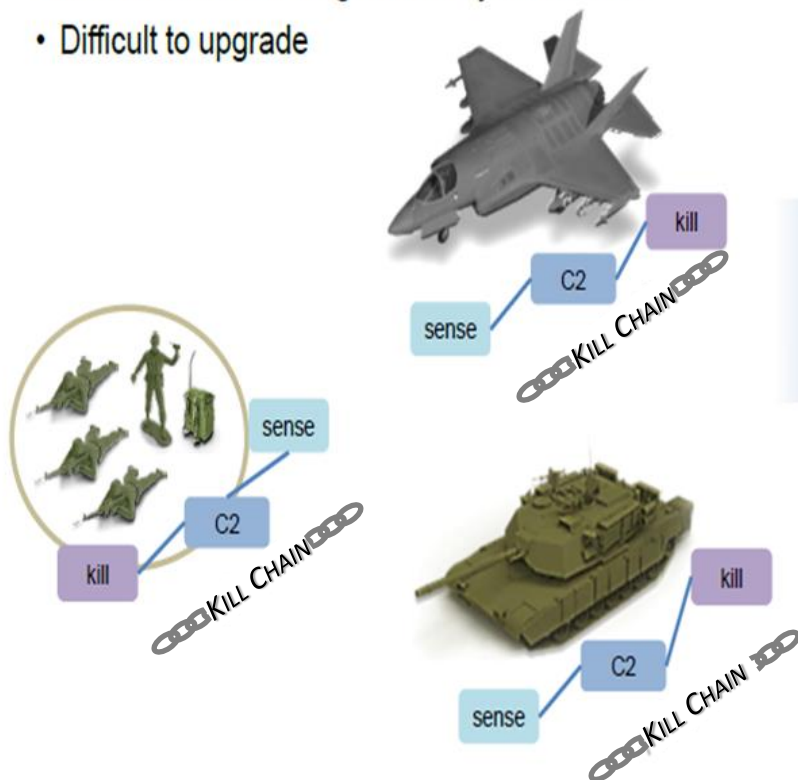
Sources: Sec. 855. 10 U.S.C. 2358 Mission Integration Management; House Report 114-840 NDAA for FY2017 Conference Report to Accompany S. 2943.

Re-aligning R&E to key national defense mission focus areas: Close Air Support; Air Defense/Counter-Air; Interdiction; Intelligence, Surveillance, and Reconnaissance

Engineering the Mission: Emphasize End-to-End Effects

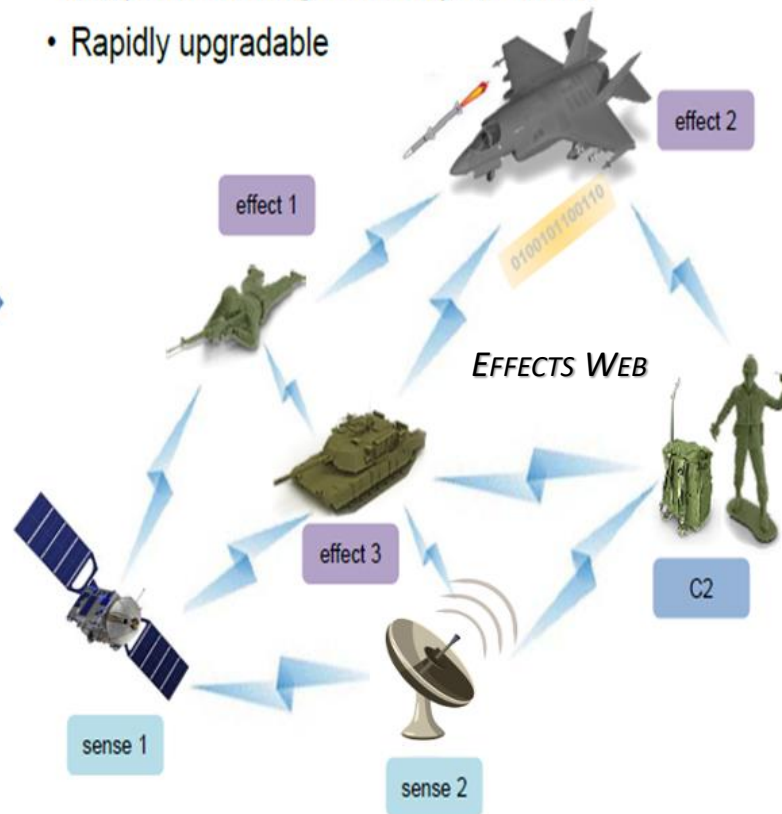
From Monolithic Kill Chains...

- Risk centralized in monolithic platforms
- Vulnerable to evolving adversary kill-chains
- Difficult to upgrade



To Adaptive Kill Webs...

- Risk distributed across manned/unmanned platforms
- Adapts to evolving adversary kill-chains
- Rapidly upgradable



- In today's acquisition process, programs are matured independently
- System-of-systems integration occurs when delivered

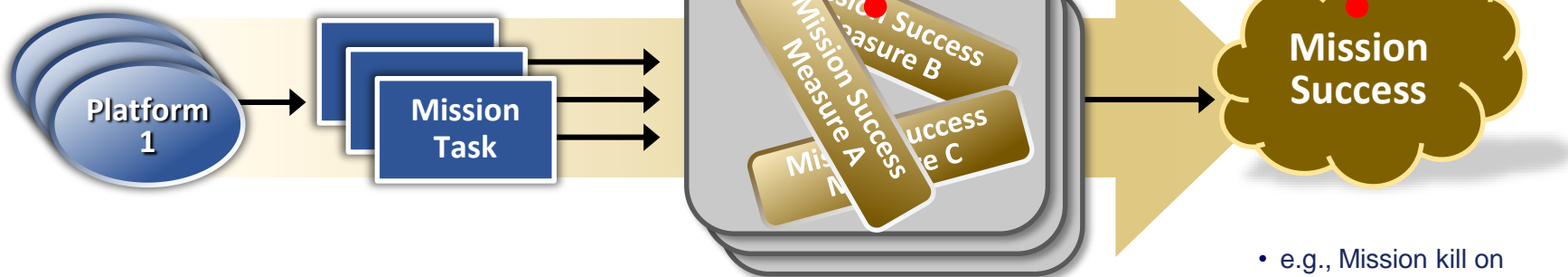
Optimize enterprise effects vs. platform effects



Mission Blueprint - Success Measures

Today's acquisition path with system / platform engineered focus

Platforms' support of the mission task and success is defined after the system is fielded; Results are mixed

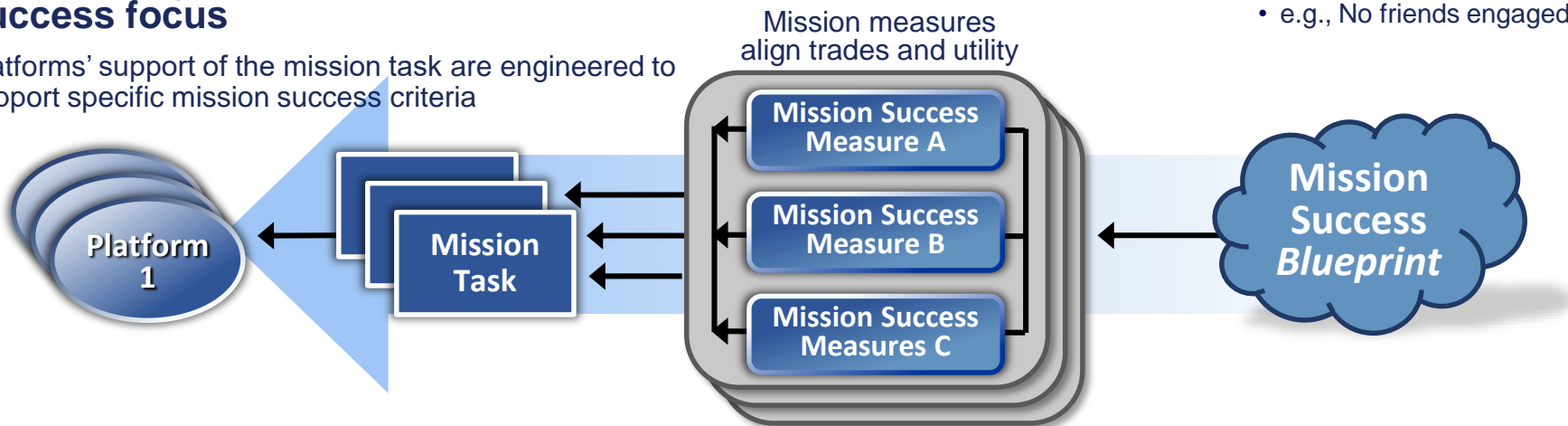


Utility assessed after system is delivered and all trades have been made

- e.g., Mission kill on every target in the raid
- e.g., No friends engaged

Mission Engineered path with mission success focus

Platforms' support of the mission task are engineered to support specific mission success criteria

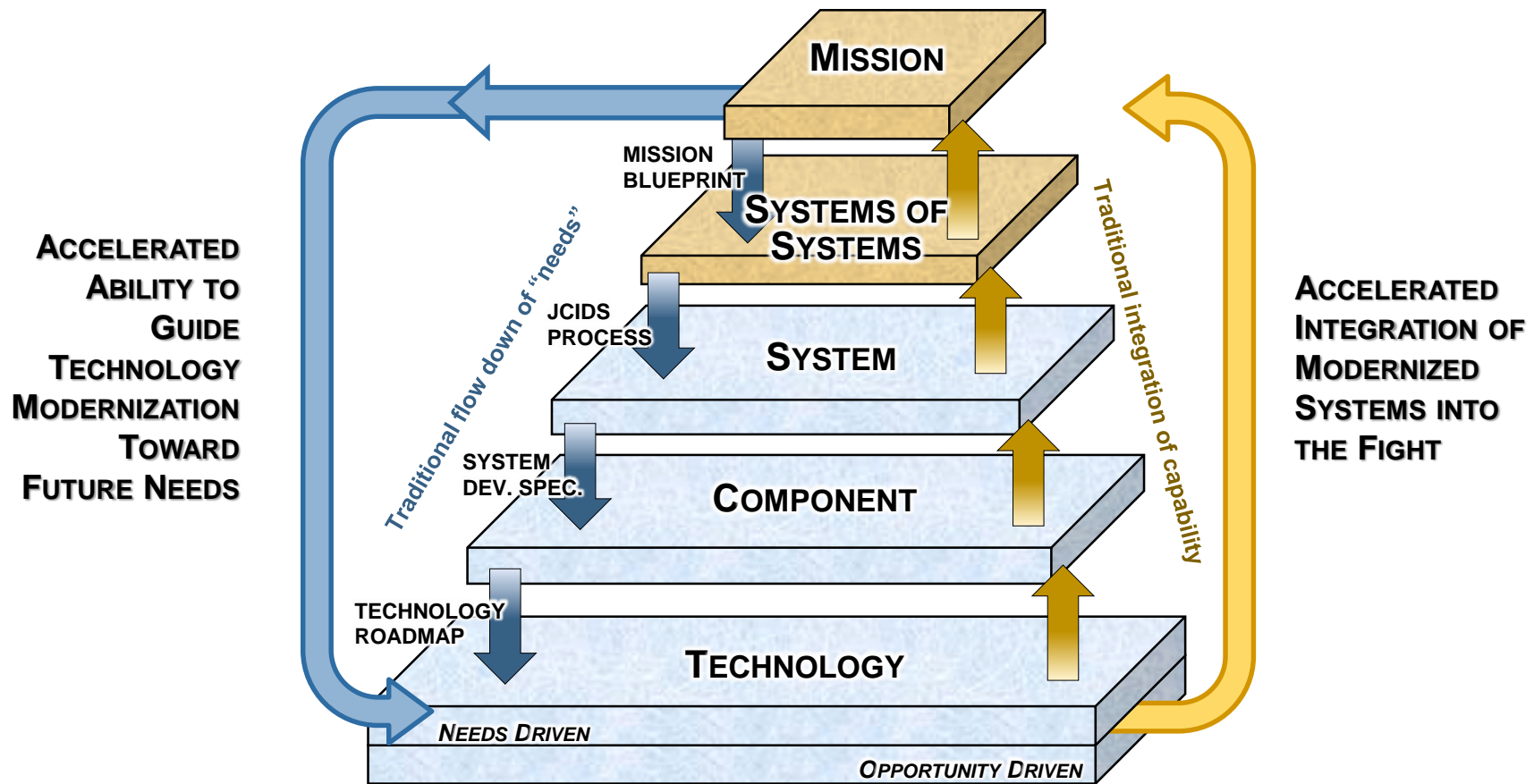


As platforms are developed their contribution to the mission can be scored against Mission Success Measures; Enables mission-based informed trades and funding prioritization



Mission Engineering

Enabling Accelerated Systems Engineering



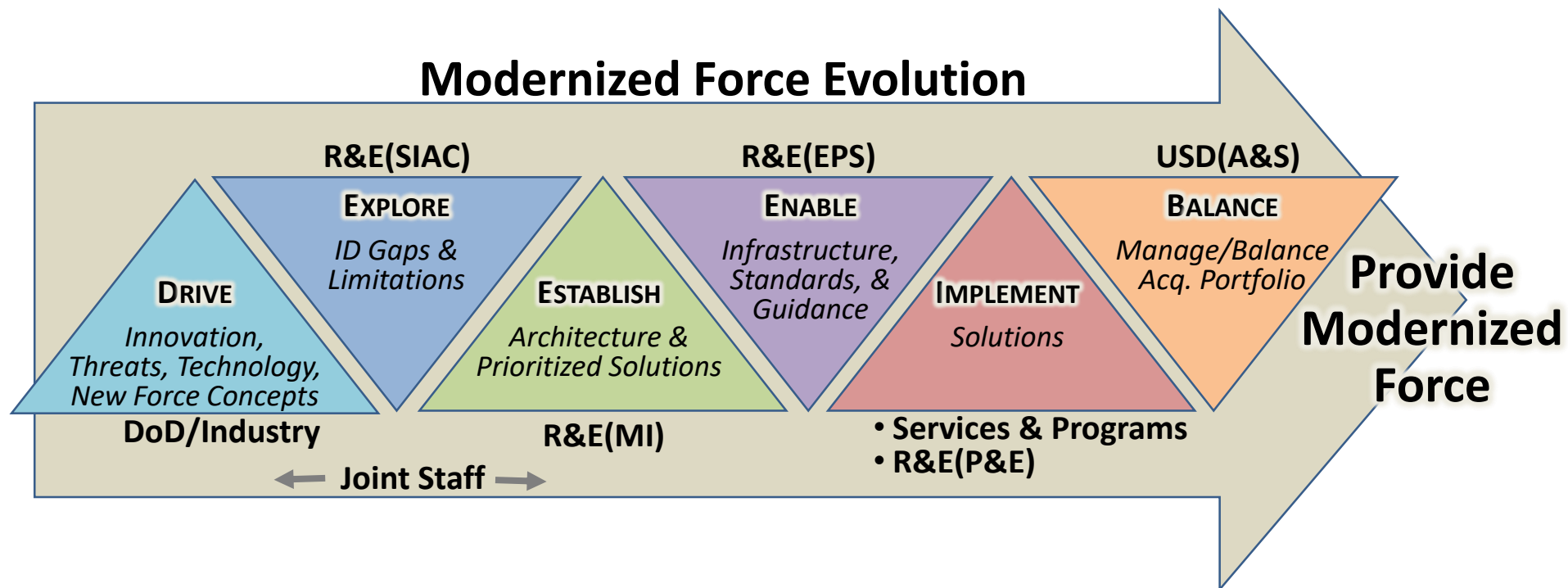
Focus on mission vs. systems' effectiveness
Accelerated ID of technology needs; accelerated integration of technology opportunities



Aligning Modernized Force Development



Modernized Force Evolution

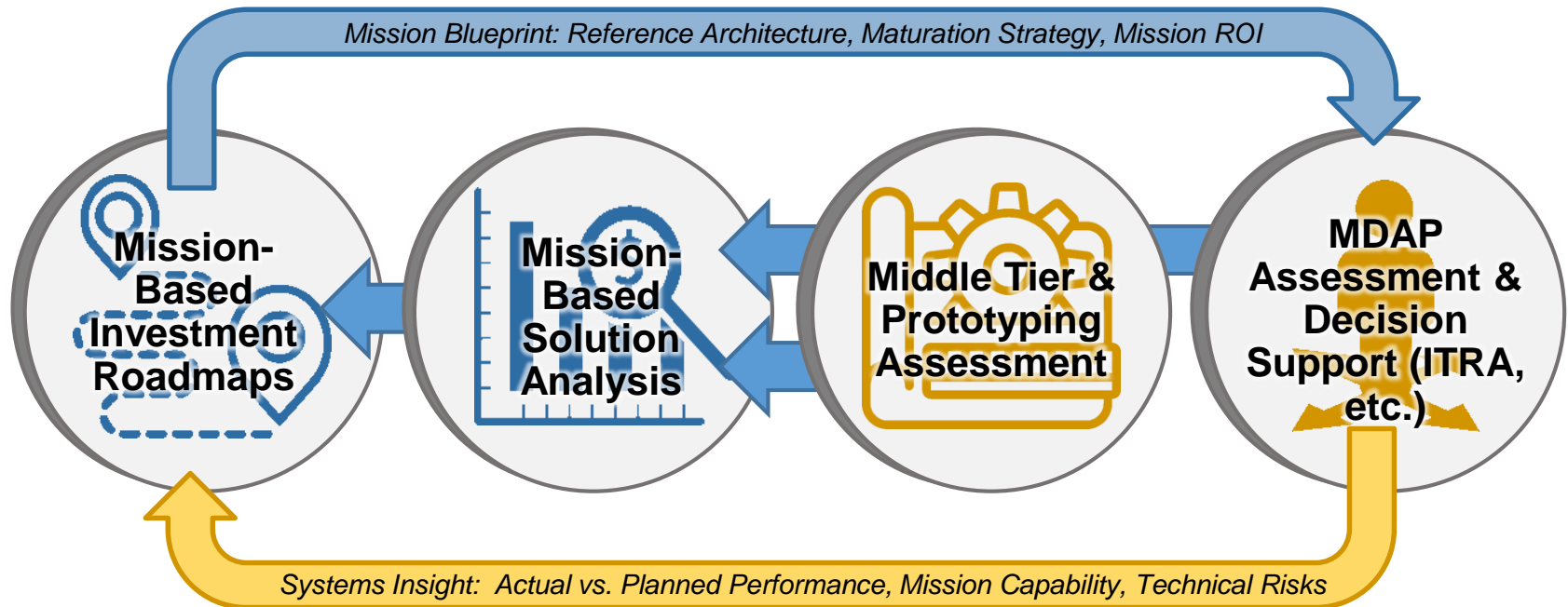


Streamline and align development efforts along a unifying Mission Architecture to more rapidly provide a Modernized Force



Interrelated ME and Capability Integration

MISSION ENGINEERING

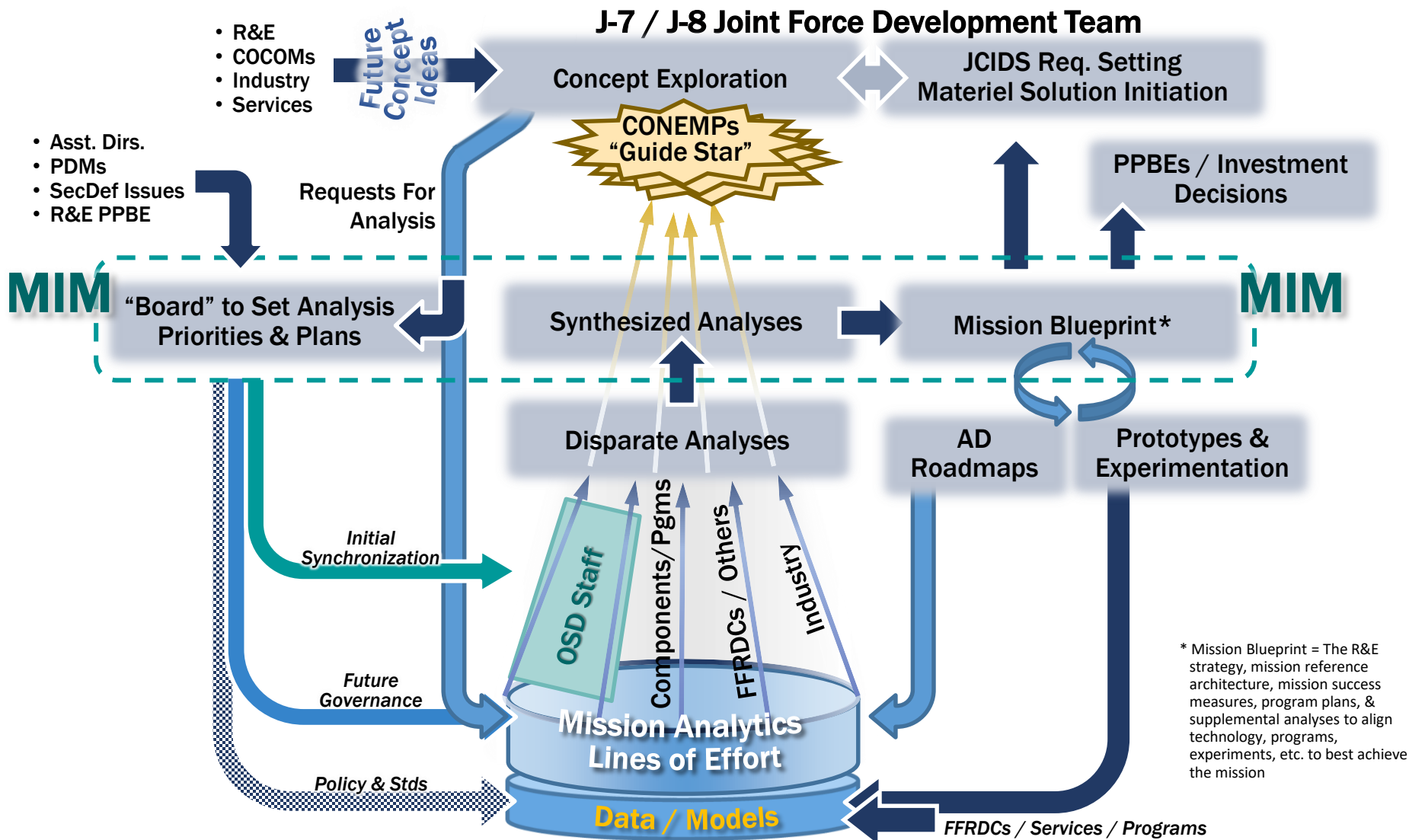


CAPABILITY INTEGRATION

Mission Engineering and R&E risk assessment are two sides of the same coin — insight from ongoing program engagement informs ME analysis, and vice versa



Mission Integration Management



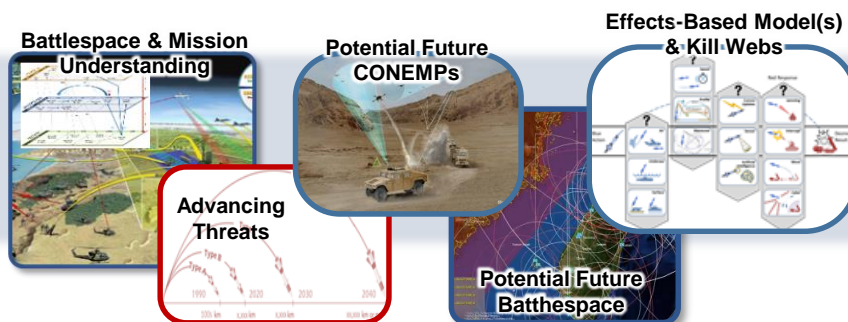


The Mission Blueprint

The Products of Mission Engineering

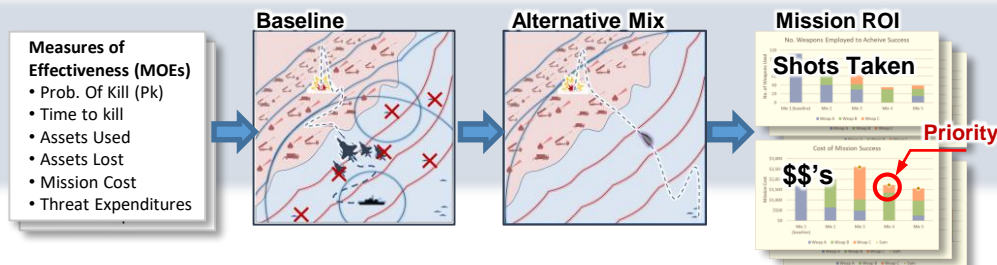
Mission Description

- CONEMPs & Operational Context
- Conceptual Capabilities
- Mission Analysis “Guide Star”



Mission Return on Investment

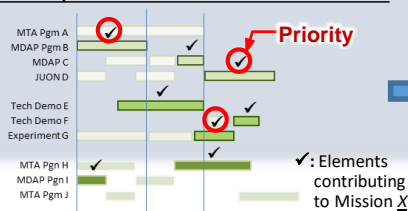
- Analytics to Determine Efficacy
- Substantiation for Prioritization



System Maturation Strategy

- Sequencing/Opportunities
- Funding Alignment

Which Systems and When to Deliver to achieve ROI



Mission Reference Architecture

- Resulting Optimal Implementation
- “Guide Star” for Requirements, Programs, Test Infrastructure, Prototypes, Technology, etc.





Mission Engineering Process

Mission Characterization

Problem Statement

E.g. What is the capability improvements of integrating currently programmed hypersonic weapons into the JSEAD mission in the 2030 timeline?

Mission Characterization

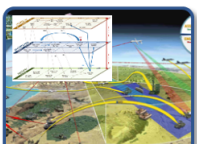
Scale the scope of the set up to match the problem need

J-Staff / CCMDs / SIAC / Other Products



Operational Construct

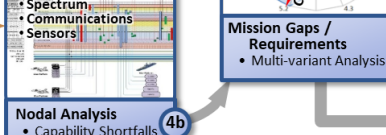
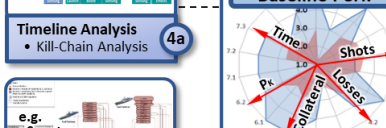
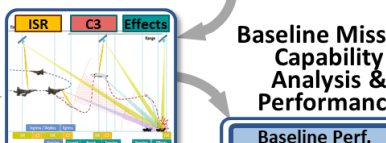
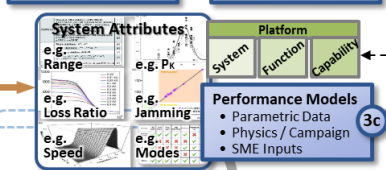
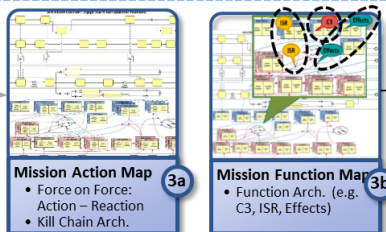
- Threat Scenario
- Forces - Red/Blue
- Strategic, Operational, Tactical Objectives
- Rules of Engagement



CONOPS

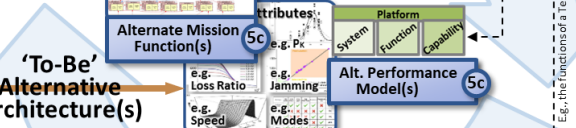
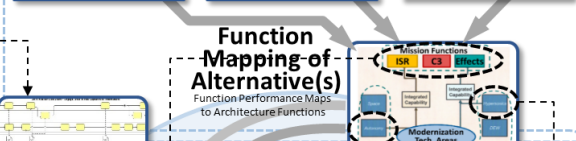
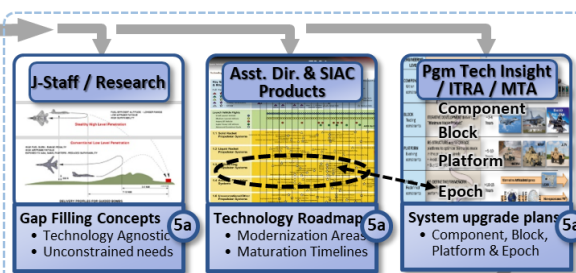
- Operational View
- Engagement Sequence
- Timeline in Geo-space

Baseline 'As-Is' Architecture and Performance Characterization

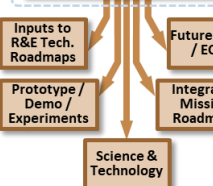
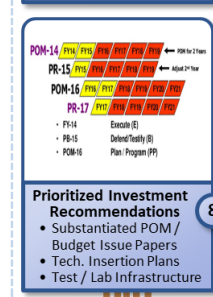
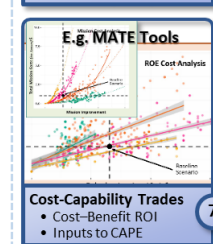
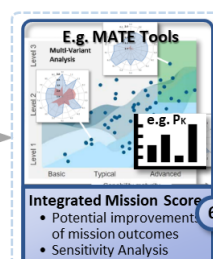


Inputs from Operations, Program Metrics/Risk, Test & Demonstration, Prototyping & Experimentation

Alternatives Performance and 'To-Be' Architecture Characterization



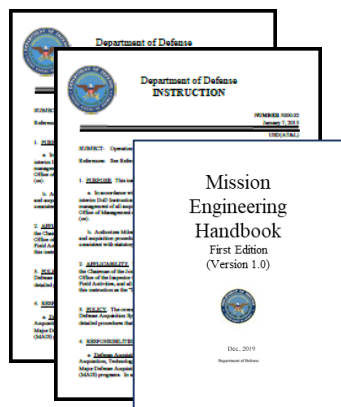
Investment Analysis and Sequencing





Implementing Mission Engineering

Roles, Policy, Guidance

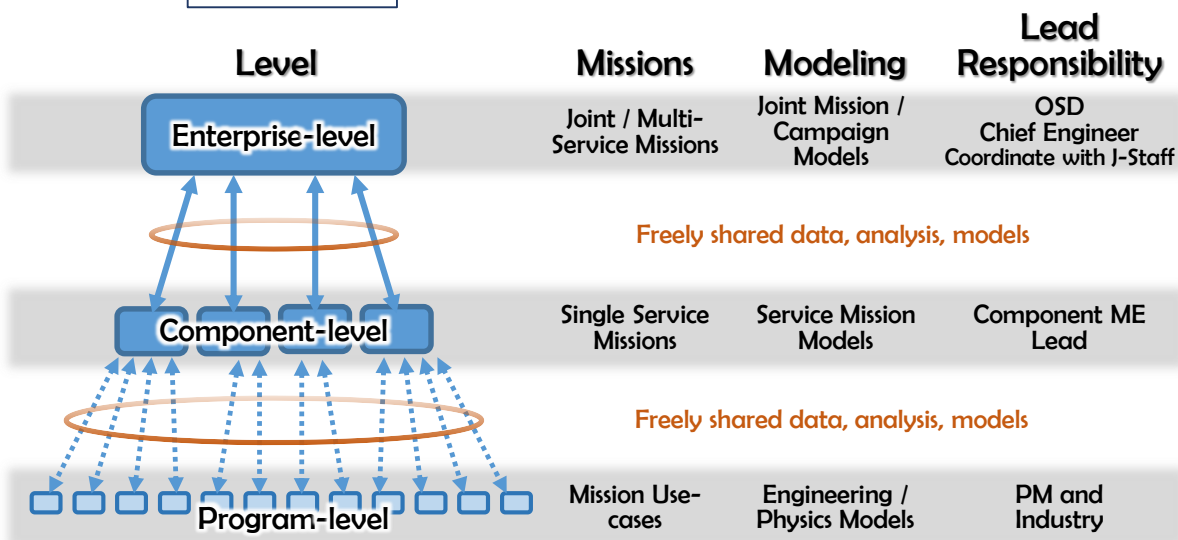


POLICY AND GUIDANCE

- DoDI 5000.02 (*Revision*)
- DoDI 5000.ENG (*New*)
- Mission Engineering and Mission Integration Management Handbook (*New*)

KEY TENETS

- Applies to all Defense Acquisition System Pathways
- Continually assess/reassess Mission Risk, Issue, Opportunity (RIO) at decision points
- Programs must come with mission analyses
- Shared data
- Shared responsibility
- Use higher-level models when applicable
- Engineer lower-levels models to support higher level models
- **TRANSPARENCY**

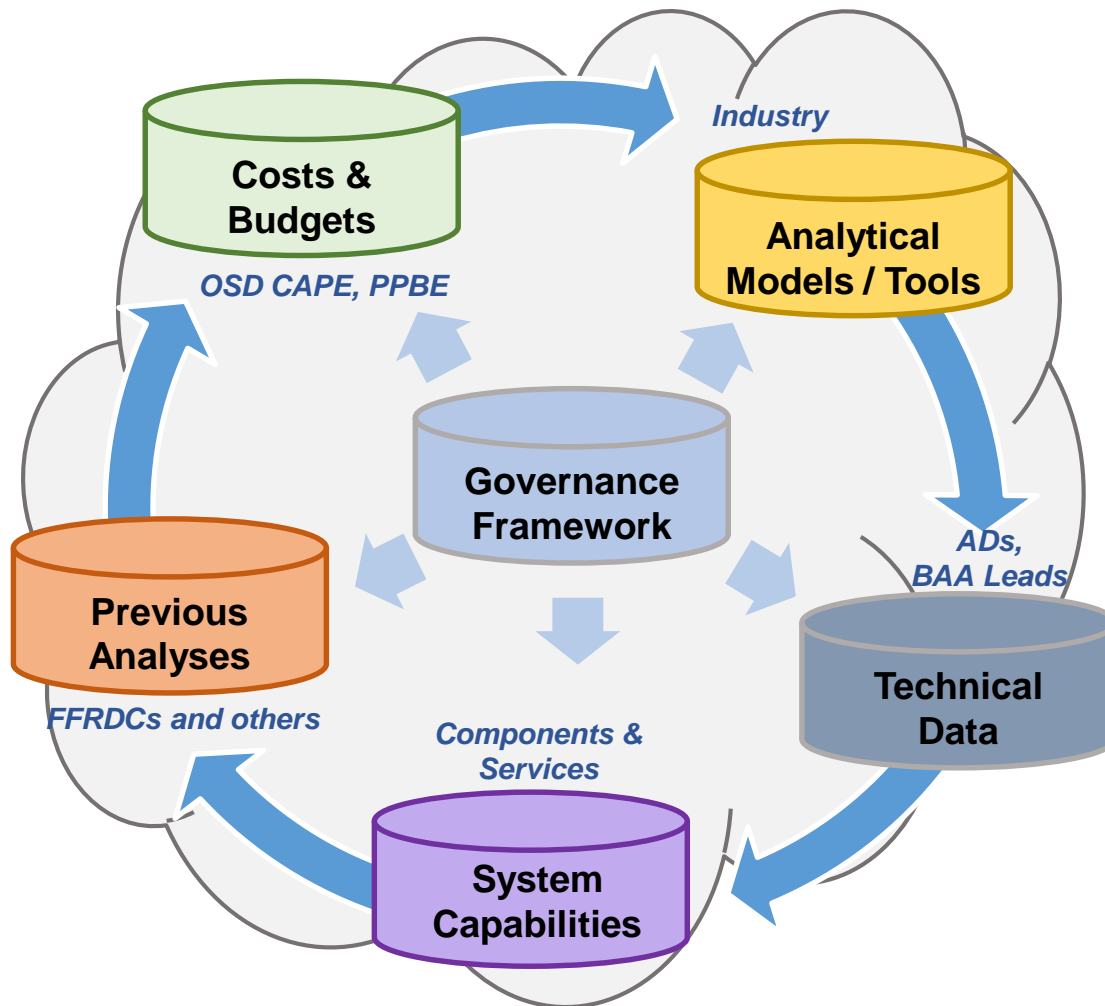


Loosely coupled, distributed implementation adhering to an integrating framework



Mission Engineering Knowledge Management

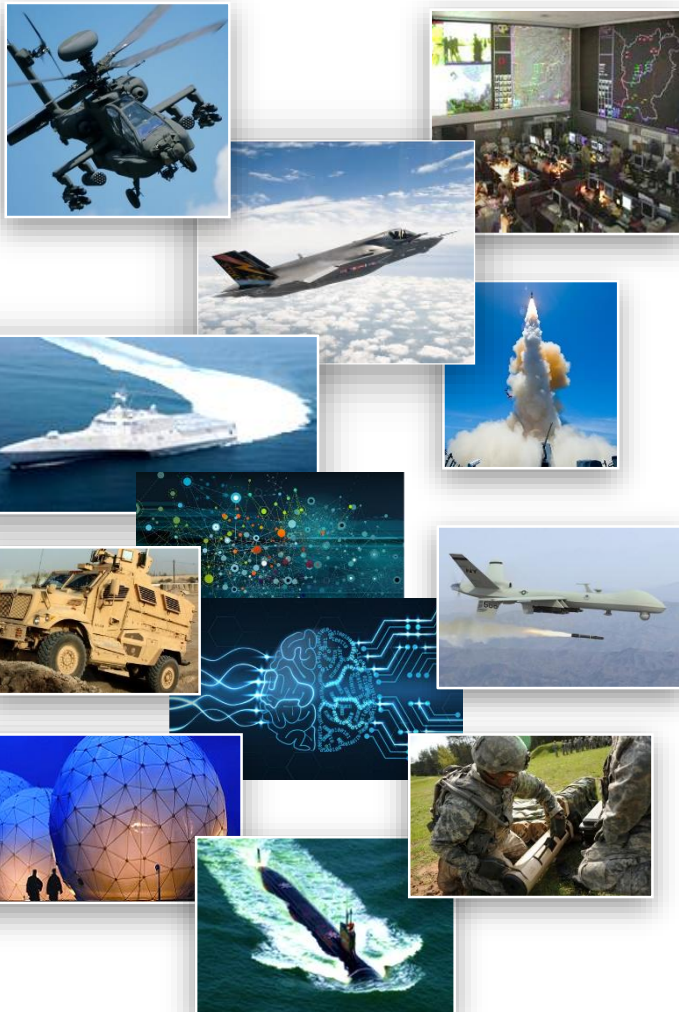
- OSD to champion infrastructure
- Transparency of program performance data
- Industry-provided design models
- Increased oversight of program interdependencies
- Collaborative mission efficacy analysis
- Curation of data – accuracy of analyses depends on pedigree of data



Need collaborative environment, tailorable software tools, authoritative models, data



Way Ahead: Challenges for DoD and Industry



- End-to-end solution sets vs. platform-centric solutions... Show the Mission return on investment
- Well-managed interdependencies ...
- Technical measures, metrics, data to track progress toward mission capability ... we can't correct what we don't know isn't going to work
- Preserve solution options later in the acquisition cycle ...
- Incentivized modularity, adaptability, availability, resiliency, security ...
- Adhere to Industry standards for data/products to improve communication/integration ...
- Need proper balance between intellectual property management and open collaboration ...
- Improved tools to enable architecture, mission interdependency, gap analyses, etc. ...

As a community we need to better address operational mission performance in acquisition



DoD Research and Engineering Enterprise

Solving Problems Today – Designing Solutions for Tomorrow



DoD Research and Engineering Enterprise
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[@DoDCTO](https://twitter.com/DoDCTO)



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Questions?

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Modernization Priorities

“We cannot expect success fighting tomorrow’s conflicts with yesterday’s weapons or equipment.”
– National Defense Strategy

- Fifth Generation Cellular Networking Technology (5G)
- Autonomy
- Biotechnology
- Cyber
- Directed Energy
- Fully Networked Command, Control, and Communications
- Hypersonics
- Machine Learning / Artificial Intelligence
- Microelectronics
- Quantum Science
- Space

For each modernization priority, a Portfolio Manager (Assistant Director) is responsible for establishing the DoD-wide, mission-focused strategy and execution plan.