

MITRE

**SOLVING PROBLEMS
FOR A SAFER WORLD**

JOINT ALL DOMAIN COMMAND & CONTROL (JADC2)

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Command & Control Needs Attention

FROM WORLD WAR II

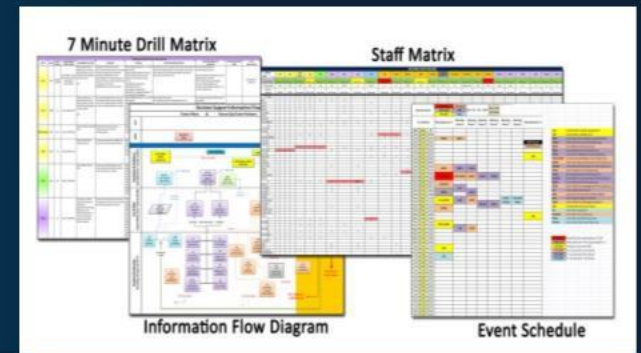
TO TODAY

COMPLICATED BY THIS

US PLATFORM
CAPABILITIES



US COMMAND
AND CONTROL
CAPABILITIES



WITHOUT BETTER COMMAND & CONTROL, WE CANNOT COUNTER ADVERSARY ALL DOMAIN OPERATIONS.

Why is JADC2 needed?

We need to understand and decide faster and better across a range of missions.

- Our way of war is predictable. Our adversaries watched and learned.
- We are reliant on individual domain supremacy, but we are contested in every domain.
- Our adversaries can control tempo and maneuver across competition and conflict.

We need to persistently target and engage our adversaries in competition and conflict.

We must be able to counter A2AD strategies to be successful.

- Execute operations using distributed and/or disaggregated forces when disrupted.
- Regain advantage of time and space.

WE CANNOT CONTINUE TO OPERATE WITH SERVICE-CENTRIC, HUMAN POWERED, STOVE-PIPED C2.

What do we need from JADC2?

A set of C2 capabilities that can be **brought together to support** a variety of mission areas in their own unique ways.

Focused on **mission-driven, context-based** understanding and decision-making.

Employs loosely **coupled interoperability** to enable data sharing.

Enables **integration** of existing platforms and **capabilities** with minimal retrofit.

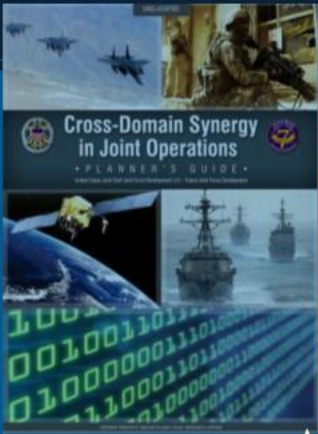
Incorporates **better data, better decision-making,** and **new capabilities** as available.

Degrades gracefully as C2 and communications are challenged – **Dynamic PACE.**

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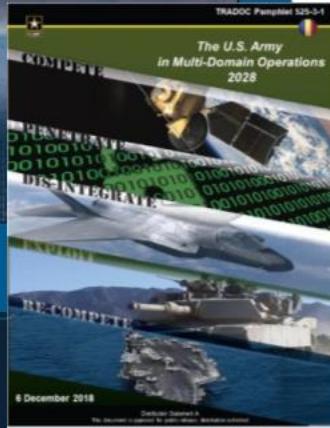
Evolution of JADC2 – A Snapshot

Jan 2016
JSJ7 Cross-Domain
Planner's Guide



Nov 2017
CSAF
MDC2 ECCT
Campaign Plan

Dec 2018
USN
DMO



Dec 2018
US Army in
MDO (RNGW Study
in 2017)

Jun 2019
USAF MDC2
Implementation Plan



Jul 2019
JADC2 JROCM

Jan 2020
DEPSECDEF
JADC2 CFT

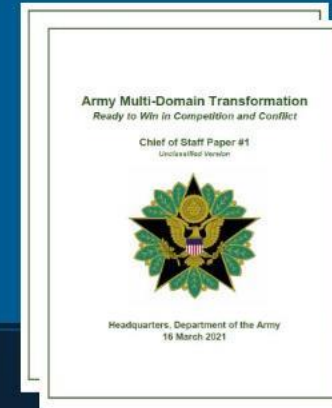


Oct 2020
CNO
Project Overmatch



Dec 2020
Navy, USMC, USCG
Advantage at Sea

Feb 2021
DEPSECDEF
JADC2 CFT Revised



Mar 2021
CSA
Papers



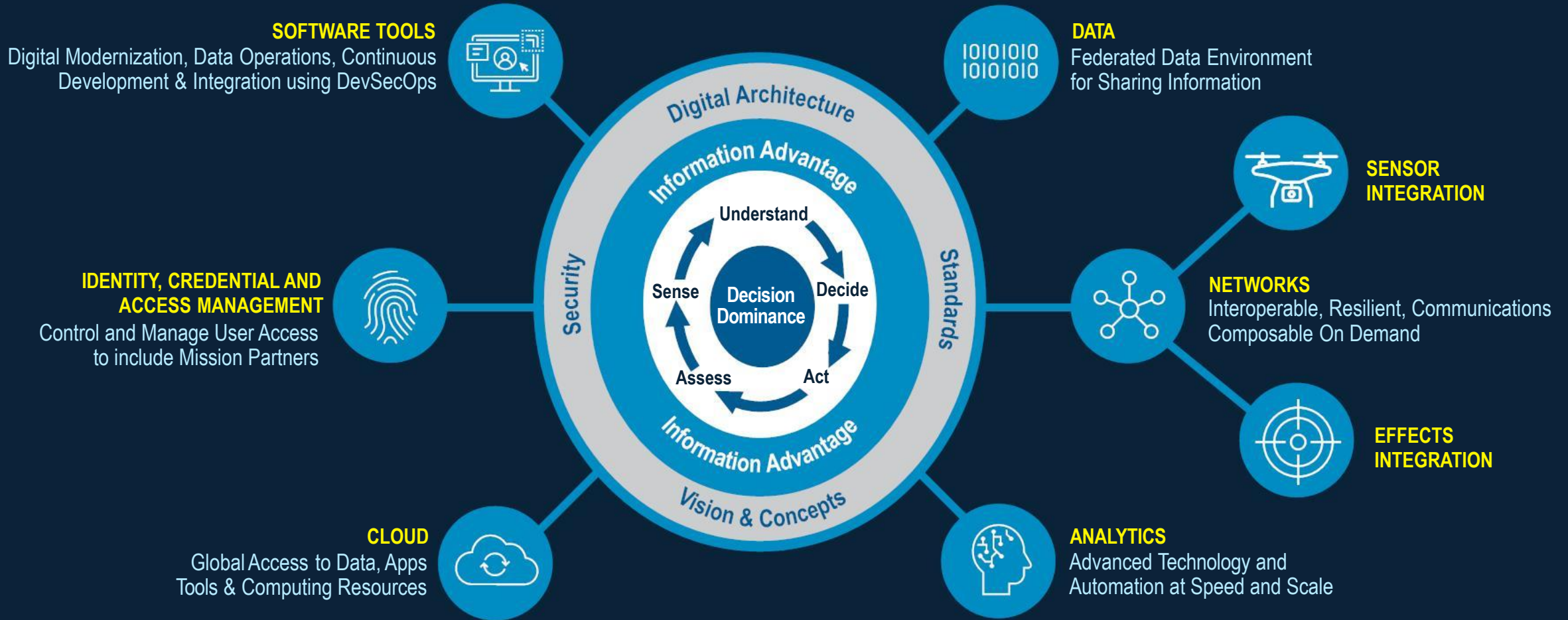
May 2021
CSAF
ABMS
Campaign Plan

JADC2 Framework – The DoD Perspective

- 2019 ● All Domain Convergence, Any Sensor to C2 to Best Shooter.
 - 2020 ● Improve decision-making at point of need, leveraging capabilities across domains, with partners, to achieve convergence at speed required.
 - 2021 ● Sense, make sense, and act at all levels and phases of war, across domains, with partners, to deliver information advantage at speed of relevance.
 - 2021 ● SECDEF Signed Strategy on 13 May with Implementation Plan in Draft.
- JADC2 is not a formal program or concept. A framework requiring C/S/A contributions that work together to improve Joint C2.

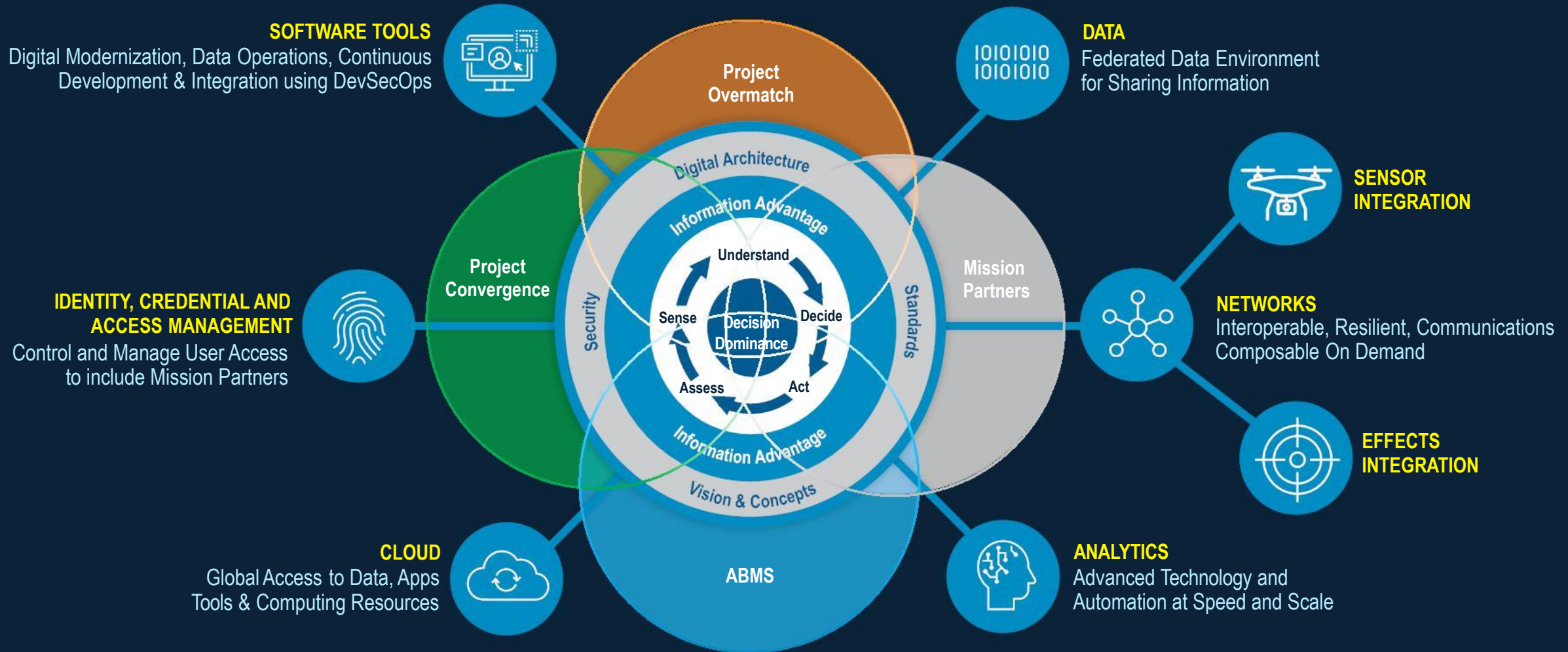


Enabling JADC2 – Envisioning the Future



Next Generation C2 & Warfighting Platform to Realize Distributed All Domain Operations

Enabling JADC2 – Cohere Service & Partner Contributions

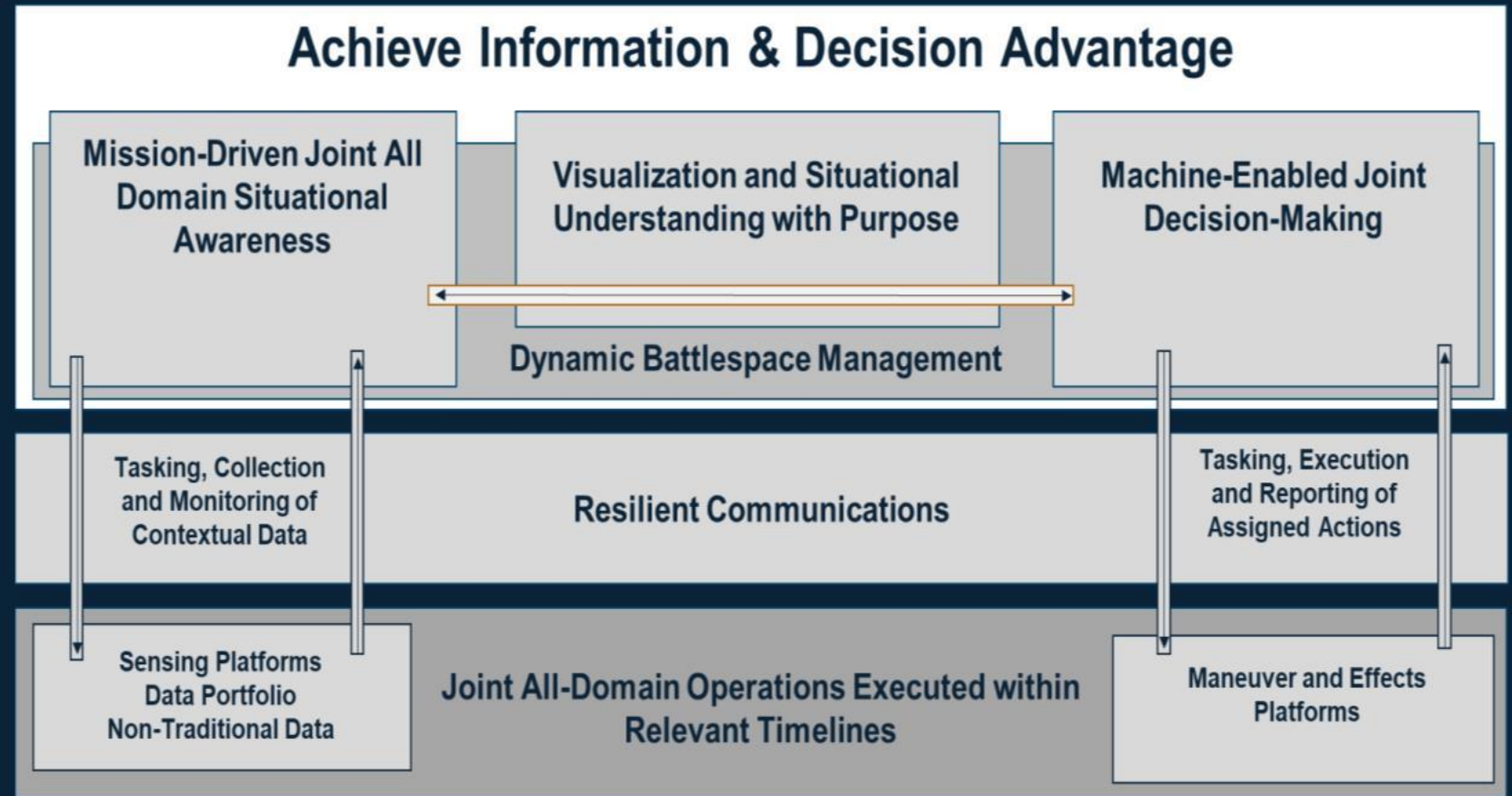


Next Generation C2 & Warfighting Platform to Realize Distributed All Domain Operations

Realizing the Future – Enable JADC2

Decision Dominance:

- Exploit all available data based on contextual need & automation.
- Enable decentralized C2 & distributed operations.
- Employ agile C2 design based on mission & composability.
- Optimize resource use through human-machine teaming.



Enable All Domain Convergence with Near-Term Emphasis on Massed, Simultaneous Engagements to Defeat A2/AD and Fleeting Targets

BE FASTER, WITH GREATER PRECISION, AND WITH A HIGHER PROBABILITY OF SUCCESS!

Realizing the Future – Start with a North Star

Effects

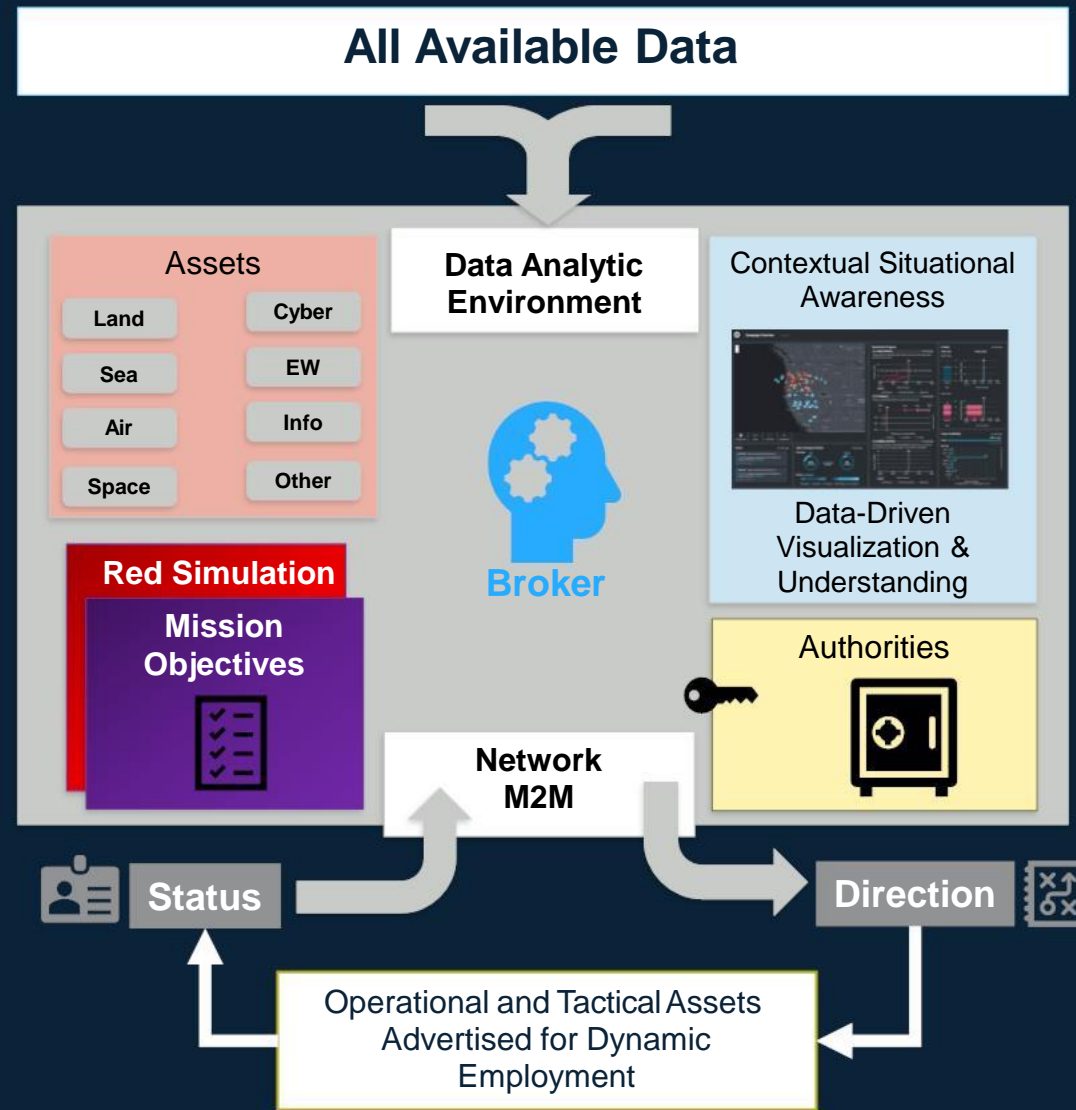
Actions or capabilities applied to adversaries to modify their behavior, posture, or abilities.

Can be applied by **effectors** at all levels of conflict.

- Lethal
- Kinetic
- Non-lethal
- Non-kinetic

Broker

A human/machine construct that acts as an agent to optimally fulfill all requests for and upon decision authorizes delivery of **optimized solutions** to Asset requests.



Asset Market

Ingests situational **awareness** information.

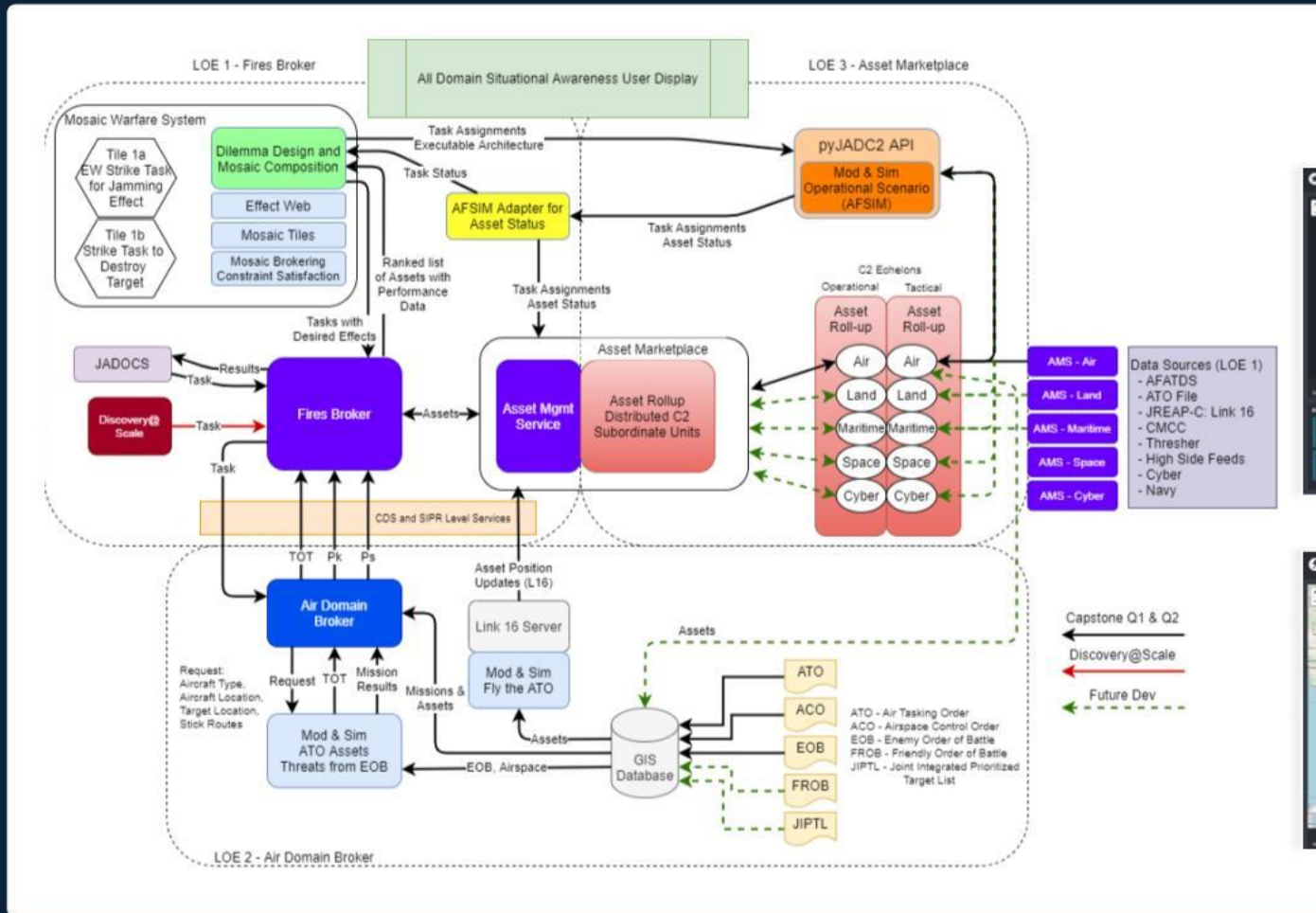
Contains dynamically updated inventory of **effectors and sensors with operational status**.

Includes **domain and warfighting functional brokers** to accelerate kill chains and operational workflows and decisions.

Brokers work in concert with visualization of the situation, mission, intent, asset status, and attack guidance to develop **optimized options** to address effects requests.

Enables access to **authorities necessary for employment of effects** – build towards conditions-based authorities construct.

JADC2 Functional Architecture – Making it Real

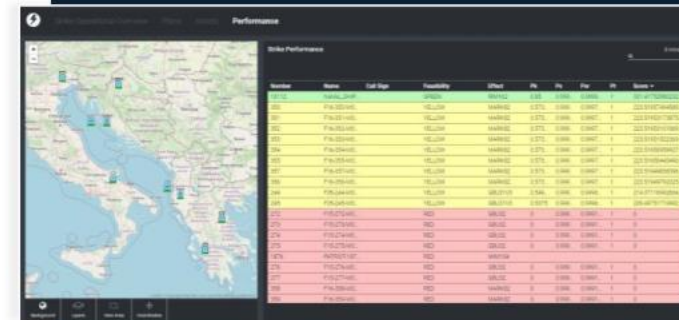


*Starting Point for Next Gen C2.
Technical Reference Architecture.*



Context-Based Awareness via Data and Workflow Automation

User-Focused Customizable Displays



Model Enabled Decision-Making with Brokers and Mosaics

Creating Decision Space and Speed across Domains

WE ARE OPERATIONALIZING OUR JADC2 VISION AND DEMONSTRATING A PATH TOWARDS ACHIEVING INFORMATION AND DECISION ADVANTAGE.

JADC2 is a MITRE Internal Priority – Investments ~\$5M

INTERNAL RESEARCH & DEVELOPMENT PROJECT

JADC2 Functional Architecture Research and Prototyping

JADC2-NC3 Integration Study

Joint Electromagnetic Spectrum Operations and Data Sharing

JADC2 Experimentation Environment

Mosaic Warfare Research and Prototyping

Option Awareness for Agile Combat Employment

AI Enabled Courses of Action (COAs)

Logistics Models for Joint Agile Combat Employment

Universal Awareness for IoT-based Decision Support

- Advancing critical JADC2 concepts and capabilities.
- Addressing key operational & technical risks.
- Partnering with direct funded projects to maximize impact.
- Seeking industry partners for development and transition.

**COMPLIMENTARY WORK EXECUTED WITH A COMMITMENT TO COLLABORATION
AND A COMMON GOAL OF ADVANCING JADC2!**

Applying DoD guidance to Joint All Domain Operations

DoD Data Decrees*

1. Maximize data sharing and rights for data use: all DoD data is an enterprise resource.
2. Publish data assets in the DoD federated data catalog along with common interface specifications.
3. Use automated data interfaces that are externally accessible and machine-readable; ensure interfaces use industry-standard, non-proprietary, preferably open-source, technologies, protocols, and payloads.
4. Store data in a manner that is platform and environment-agnostic, uncoupled from hardware or software dependencies.
5. Implement industry best practices for secure authentication, access management, encryption, monitoring, and protection of data at rest, in transit, and in use.

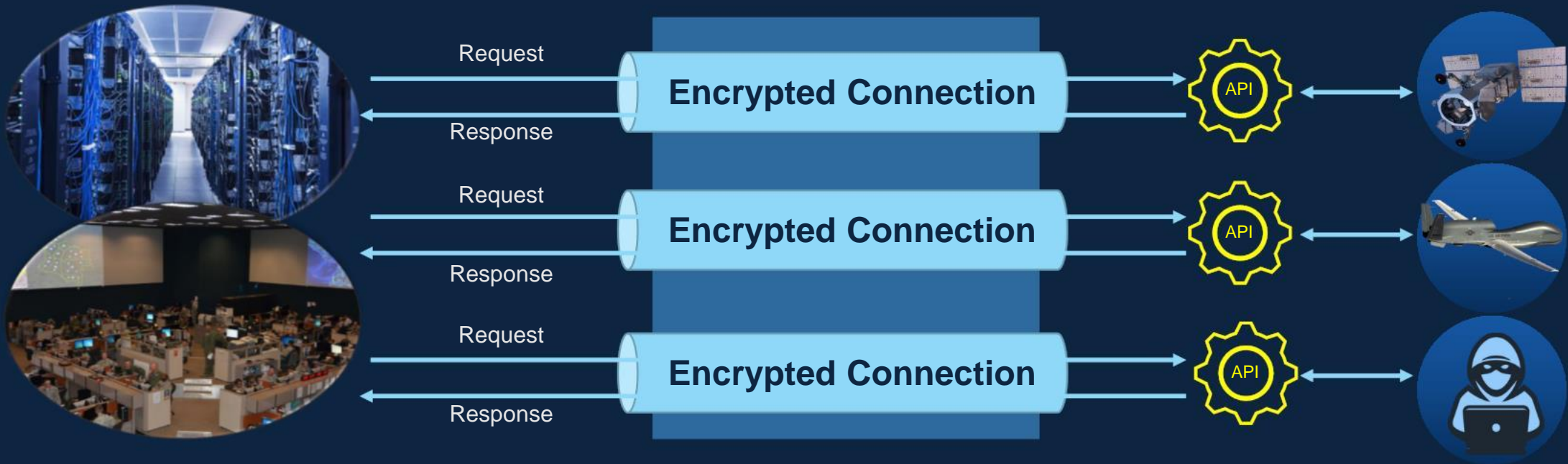
MITRE's JADC2 Data Approach

- Expose data and services via open interfaces to enable access and discovery (1, 2, 3, 5).
- Convert data into meaningful information – move attributes not raw data when possible (4).
- Push compute infrastructure to edge for processing data close to source (4).
- Align data and automation to functional areas solve operational problems.

*DoD Data Strategy 21 MAY 2021

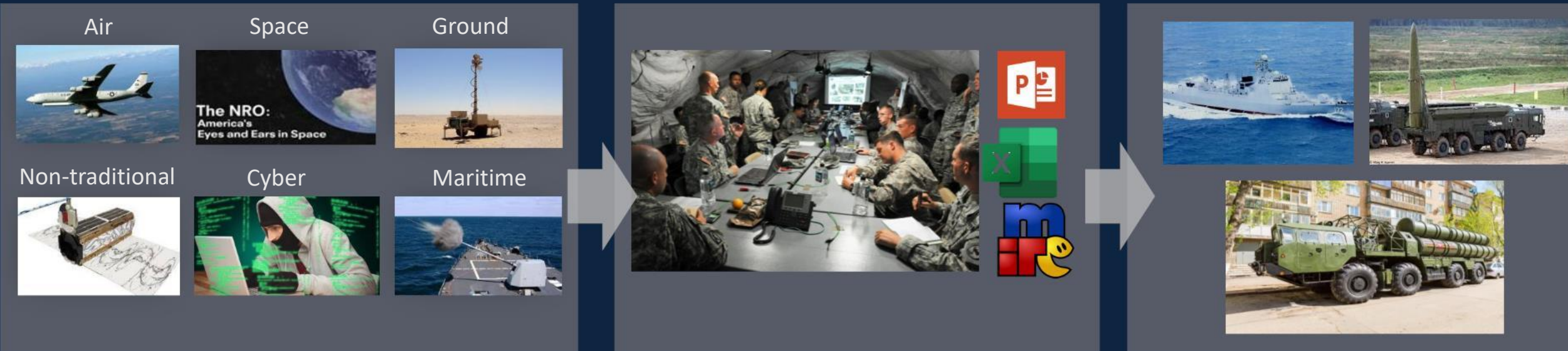
Securely Exposing Data – Application Programming Interface

- Require new systems expose data with documented interfaces.
- Prioritize building APIs to legacy systems driven by specific mission needs – unlock underutilized data.
- Approach is agnostic of centralized vs. decentralized data strategy.



LOOSE COUPLING OF DATA SOURCES TO DATA CONSUMERS

JADC2 Collaboration on Digital Engineering



Advanced Capabilities

Antiquated C2 Processes

Highly Relocatable Targets

- There is a *significant* amount of work to be done in order to operationalize JADC2.
- Making tangible progress will only happen through a collective and collaborative effort and approach.
 - Technology developments taking place within industry could help the DoD get there quicker.
- Potential touchpoints and collaboration.
 - Common Mission Engineering products (scenarios, mission threads, process models, data analytics).
 - Shared experimentation and decision-aiding infrastructure (models, AI/optimization/learning algorithms).

MITRE JADC2 Experimentation Environment

- Originally developed through MITRE IR&D.
- Utilizes fast, extensible GOTS software.
- Informs evolution of JADC2 concepts and capabilities including non-materiel aspects.



Generate mission effectiveness metrics through experimentation with:

Current (live) and future (virtual) C2 services, platforms, and effects

Interfaces with APIs for C2 supporting functions

Human in the loop interaction

Novel course of action generation

MITRE research

MITRE JADC2 Experimentation Environment Partners

Partners

- **MITRE IR&D**
 - FFRDC Collaboration
 - Industry Partnerships
-
- Air Force Futures
 - ABMS
 - Army Futures Command
 - Project Convergence
 - OSD, OUSD R&E
 - NRO/AS&T (Planned)

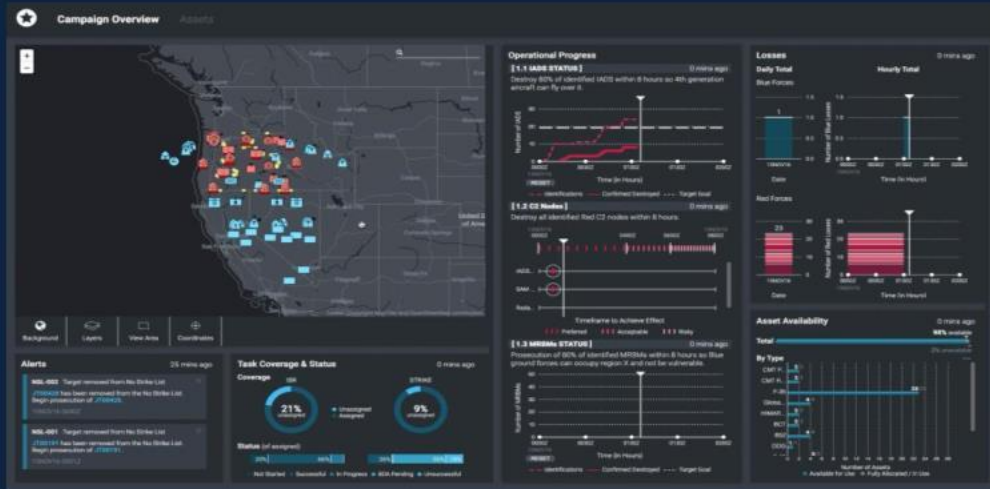
Problems Addressed

- Where can we automate and optimize to reduce timelines?
- How do next generation C2 prototypes perform relative to legacy C2 systems?
 - Centralized vs. decentralized C2, federated decision-making via asset markets and brokers
 - Proposed all domain C2 structures and organizations
- **How feasible is machine-aided all-domain task brokering?**
 - ISR, Strike, IAMD, Space, Contested Logistics
- How can we develop situational awareness from rapidly updated data?
 - API research
 - Data Automation with Integrated Analytics
- How can we test performance of C2 prototypes?

COLLABORATION MOVES CAPABILITIES FORWARD.....FASTER!

Thoughts for the Future

We Need a New COP Paradigm



See, understand, and act first via mission-driven, contextual awareness, temporal/spatial visualization, machine-aided understanding.

- Integration via data operations and automation with purpose.
- Focus on data gaps not data on hand.
- Machine-to-machine sharing of core data.
- AI and automated planning capabilities to rapidly assess and convey COAs.

Enable All Domain Convergence

Deliver Integrated, Layered Non-Kinetic/Kinetic Effects in Competition and Conflict.

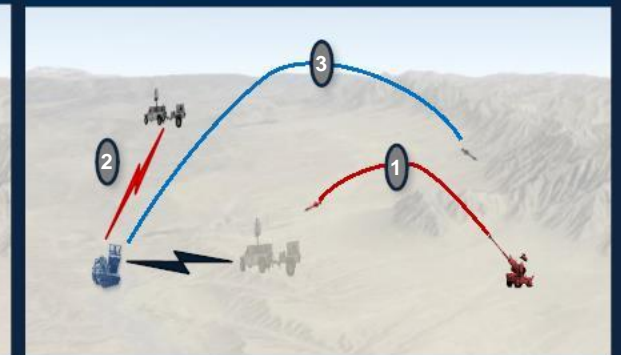
- Brokered Assets using Advanced Algorithms (Dynamic Asset and Options Awareness, mission relevant AI/ML).
- Enable Resiliency via Composable Effects Chains, Decouple Data, Networks and Systems.
- Build Interoperability on Demand – Network Diversity.

Efficient Asset Utilization in Complex Battlespace



ISR tip-and-cue, synchronized effects, optimal effect-target pairings

Rapid Re-planning in Response to Changing Battlespace



Generate, modify, and execute Fires at operationally-relevant time scales

JADC2 is a Wicked Problem.....

Each Service has modernization efforts underway addressing Service-specific challenges and requirements.

JADC2 CFT is establishing a strategy, implementation plan, architecture.



Defense-Industry-
FFRDC-UARC
Partnership



Services are collaborating. Pursuing opportunities for "Combined" JADC2.

SYSTEMS ENGINEER & INTEGRATE HORIZONTALLY & VERTICALLY TO MAKE JADC2 SUCCESSFUL!

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