

What is your background and how did you get into the DoD tech business?

I have a computer systems engineering and military systems and operations analysis background and have been providing C4ISR engineering and enterprise architecture support to various DoD entities for the past 30 years, 21 of those with the MITRE Corporation. I began my career right out of college supporting the Army's Tactical C2 Systems Engineering and Integration effort where we sought to establish a Force Level Control construct that linked the various battlefield functional area control systems like fires, air defense, intel. We can look at the analytics we conducted to define and implement Force Level Control and its lower echelon components (FBCB2, CVC2) as a predecessor to what we seek to achieve today with JADC2. How can we bridge this very diverse, distributed force in terms of functionality, data, enabling communications and supporting IT.

We conducted some of the earliest data standardization and data management studies for the Army and NATO and developed prototypes to automate the military-decision making process with an emphasis on data-driven vs message text format-driven information. That work exposed me to the complexity that exists within industry provided solutions and the need to be open, modular, and non-proprietary.

I spent several years supporting Army Digitization as part of Force XXI and led C4ISR architecture and operational design activities for the Stryker Family of Vehicles and Stryker Brigade Combat Team. That experience highlighted to me the importance of the non-materiel aspects of C2 and warfighting. We must innovate along both axes – the art and science of warfare. The revolution in military affairs spans technology and organizational innovation. The human capital component and how IT helps us exploit that capital is critical and cannot be understated.

I have had the opportunity at MITRE to work as an individual contributor, a project leader, a portfolio manager, and a resource manager. Since April of last year, I have been MITRE's JADC2 Cross-Cutting Outcome Lead and am tasked with establishing our NSEC FFRDC perspective and recommended strategic approach to advance JADC2. That includes managing our internal research and development efforts, shaping direct funded work across our DoD sponsors and collaborating with industry and other FFRDCs to bring clarity of purpose and unity of effort to bear. I view my current role as part strategist, part IT and force design futurist, and part technology collaborator.

What new technologies do you see as critical for the DoD?

From a JADC2 perspective the critical challenge is how do we achieve and sustain Decision Dominance over the adversary? We must do this across the continuum of competition and conflict. That requires the ability to deliver fast & effective sense and decision-making at the point of need efficiently leveraging all available data and capabilities to achieve operational objectives.

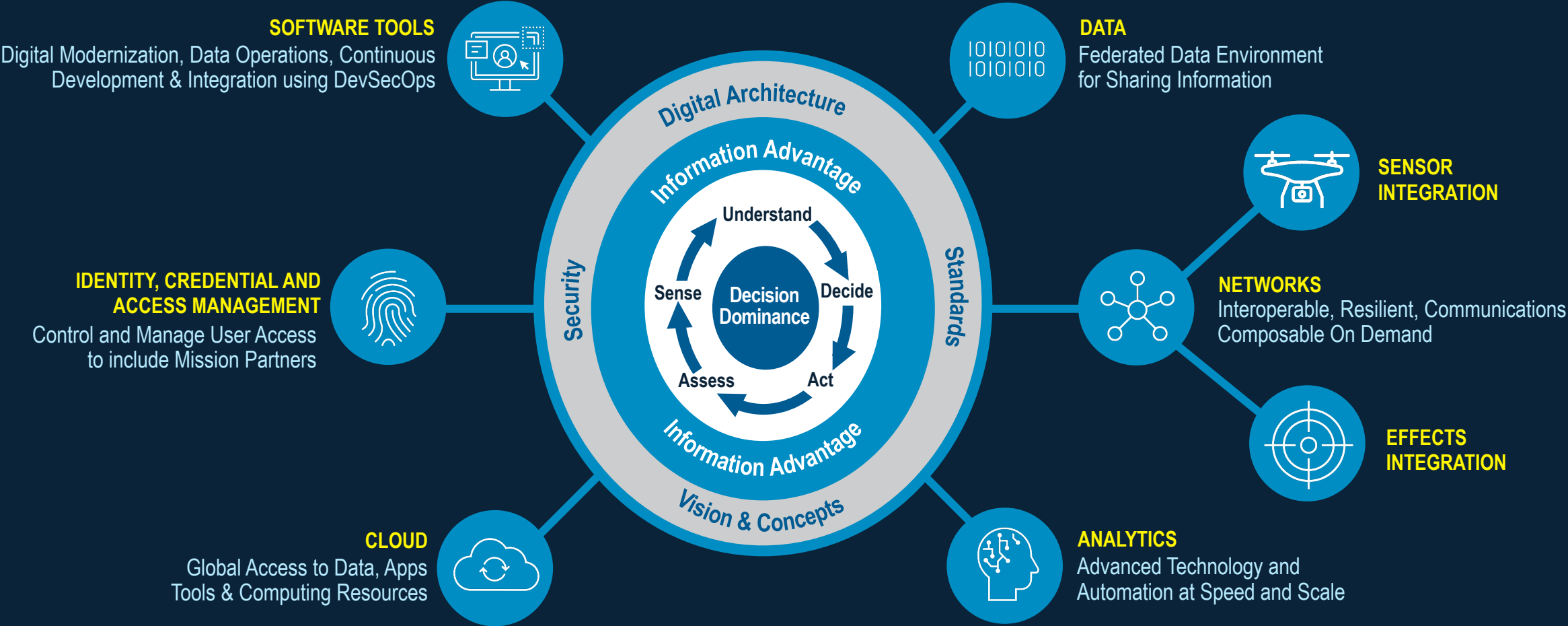
We are in an era of data-centric warfare. We have moved beyond network and platform-centric warfare. We must connect vast, distributed data sets together via a data fabric or data mesh architecture design that is strategy/mission driven. We must think about using knowledge graphs and other technologies to help us link disparate data together into a schema associated with mission attributes. We must be able to apply advanced data analytics, including AI/ML and other data science generated algorithms to that data fabric to build awareness, visualize and understand the operational environment and generate machine-aided option and asset employment recommendations for the commander. DevSecOps and agile software development and integration that is focused on operational user needs within the given mission provides the means by which the operator interacts with the data and knowledge presented via analytics. That must be tailored and customized as missions change and data sets emerge, evolve, disappear over time. We should also think in terms of open, API based data access and little S data standards. Exploit what is possible versus stifling innovation.

Access to this C2 capability is via cloud computing technologies that include hybrid designs to deal with the disruption and attrition of warfare. Data access and persistence at the tactical edge must be accounted for in the design and user role based access and control technologies enable data access along the lines of data feeds and pulls versus need to know data exchanges. Zero Trust and ICAM technologies play a critical role in securing the C2 ecosystem.

Resilient communications technologies that bring link and path diversity to the fight and the ability to conduct and execute dynamic PACE planning – automate network reconfiguration based on adversary action and environmental and mission factors. We must think of dynamic PACE planning and execution not only for the network, but the C2 architecture and nodal decision authorities and the associated data accesses required to execute those authorities as well. Proliferated LEO for ISR and communications, 5G, quantum technologies, Starlink, 5G are all in play. We must also think about signature protection, deception/obfuscation. Protect our C2 and communications architecture, deceive the adversary and seek to counter their ability to do the same.

We should also think in terms of loosely coupled or decoupled operations. Decouple data from systems and systems from networks. Use M2M to exchange core data in support of sensor, effector, and other combat platform integration across the network.

Technologies

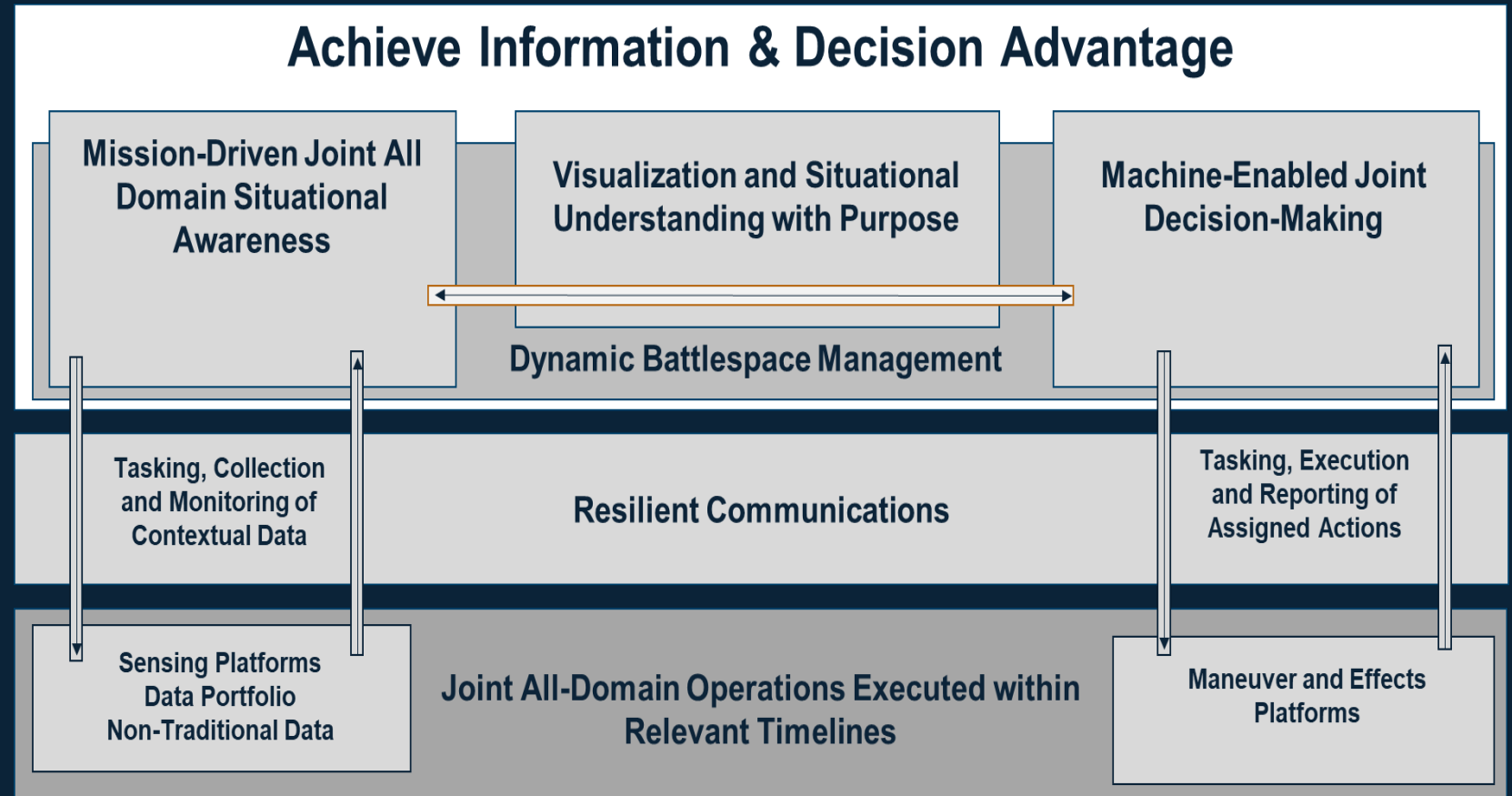


Next Generation C2 & Warfighting Platform to Realize Distributed All Domain Operations

Overview of 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!

Overview of JADC2

Commanders in today's hyperactive, complex, and highly lethal battlespace need to be able understand and decide faster and better across a range of mission areas. The US and its allies and coalition partners became reliant on individual domain supremacy in permissive operational environments and focused on exquisite platform and system of system designs for C2. We are now contested in every warfighting domain, engaged in cyber warfare within the global information environment and must operate in a semi to non-permissive environment. We must take back control of operational tempo and maneuver across competition and conventional conflict while deterring escalation to nuclear conflict.

Achieving the mass, scale, and simultaneity needed for successful all domain operations demands an entirely new approach to Command and Control (C2) that provides commanders the ability to rapidly recognize, understand, decide, and execute operations. Today, planning, synchronization, and execution of combined operations at the speed required is difficult if not impossible as legacy C2 systems are impeded by multiple barriers including those between warfighting domains, across echelons and classification levels, between the military services themselves, and with allies and mission partners.

Providing commanders with superior sense and decision-making capability will require a new C2 architecture that enables contextual access and exploitation of all available data to establish a shared, clear understanding of the mission, situation, available resources, and force employment options. What is needed is a mission-driven, all domain situational awareness capability to provide the foundation for improving the speed, scale, and effectiveness of decision-making. In simple terms, we must improve our machine enabled ISR (sensing) and decision-making capabilities and capacity.

Integrating technologies such as artificial intelligence, machine learning, and real-time modeling and simulation of asset options will better enable commanders to optimize available resources. Moreover, to provide resilience in the face of adversary attacks, the new C2 architecture must be designed for decentralized C2 on demand that can enable widely distributed operations across a large battlespace. And to overcome the fragility of single and cross-domain kill chains, the architecture must employ an all-domain effects web using diverse communications paths and machine to-machine transmission of data. Think in terms of composable effects chains constructed on demand and driven by model-enabled mission command.

A particularly compelling challenge facing the Future Force is meeting the rapid timelines required for finding, fixing, and engaging the relocatable systems that peer adversaries increasingly rely upon to create standoff via robust A2/AD defensive networks. Addressing this challenge will require employing new and innovative technologies in domain- and service-agnostic ways to dramatically accelerate all domain effects chain functions. For example, human-machine teaming can be used for better option awareness and selection thus accelerating decision-making. This will create the ability to leverage context-aware displays and tailorable mission dashboards and analytics, allowing commanders to visualize and understand the current and projected situation and associated strengths, weaknesses, gaps, and opportunities, thus improving the speed of battlespace recognition, planning, decision, and action. The idea is to initiate improved operational workflow and effects chain execution, along with associated data brokering, and asset orchestration in time, space, and purpose. Furthermore, collaborative battlespace operations as well as deconfliction can be aided via dynamic battlespace management processes that leverage the information and knowledge produced by contextual awareness. Simply stated, we must define, model, and automate C2 workflows with purpose in mind and leverage automated data pipelines that include integrated analytics seeking to address the data attributes required for the assigned mission.

Overview of JADC2

Today's C2 structure must be significantly adapted to realize all domain convergence at the speed and scale. To fully achieve this vision, the next generation C2 architecture must shift from single military service and domain-centric operations centers to All Domain Operations Centers (ADOCs) that are mission/function-oriented and distributed across operating areas. These must also be connected to multi-domain force packages and battle management teams at lower echelons. ADOCs and battle management teams must exploit shared, contextual all domain, all services, all mission partner situational understanding that replaces fragmented situational awareness resulting from isolated domain or service architectures.

In this proposed structure, collaboration and dynamic tasking of integrated all domain assets replace staff-intensive coordination, synchronization, and deconfliction processes associated with deliberate single domain planning. The human-machine team replaces manually intensive military decision-making processes within the ADOCs for strategic and operational-level planning. Integrated kinetic and non-kinetic effects planning and employment and operationalizing the non-physical battlespace (the electromagnetic spectrum and information environments) improve force integration and synergy. Decentralized C2 employing conditions-based and distributed authorities and dynamic network and data access planning replaces centralized C2 structures and fixed single domain focused operations centers. And an agile and resilient global network connects the ADOCs, multi-domain forces, and battle management teams replacing a complex set of disparate Joint and service networks streamlining information exchange and machine-to-machine communications.

DoD Taking Advantage of JADC2

JADC2 CFT focus on a set of enterprise services – leveraging DoD Platform One to rapidly generate software apps that act upon some set of enterprise data (read AF UDL, Data One) and includes some sort of enterprise data streaming service (read AF Feed One). The idea is to push a set of MVPs out every 3-4 months I believe, but the acquisition strategy is ill defined at best and the lack of collaborative service participation is striking. There is a move from strategy and requirements documentation to building and perhaps mandating enterprise services, but for who? The CCMDs? There is also an acceleration in terms of CCMD data and AI application development, that is focused on each theater's unique requirements.

From a service perspective, no service has a JADC2 or JADC2-like solution today. The service focus and now to a large extent the focus of the JS J6 led JADC2 CFT is the tactical edge and building up. The niche for JADC2 has always been the operational level of war. We need to focus there and build up, down, and out. The engineering and integration down bridges the service all domain C2 developments. But the emphasis must be operational support that defeats long and mid range adversary A2AD capabilities, degrades their C2, network, and enabling infrastructure to create the windows of opportunity for tactical operations. Regarding the tactical focus, it is important to note that every service views tactical edge somewhat differently and the scale and complexity of delivering all domain capabilities and capacity at an edge node varies widely. There is minimal best of breed opportunities at the edge. Think in terms of decentralized C2 of distributed operations using disaggregated forces where we have conditions-based authorities to employ effects I own, have access to that others employ on my behalf, or can be assigned for employment based on mission needs/conditions being met.

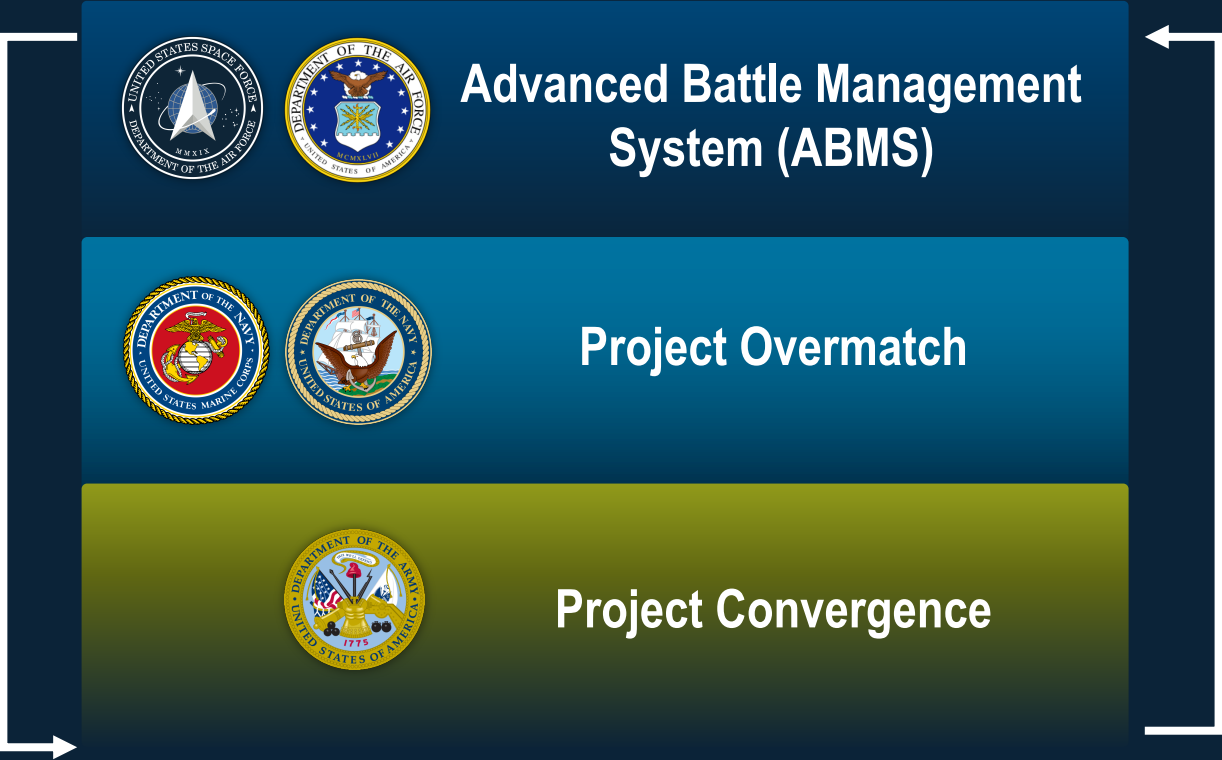
JADC2 Framework – The DoD Perspective

- 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.



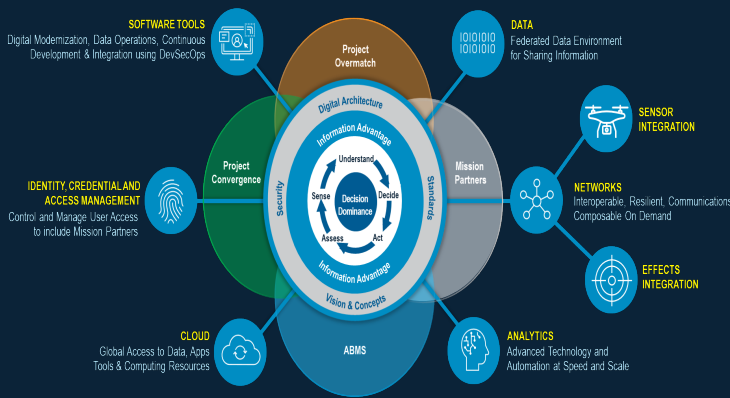
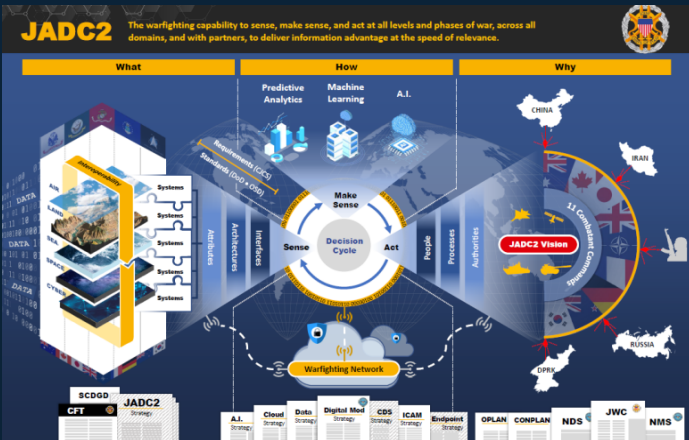
JADC2 is a Wicked Problem.....

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



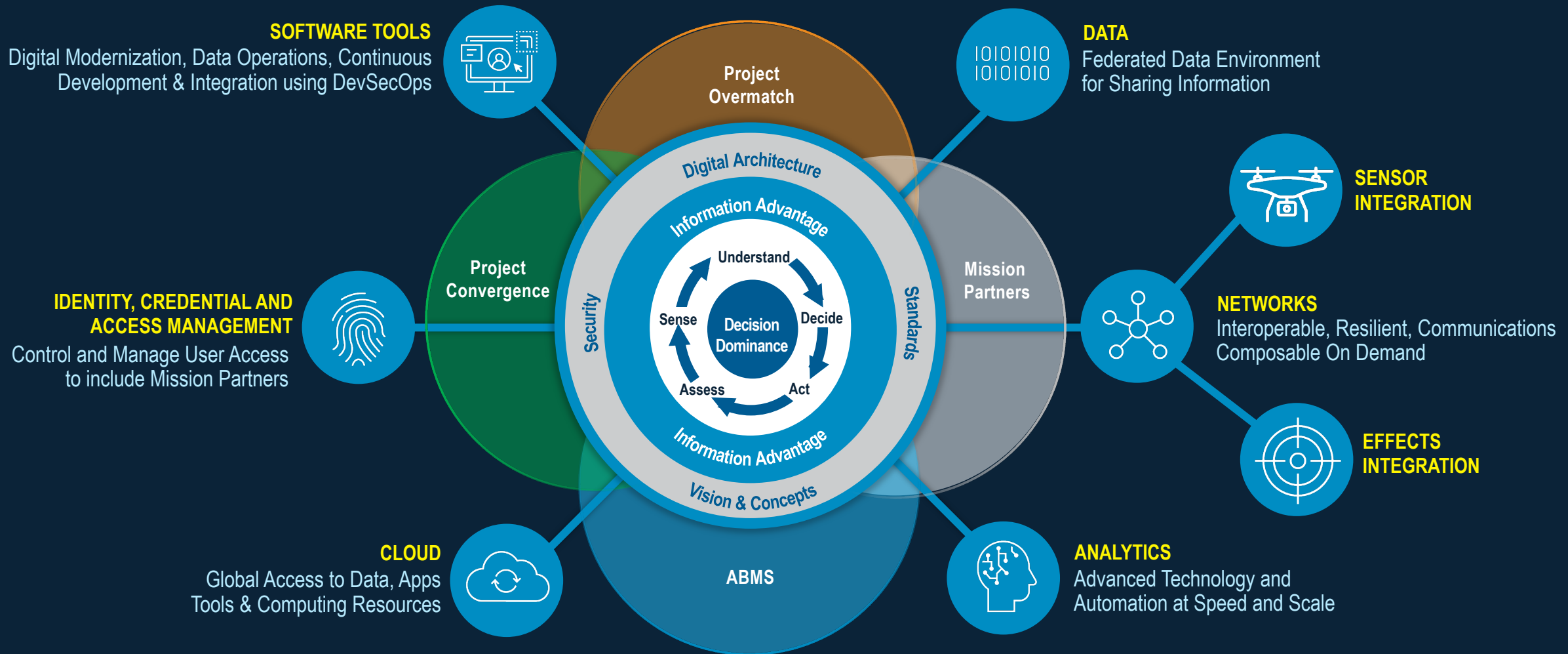
Services are collaborating. Pursuing opportunities for “Combined” JADC2.

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



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

Evolving JADC2 – Cohere Service & Partner Contributions



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

Cybersecurity

We must operationalize the non-physical battlespace and better employ holistic effects. The importance of cyber during competition cannot be understated. How can we strategically employ cyber effects to shape the environment and adversary action? How do we counter mis/disinformation campaigns and win the information war?

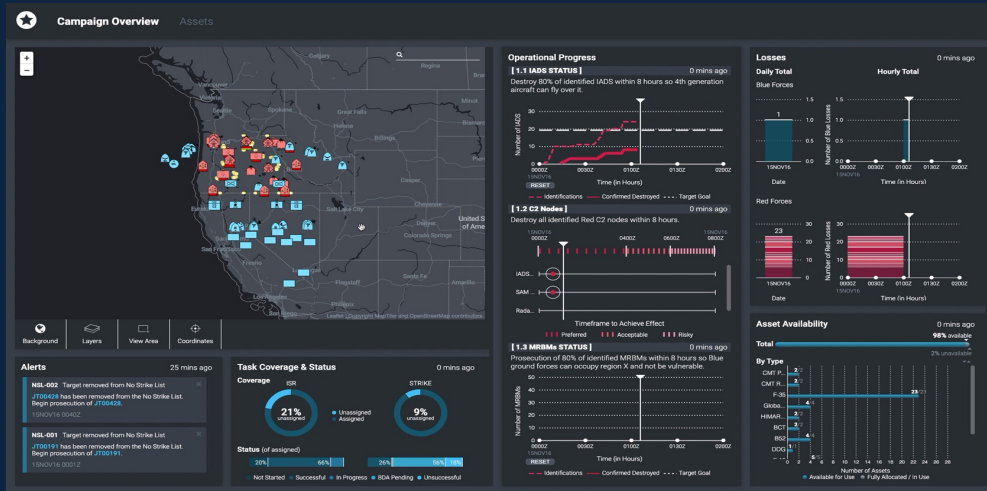
We must bake in cyber security in everything we do. Protect intellectual property rights, defend our IT exploration and architectural designs – better employment of classified infrastructure within the DIB. That means partnership with DoD and improved policy and trust in sharing scenarios, data, models, and simulations that underpin our mission and digital engineering efforts.

From an operational perspective, defensive cyber must be at the forefront of what we do. We must protect our C2 nodes, data, analytic tools, apps, and networks. We must deceive the adversary and employ offensive means to not only protect our capacity but degrade, deny, or destroy their capacity. The digital war will likely be one in cyberspace and the information environment. The core tenet of information advantage and its use of data as a strategic asset is the key to achieving decision dominance and overwhelming the adversary's ability to C2 their forces and employ that A2AD capabilities.

Roadblocks and Path Forward

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.

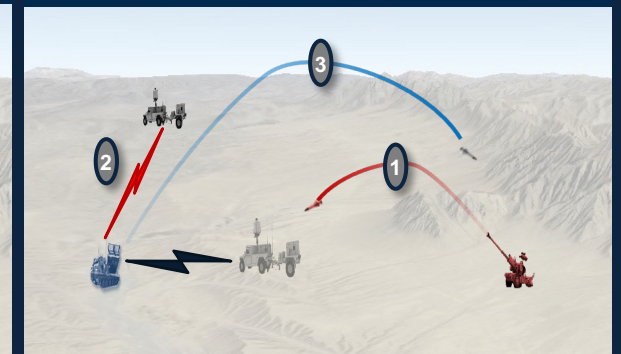
- Brokered Assets using Advanced Algorithms (Dynamic Asset and Options Awareness, mission relevant AI/ML).
- Enable Resiliency via Composable Effects Chains, Decouple Data, Networks and Systems.
- Build Interoperability on Demand – Network Diversity.

Efficient Asset Utilization in Complex Battlespace



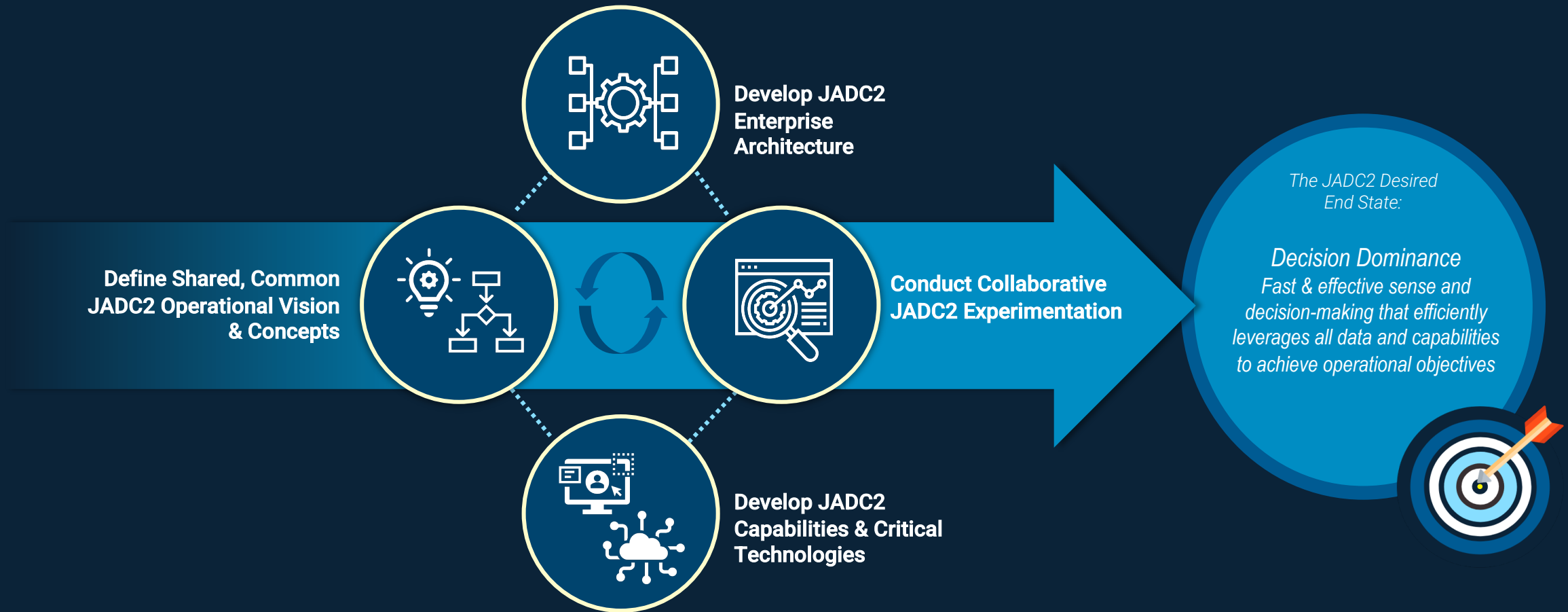
ISR tip-and-cue, synchronized effects, optimal effect-target pairings

Rapid Re-planning in Response to Changing Battlespace



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

MITRE Approach to *Enable* Achievement of JADC2



APPLY FFRDC EXPERTISE TO SHAPE WORK PROGRAM AND DELIVER ANALYTIC RIGOR!

Tri-Service JADC2 Opportunity for MITRE

Service Chiefs Identified need to build consensus and develop a common framework for delineating / integrating JADC2 initiatives.

- Develop common taxonomy, operational construct, and outcomes-oriented implementation approach in response/support to JADC2.
- Address data imperative to enable Convergence.

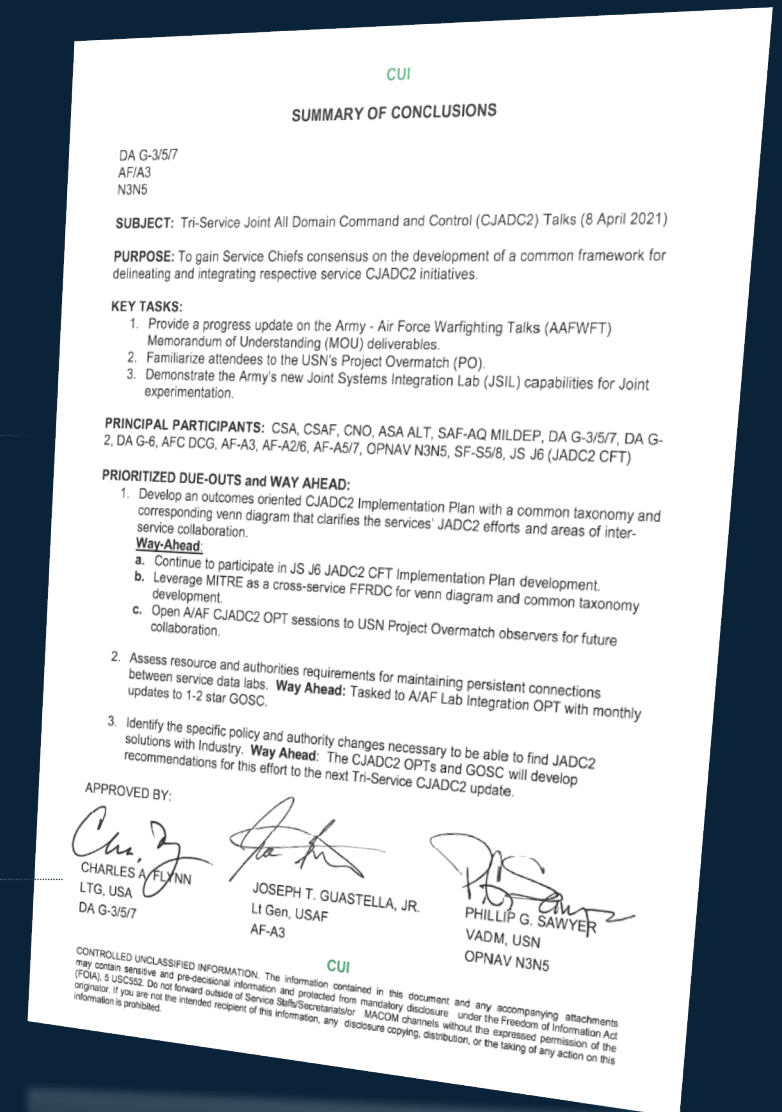
Shaping and leveraging our “JADC2” work program to execute the cross-Service FFRDC leadership role.

- Bring Services together and incrementally tackle priority challenges.
- Reduce duplication and internal competition within MITRE and our sponsor base.

Anticipated OSD (R&E) emphasis on FFRDCs to work together to advance JADC2.

OSD (R&E) and OSD (A&S) leadership. Expand JS J3 Role.

RDER and other collaborative acquisition approaches for RDTE.



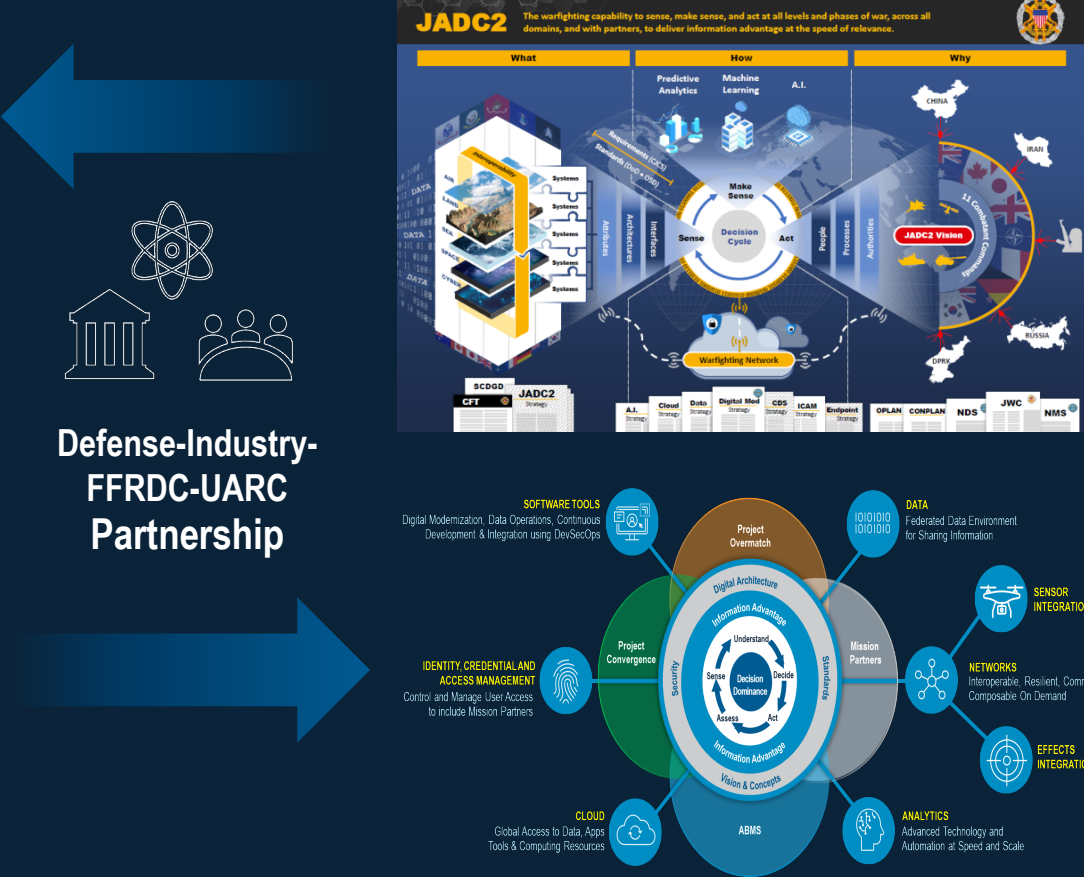
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