

Headquarters U.S. Air Force

Integrity - Service - Excellence

A Future Vision for Remotely Piloted Aircraft *Leveraging Interoperability and Networked Operations*



Mr. Jeffrey W. Eggers, DISL
AF/A2 - Chief Technology Officer

ICCRTS **21 Jun, 2013**
Alexandria VA

U.S. AIR FORCE

Integrity - Service - Excellence

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

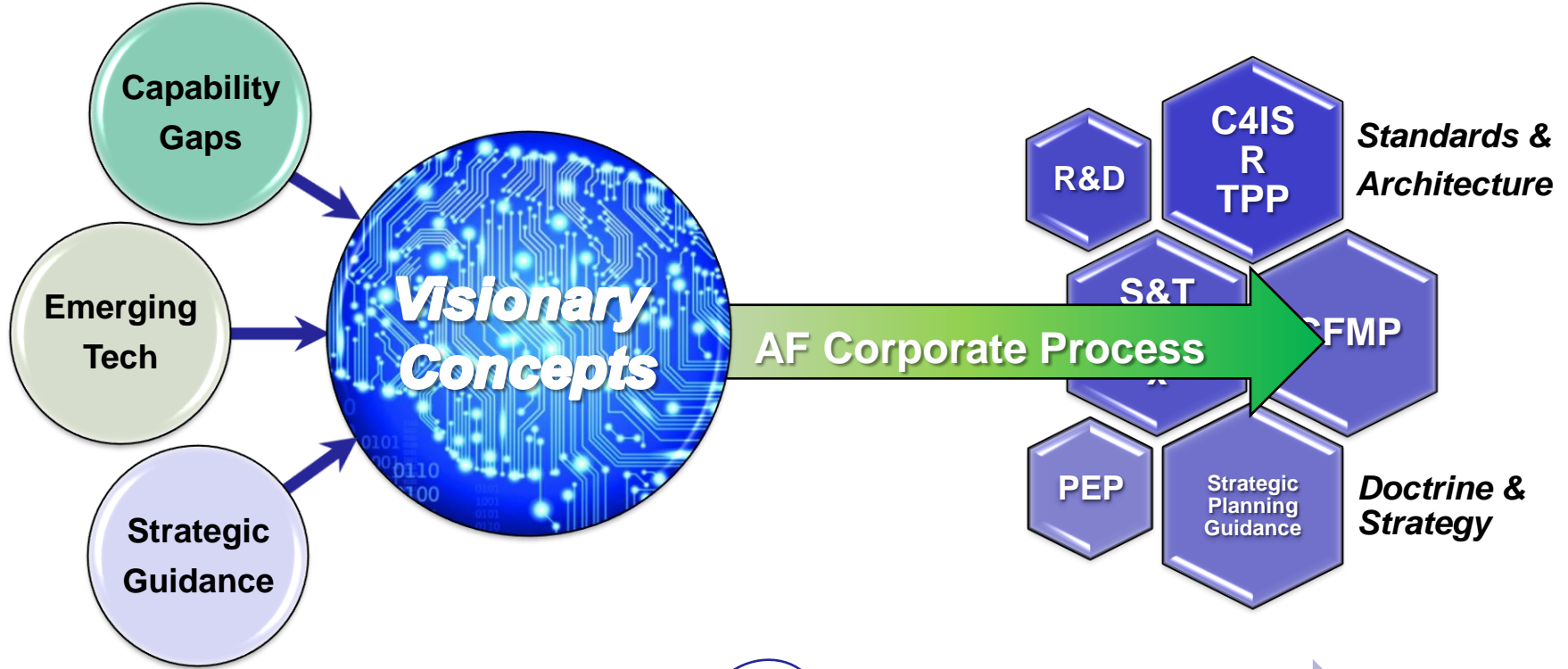
1. REPORT DATE 21 JUN 2013		2. REPORT TYPE		3. DATES COVERED 00-00-2013 to 00-00-2013	
4. TITLE AND SUBTITLE A Future Vision for Remotely Piloted Aircraft: Leveraging Interoperability and Networked Operations				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Headquarters U.S. Air Force AF/A2, Air Force ISR Agency, Lackland AFB, TX, 78236				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES Presented at the 18th International Command & Control Research & Technology Symposium (ICCRTS) held 19-21 June, 2013 in Alexandria, VA.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 18	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



AF A2 S&T Office

VISION: Collaboratively develop and coordinate strategic S&T visions and plans to support the future Air Force ISR Enterprise and its integration with partners and customers.

Injecting Visionary Concepts Into Today's Fight And Tomorrow's Programs



Integrity - Service - Excellence



Key ISR Platform Challenges

- **Growing Demand**
 - ...for Intelligence, Surveillance, and Reconnaissance (ISR) Information
 - Diverse portfolio of fielded platforms
- **Increasing Complexity**
 - Sensors, Communications, and Processing
 - New phenomenologies, analysis methods, and visualization
 - Developing open standards & distributed processing capabilities
- **Fiscal Constraint**
 - Increased emphasis on improving/recapitalizing legacy systems vs. developing new capability
- **Highly Contested Environments**
 - Shift in focus from permissive environments
 - Rapidly fielded advances have not yet been normalized



Sensors as a Service

Sensors:

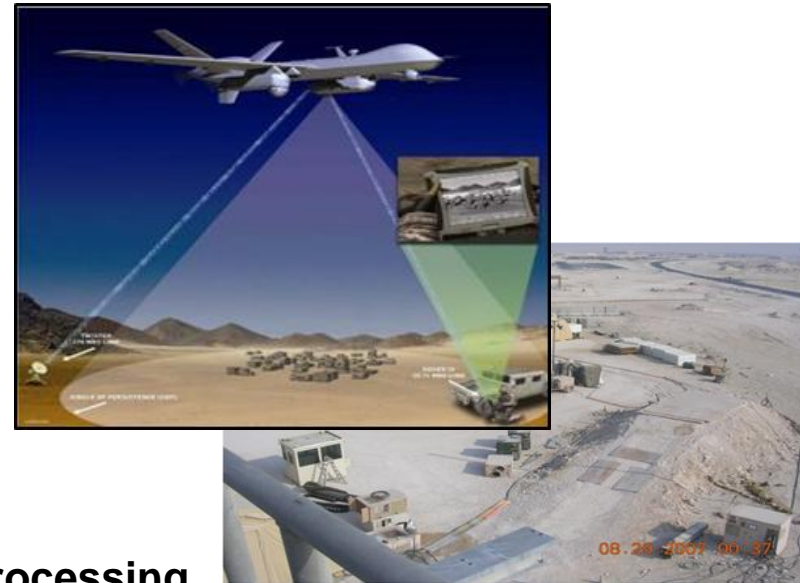
- Increases in resolution and coverage can serve multiple needs
- Must reduce Size, Weight, and Power (SWaP)
- Increased on station times and OPTEMPO have reliability impacts
- Need for frequent technology insertion

Communications:

- Data density drives need for improved compression and onboard processing
- More consumers = spectral congestion
- Need for protected / agile communication

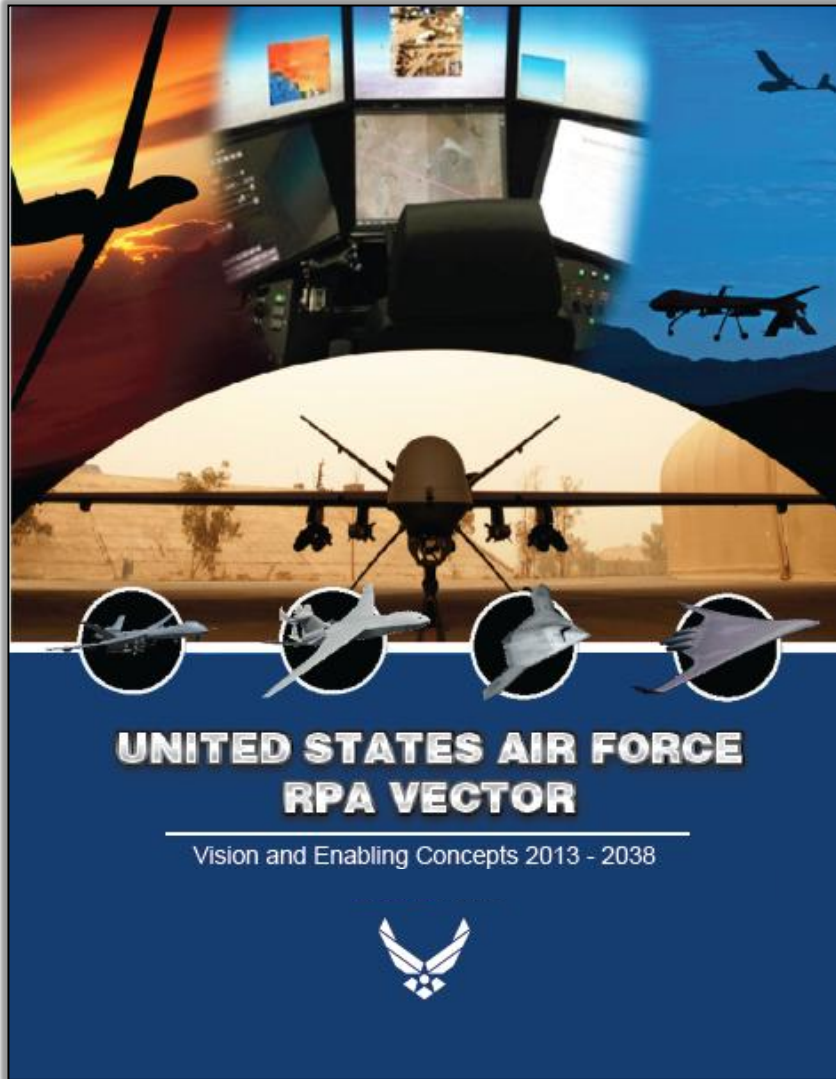
Processing, Exploitation, Dissemination:

- Immense volume of data
- Improve automated analysis and onboard processing blended with offboard skilled tradecraft analysts
- New data architectures and cross-domain federation to allow sharing of data
- Interoperability –legacy stove-piped designs must be integrated





RPA Vector Overview

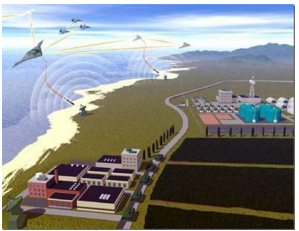


- Headquarters Air Force is currently reviewing the “USAF RPA Vector: Vision and Enabling Concepts, 2013-2038”
- Describes emphasis areas for growth and development over the next 25 years
 - Balances the effects envisioned in the USAF UAS Flight Plan with the reality of constrained resources and ambitious national strategy for a complex world.
 - Opens the aperture beyond current austere fiscal realities to explore art of the possible technologies in the 2013 - 2038 timeframe.
 - Recognizes the shift toward a smaller more adaptable military
 - Notes the strategic shift from counter insurgency and permissive operations to the Asia/Pacific region
 - Cost-effective capabilities that directly support the National Defense Strategy will have the highest priority



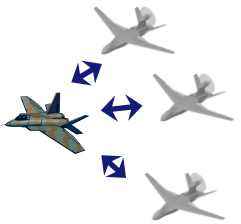
Vision for the Future

Partnership across departments and agencies, Joint and Coalition, Academia and industry, to drive innovation, technology and efficient use of R&D investments



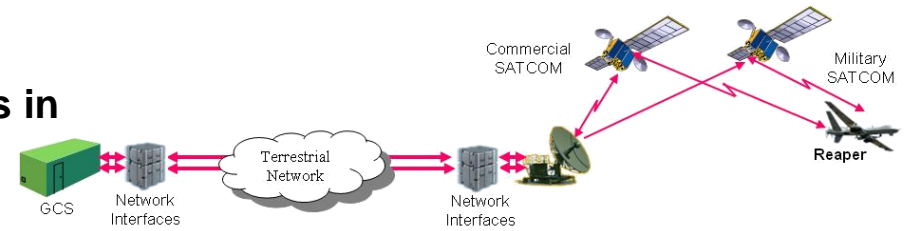
NextGen theater-level unmanned systems must detect, avoid, or counter threats – operating from permissive to highly contested access in all weather, maintaining persistent collections in the target / objective area

Force multiplication will be realized from networked control, swarming, and teaming where groups of flexibly autonomous vehicles operate in support of both manned and unmanned units in all types of battlespace



Aircraft acting as “loyal wingman” of manned aircraft may be used to conduct penetrating and persistent ISR, air interdiction, SEAD, defensive counter air, C2 of SUAS, or act as “weapon mules”

Increased interoperability through advancements in redundant and secure C2 infrastructure, open architecture, standards, and modularity

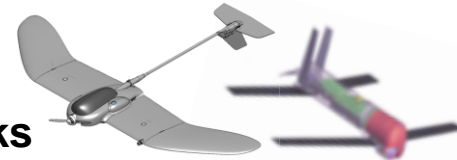




Expanded Small UAS Vision

■ Special Tactics Employment

- Integrated Organic ISR/Strike Family of Systems
- Open Architecture, Common GCS, Secure Data Links
- Dedicated Operators, Reduced Workload



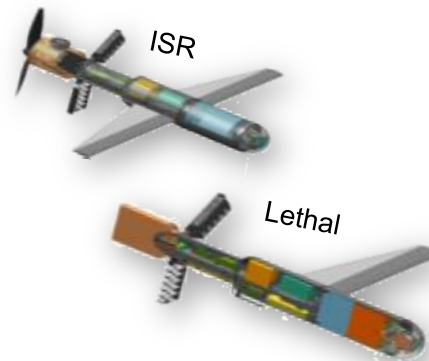
■ Special Tactics ISR

- World Wide Deployable, Rapid Reaction Group II/III SUAS Unit
- Light Footprint, Low Cost ISR Option
- Networked Autonomous C2 System



■ Air-Launched SUAS

- Common Launch Tube – Expendable
- Dual Ops from Air/Ground
- ISR and/or Strike Options
- Denied Area Penetration





Keys to Achieving This Vision

- **Integrated manned and unmanned systems**
 - **Seamlessly integrated across the full range of military operations**
 - **Future threats will necessitate an integrated force structure of manned and unmanned systems to mitigate risk**
- **Flexible Autonomy**
 - **Research in autonomous behaviors and human supervisory control promise enormous efficiencies as well capability increases as through teaming and multi-vehicle operations**
- **Open Architecture and Standards**
 - **Enables modularity and interoperability resulting in increased operational effect, adaptability, sustainability, extensibility, and potential reduced cost**
- **Secure, robust, agile, redundant C2 and information distribution**
 - **Essential for mission success in all environments and domains**

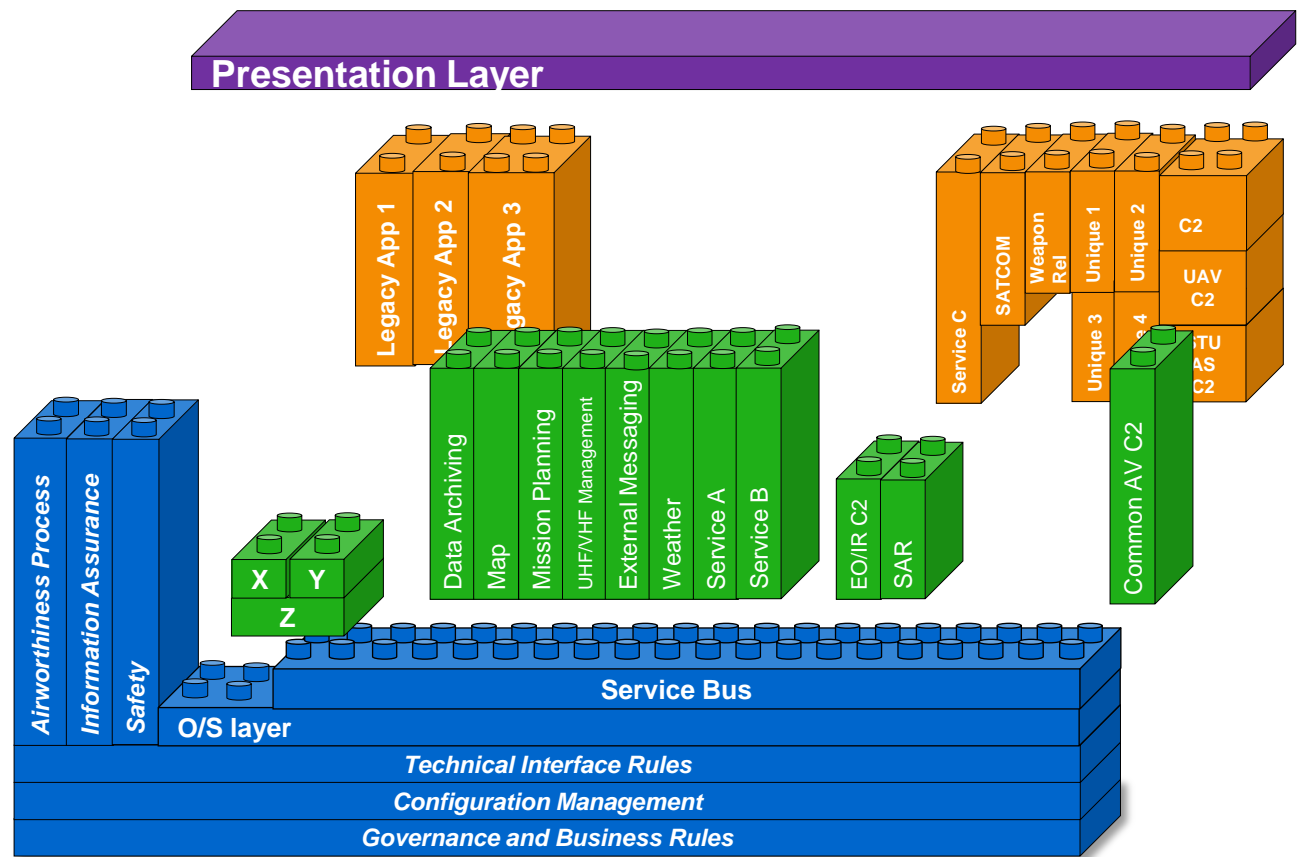


Control Station Considerations

- **Common Control System Architecture**
 - Capable of operating a range of platforms
 - Allows for multiple mission-optimized interfaces
 - Enhances interoperability within a service as well as across Joint and Coalition forces, networks, and domains
- **Key Attributes to Consider:**
 - Layered Modular Framework (O/S, Network, Middleware, Interface)
 - Interfaces to external services for data consumed and published
 - Consistent user interfaces to maximize operator situational awareness & streamline training, yet adaptable to mission need.
 - Scalable with common and unique services
- Leverage existing infrastructure to the maximum extent
- Government must own the architecture and interface standards allowing best of breed proprietary modules.



Notional Common Architecture



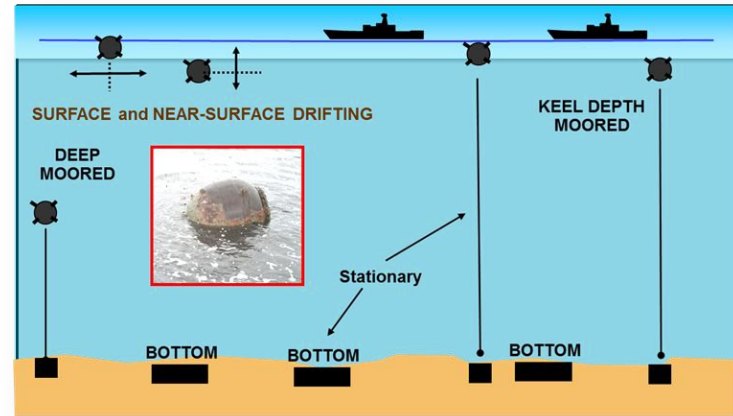
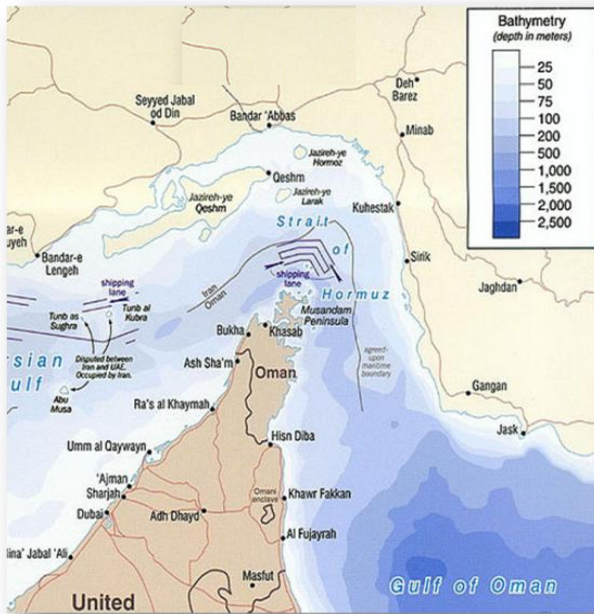
COMMON USER INTERFACE & PRESENTATION LAYER

UNIQUE COMPONENTS

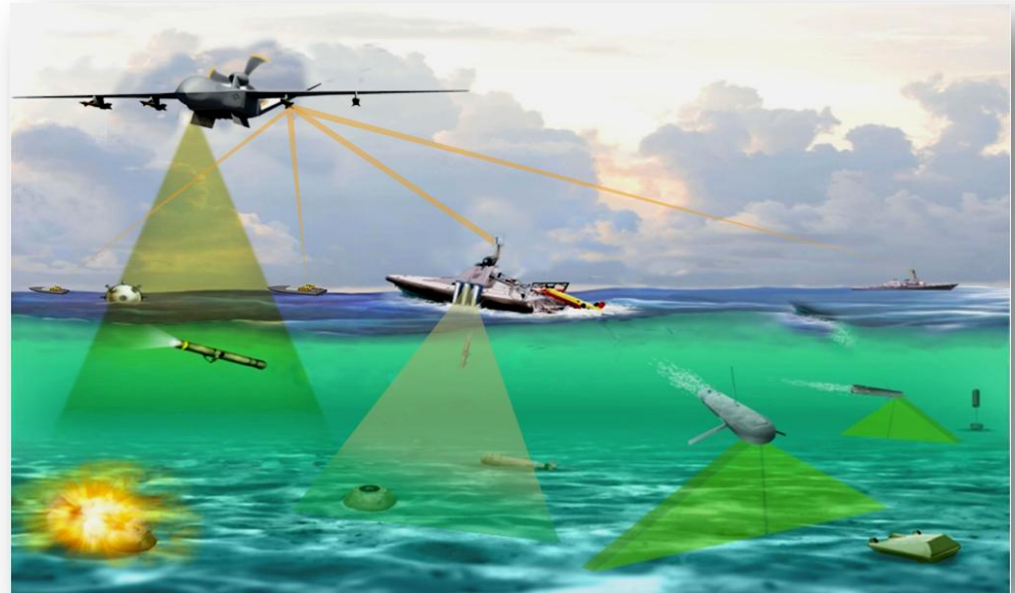
COMMON COMPONENTS

CORE FRAMEWORK

Vignette: UxS Countermine



Complex Environment of Air, Surface, and Subsurface threats



Strategic Shipping Channel

- 180 km long, 45 km wide
- 10 km wide traffic lane
- 35% of world seaborne oil
- Avg 14 Tankers per day

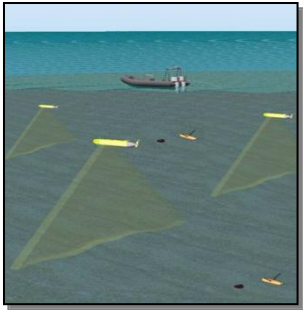


Cross Domain Collaboration

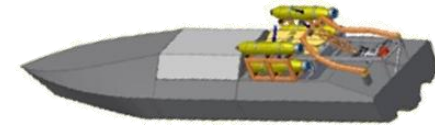
Unmanned Underwater Vehicles



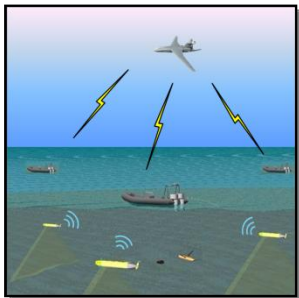
- ▶ Hunter UUV cooperatively search, acoustically linked to USV and Killer UUV
- ▶ Detections passed to Killer UUV for positive identification
- ▶ Sensor data relayed to USV for relay to operations center



Unmanned Surface Vehicles



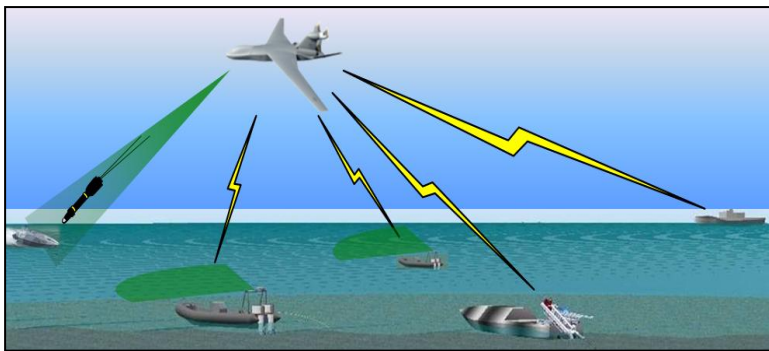
- ▶ USV and multiple UUV form automated team
- ▶ Tender can launch, recover and refuel UUVs
- ▶ USV can performs surface search and shallow mine detection
- ▶ Sensor data relayed to operations center via UAV



Unmanned Aircraft



- ▶ Communication link for multiple USV led teams
- ▶ Relay to and from operations center
- ▶ Onboard sensors contribute to surface search and provide early threat warning
- ▶ Onboard weapons provide defensive support

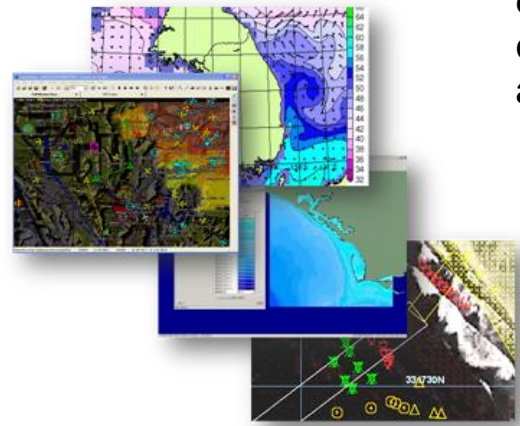




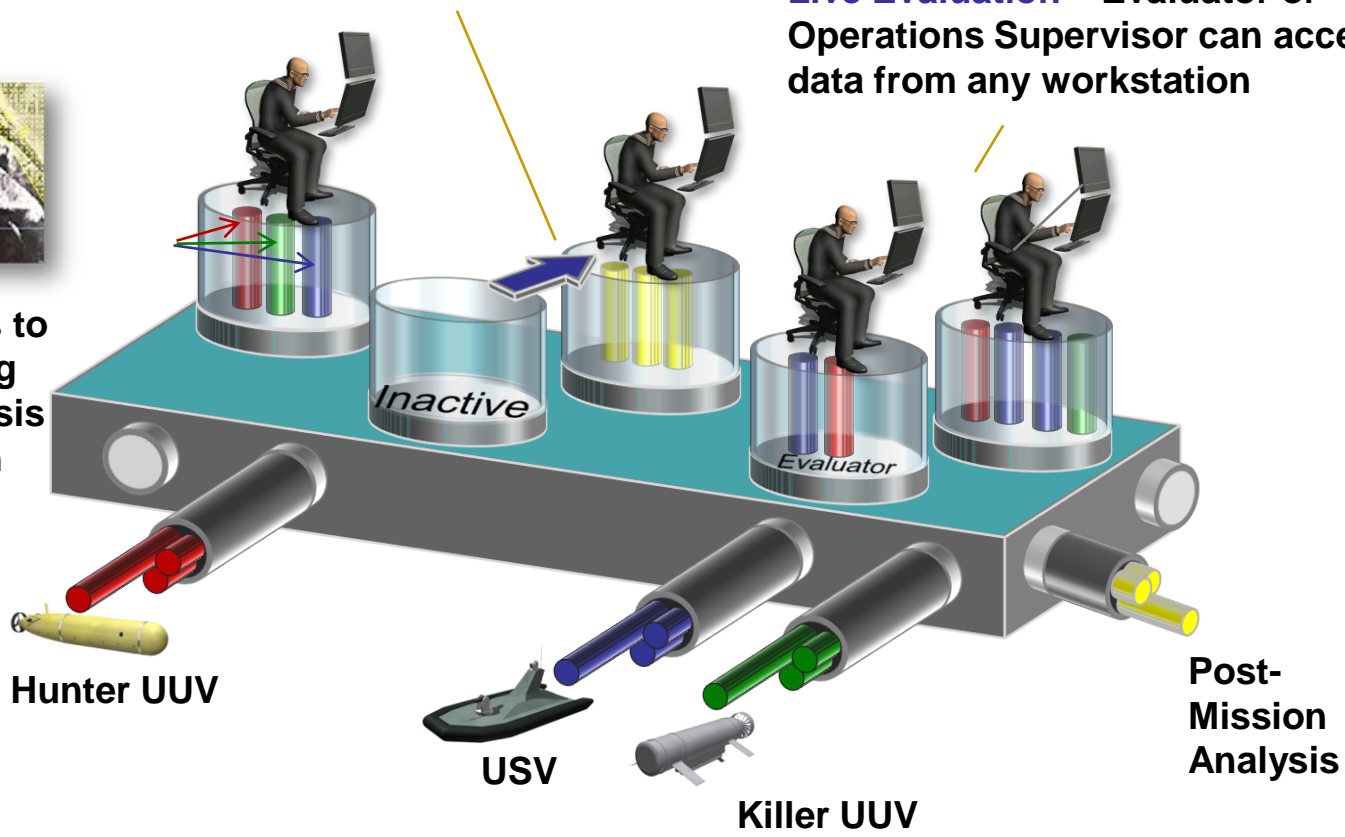
Mission Management Concept

Task Control Handoff – Overloaded or departing watch team members can hand off some or all tasks to any other workstation

Live Evaluation – Evaluator or Operations Supervisor can access data from any workstation



Mission Support – Access to essential mission planning information, sensor analysis and mission collaboration tools

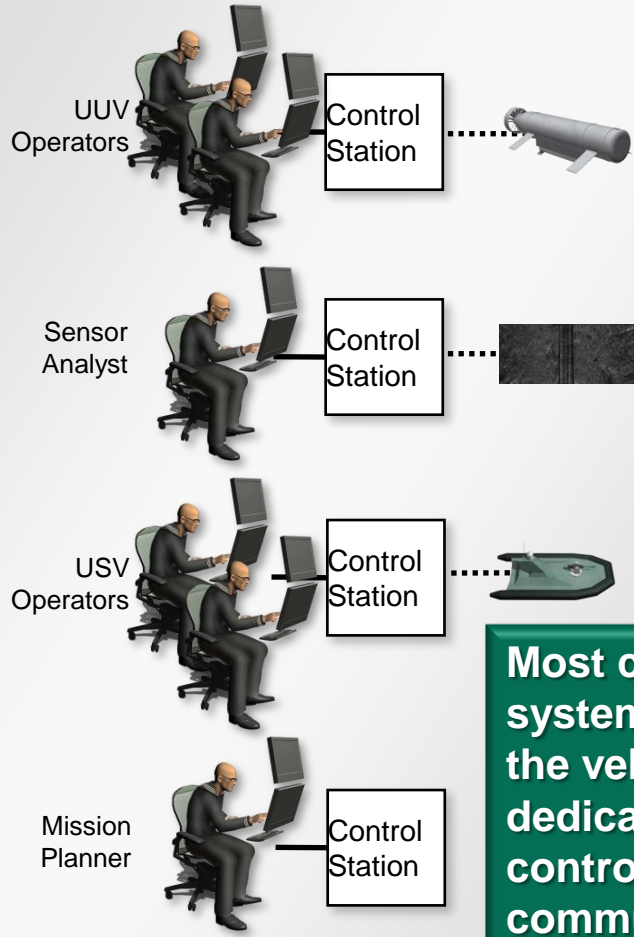


* From ONR Summit initiative



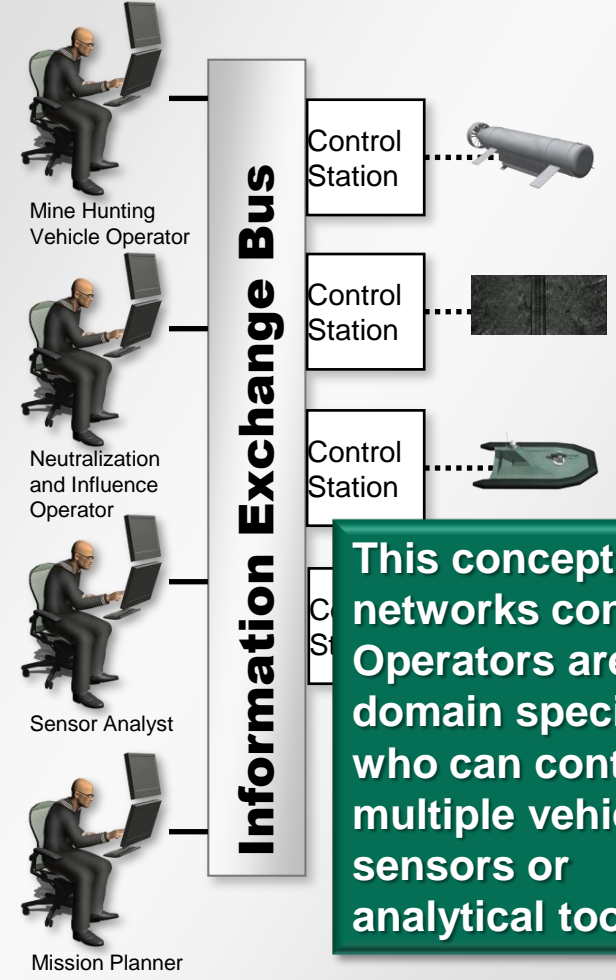
Improved Reallocation / C2

Current Coupled Tasking



Most current systems focus on the vehicle with a dedicated crew, control stations, and communications

Future Task Reallocation



This concept networks control. Operators are domain specialists who can control multiple vehicles, sensors or analytical tools.



Networked Operations

Support Infrastructure

Weather

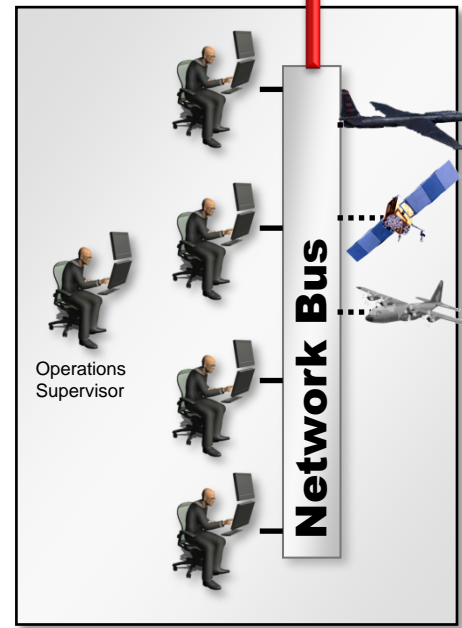
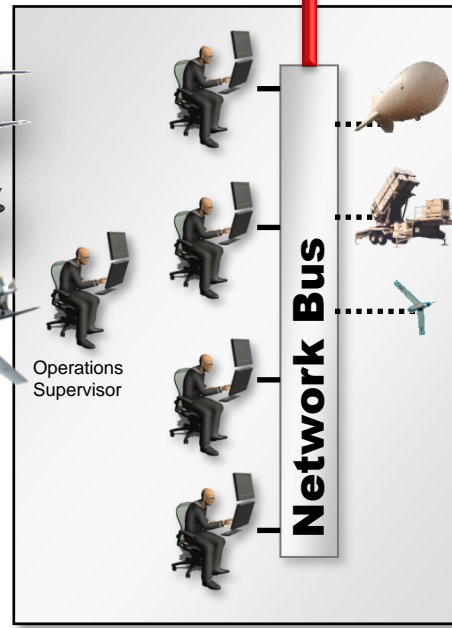
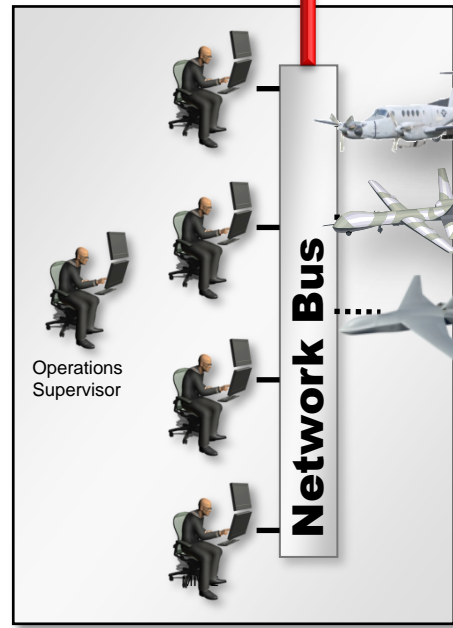
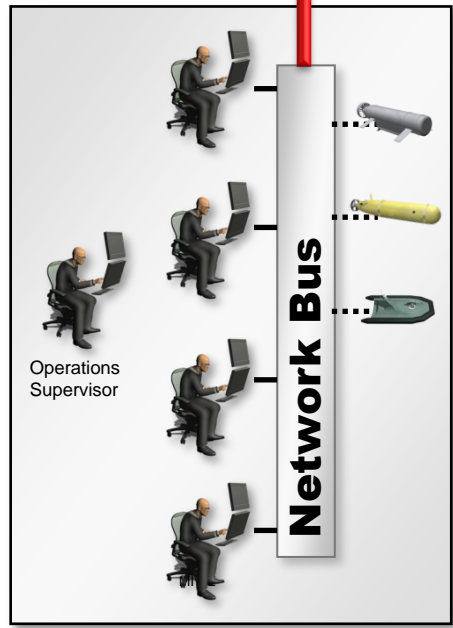
Airspace

Threat Warning

MTI

C2 Nodes
CAOC
MOC...

Mission Integration Network



Sea Operations

Air Operations

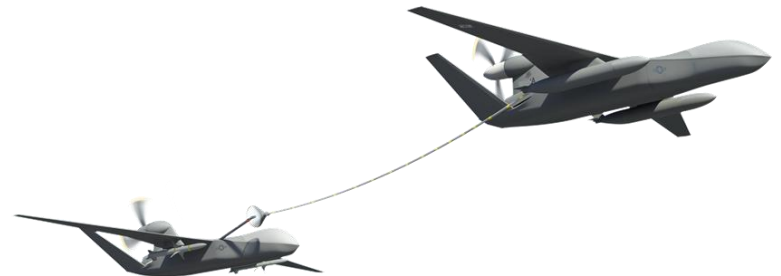
Land Operations

Intelligence Support



Summary

- Unmanned systems have had explosive growth over the past decade but many challenges remain
- Current fiscal constraints drive need for increased modernization and technology insertion into existing platforms
- Government owned and enforced standards, interoperable architectures, and networked operations have the potential to provide increased capability to the warfighter and to synergize force structures across domains
- Shift the mindset from one domain, one vehicle, one service to a network of mission managed vehicles that leverage human-supervised autonomous behaviors to reduce workload and improve mission effectiveness





QUESTIONS ?

