Autonomy Strategy and Roadmap

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What is Autonomy?

Autonomy Definition: (Joint Staff – JCRAS)

- The level of independence that humans grant a system to execute a given task. The condition or quality of being self-governing to achieve an assigned task based on the system's own situational awareness (integrated sensing, perceiving, analyzing), planning and decision-making. Autonomy is a spectrum of automation in which independent decision making can be tailored for a specific mission, level of risk, and degree of human-machine teaming.

Qualities of Autonomy:

- The system's ability to perceive and understand its environment, its mission and its own capabilities
- The system's ability to communicate and interact with humans, other unmanned systems, and its environment
- The system's ability to make choices and respond appropriately, with an ability to make plans that achieve mission objectives with varying degrees of difficulty and priority, even in a COMMS denied environment

Autonomy is more than automation; autonomy makes intelligent choices in a dynamic environment

Why do we need Autonomy?

Improving Speed and Accuracy of Decision Making

- Processing massive amounts of data at machine speed
- Correlating/Fusing multiple streams of data for better SA
- Higher precision under pressure
  - Autonomy not limited by emotions
  - Autonomy will be limited by ROE
    - Morals
    - Ethics

Reducing risk of casualties to civilians and our own forces

Enabling new Tactics and CONOPS requiring persistence and Endurance

- Autonomy at rest can remain fully operational indefinitely
- Robotic systems only limited by energy carried
  - Can be extended by in-stride refueling/charging
  - Autonomy not affected by fatigue

Enabling new Tactics and CONOPS involving large numbers of expendable assets

Enabling the use of UxS when COMMS are denied or degraded

Applications for Autonomy

Navigation and Control

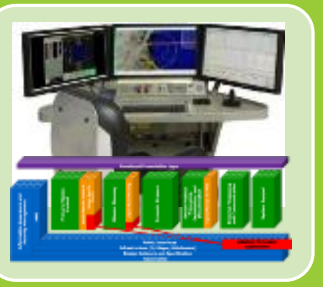
- Computer vision and data/sensor fusion
  - Identify significant characteristics of the environment
- Machine to machine/machine to man/man to machine communications (understanding)
- System health monitoring
- Fault detection

Actionable Intelligence

- Identify Trends
- Data mining
- Intelligent preparation of the battlefield

Cybersecurity

CCS: Filling the Capability Gap



Commonality

- Common software provides a **standard user interface** to **reduce training time** and **enhance operational effectiveness**
- Common hardware **simplifies system maintenance** and eases technical manual development and distribution
- Common Control System (CCS) **expedites fielding** of new UxS

Interoperability

- Promotes a **flexible, integrated warfighting** capability
- **Enhances** mission-level **availability**, providing a "network" of control systems capable of controlling all UxS
- Maximizes **distributed UxS control**
- Implements **Navy Interoperability Standards**

Multi-Domain Mission Management

- Provides **collaborative, cohesive management and execution** of unmanned systems across the battlespace
- **Synchronizes** warfighting capabilities **across all domains**, providing real-time intelligence sharing, cross-tasking, and cross-cueing

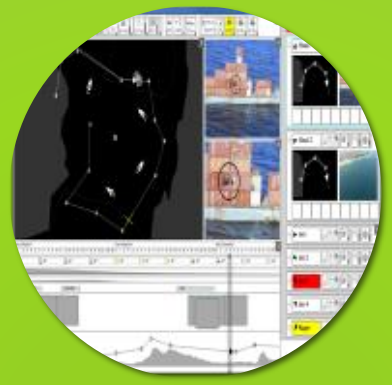
Simultaneous Multi-Vehicle Control

Direct AVO Inputs

- *Pilot is "flying the aircraft"*
- *1 pilot to 1 aircraft*

Fly From Map

- *Aircraft follow validated routes / Pilot updates routes*
- *1 pilot to multiple dissimilar aircraft*



Supervisor

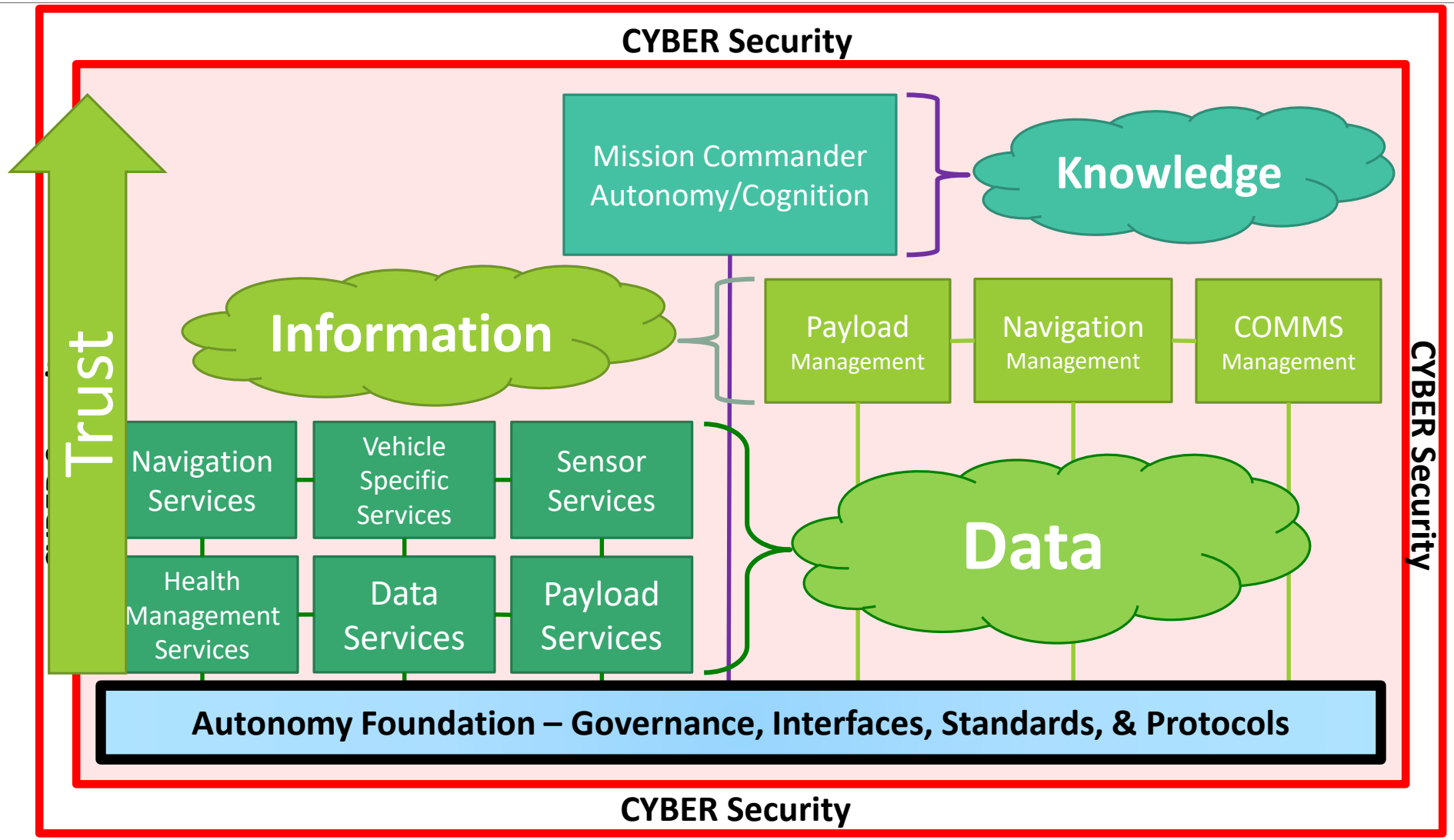
- *1 supervisor oversees about 12 aircraft (ATC model)*

Executive

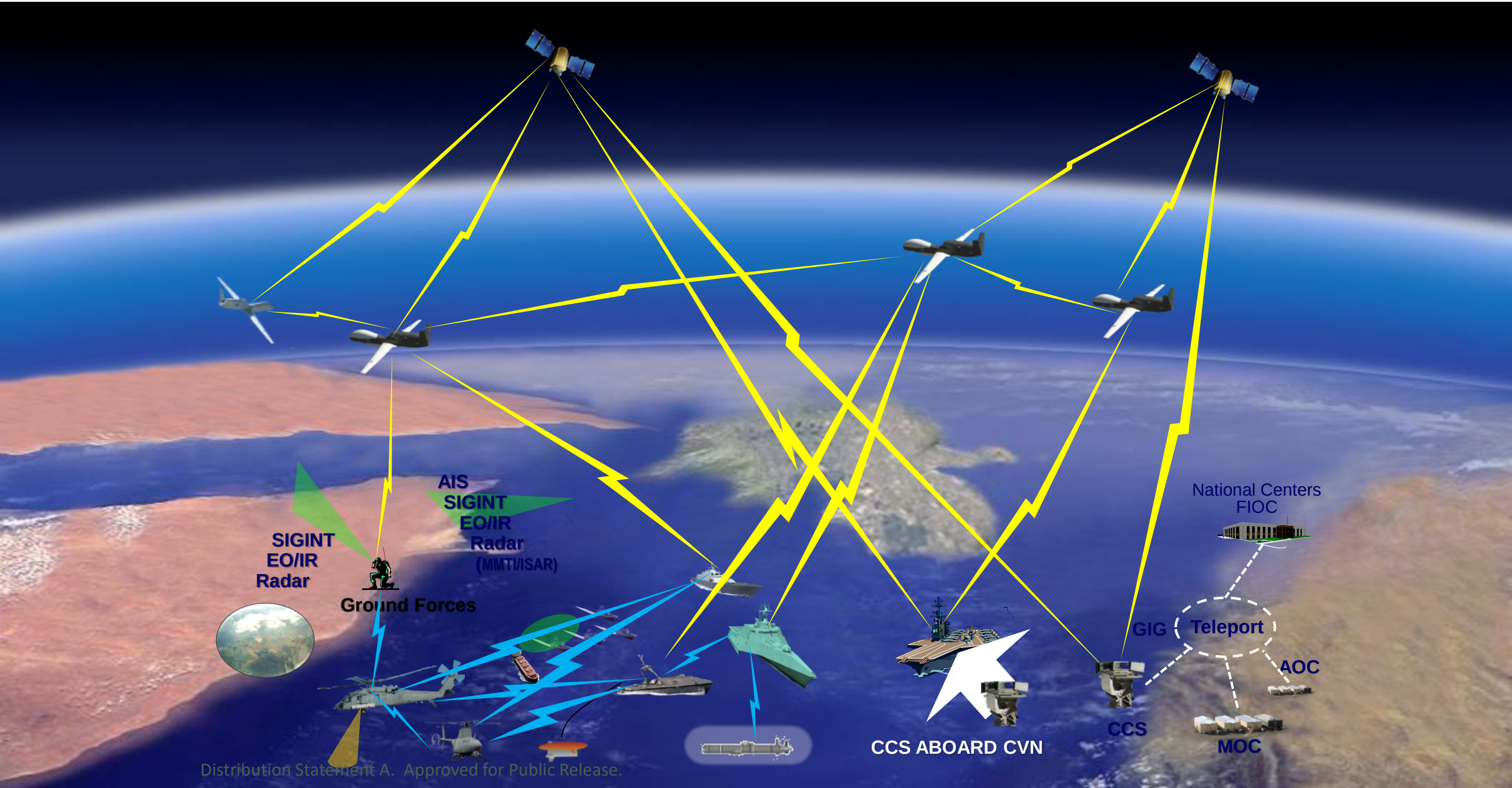
- *Executive enters mission commands: "follow that ship"*
- *Routes automatically generated*

Increasing level of UxS autonomy

Autonomy Architecture



Autonomy Architecture Drives Interoperability



Questions