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Department of Defense
OFFICE OF PREPUBLICATION AND SECURITY REVIEW

Autonomy and the National Defense Strategy

April 3, 2019

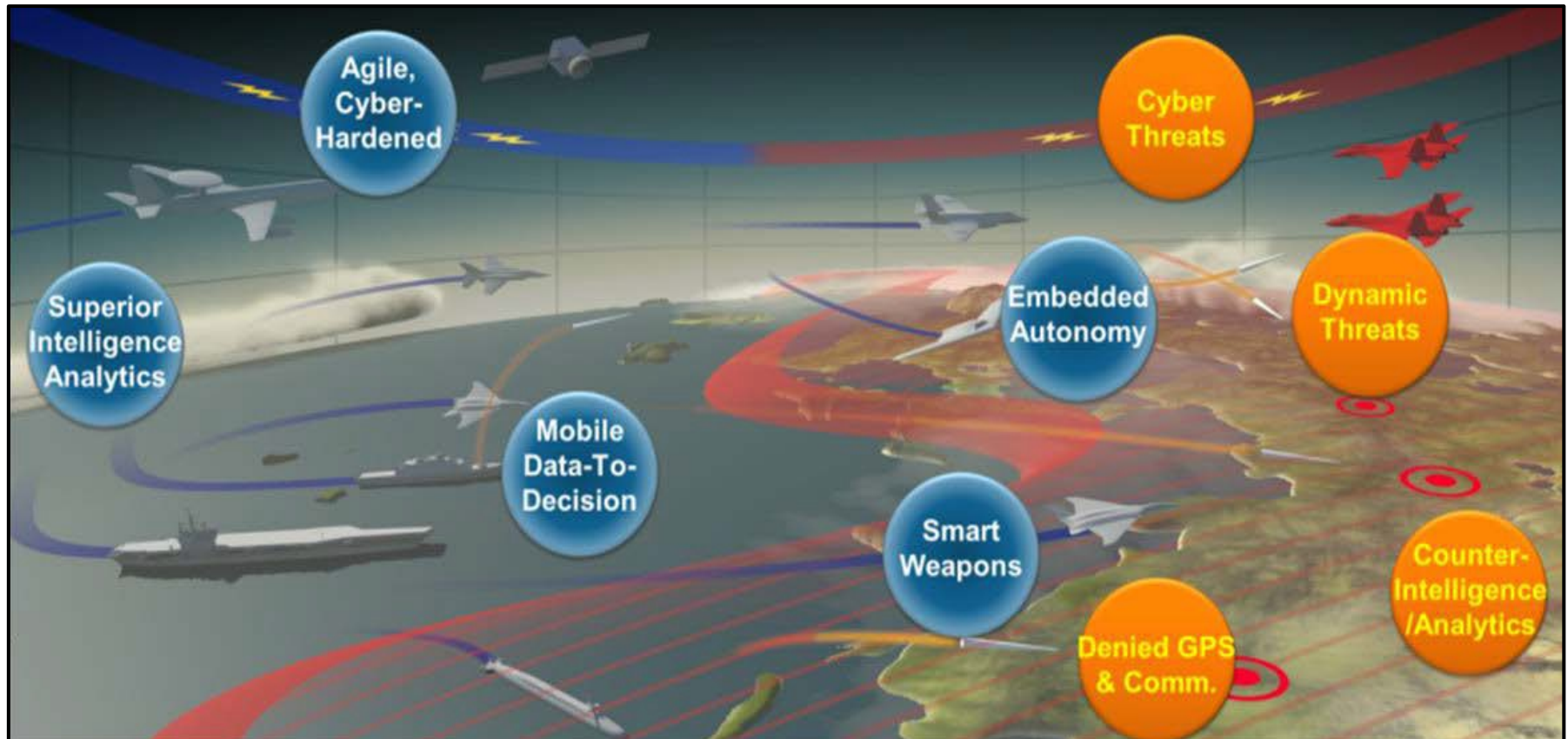
Wayne Nickols

Assistant Director for Autonomy

Undersecretary of Defense for Research & Engineering



Benefits of Autonomy ...



- Increase the speed and accuracy of decisions
- Enable new tactics and operational concepts requiring persistence and endurance
- Reduce the risk of casualties to both civilians and US troops
- Enable operations in Cyber/EW environments
- Enable use of unmanned platforms when comms to those platforms are denied
- Enable ability to operate platform if human operators are injured or killed

... and Challenges of Autonomy

- **Programmatic**
 - Technology or Application
 - Ubiquity
- **Operational**
 - CONEMP/CONOPs
 - An unwillingness to reduce force structure
 - Trust and confidence issues related to autonomous behaviors
- **Moral**
 - Responsibilities associated with the unmanned application of force
- **Policy**
 - Who is responsible and liable for an autonomous asset?
 - DOTMLPF-P – how do we make autonomous systems part of the team?
- **Technical**
 - Machine Perception, Reasoning and Intelligence
 - Human/Unmanned System Interaction & Collaboration
 - Scalable Teaming of Autonomous Unmanned Systems
 - Test & Evaluation and Verification & Validation

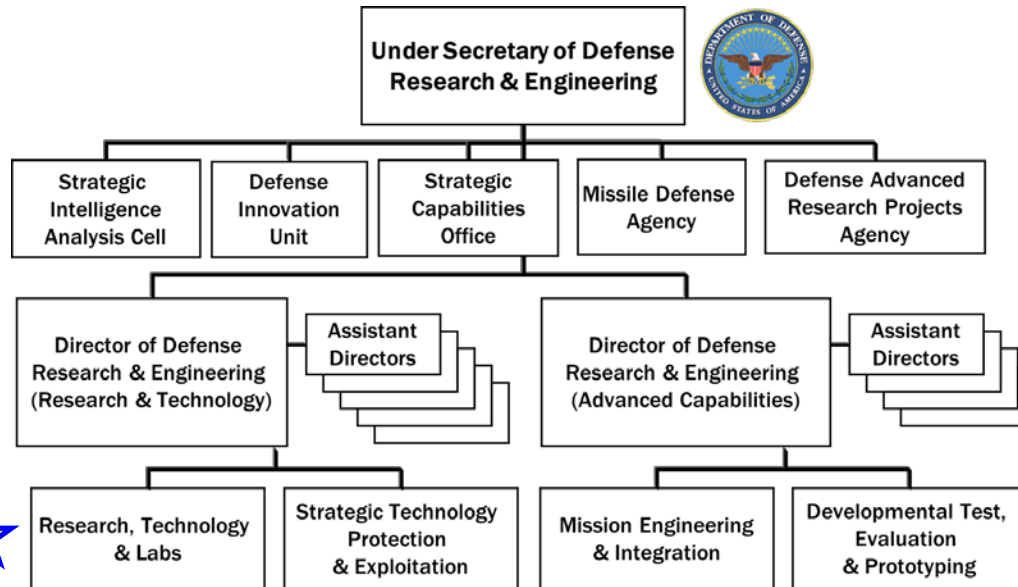
Role of the Assistant Directors

- **USD(R&E) Mission**

- Ensure Technological Superiority for the U.S. Military
- Bolster Modernization

- **Assistant Directors**

- Develop DoD-wide vision and strategy for modernization priorities
- Develop technology roadmaps
- Collaborate with DoD/federal partners, industry, academia, and, international partners
- Support Senior Leadership with technical expertise



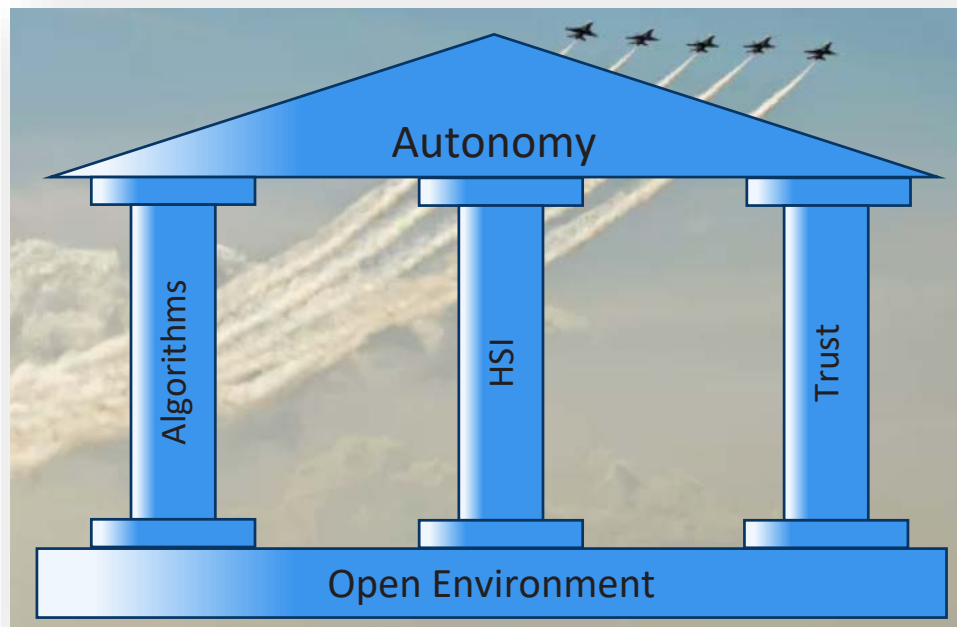
★ AD for Autonomy

Reliance 21
Autonomy Col



Autonomy Col Overview

Autonomy is the freedom to select a course of action required to achieve a higher authority's objective(s)



- **Autonomy Col Sub Areas**
 - Machine Perception, Reasoning and Intelligence
 - Human/Autonomous System Interaction and Collaboration
 - Test, Evaluation, Validation, and Verification
 - Scalable Teaming of Autonomous Systems

Col Goal

Advance autonomous systems by assessing S&T investments, gaps, and opportunities, and initiating critical enabling technology development.

LOE 1: Build a more lethal force

- Improve mission performance while lowering cost by providing support in extended duration missions where sufficient manning is impractical



Extend the Reach/Prevent Surprise

- Single-user multi-robotic control
- UAV/UGV collaboration & control
- Extended duration ISR operations



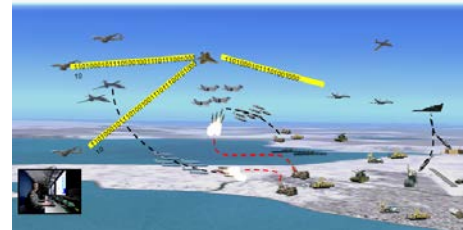
Mitigate Risk

- Capabilities for C-IED
- Capabilities for CBRNE
- Air collision avoidance

- Mitigate risk when the operating environment is too dangerous for manned platforms or in communication-denied environments when remote piloting is impossible



- Overcome adversarial combat threats that are too numerous, fast, and/or dynamic for human engagement or countermeasure management



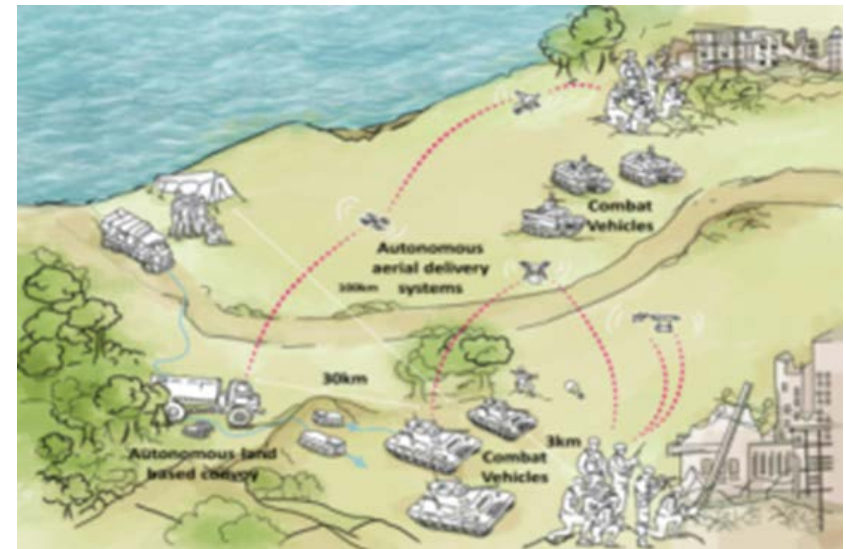
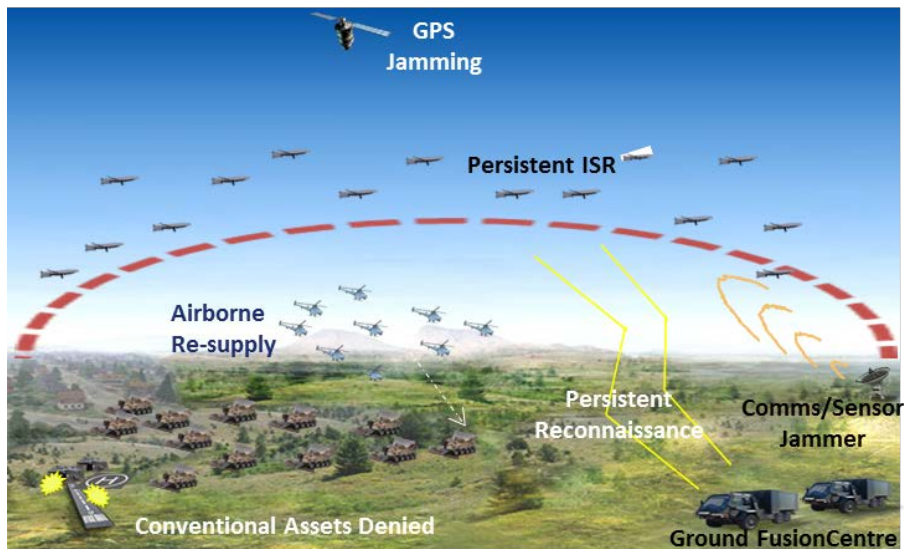
Dynamic Engagement

- Enable Command and Control
- Provide robust and resilient communications in the tactical field

Teaming of Humans and “Intelligent Machines” to Expand Capabilities


LOE 2: Strengthen the operational pull for autonomy

- Conduct experimentation to develop new CONOPS for autonomous systems
- Conduct extensive testing in realistic environments, including humans, to ensure that systems operate effectively and are relatively resistant to adversarial behavior
- Leverage commercial R&D in autonomy to reduce costs, particularly in logistics, maintenance, and information analysis




LOE 3: Accelerate DoD adoption of autonomous capabilities

- Develop a common development framework and architecture for autonomous systems and pursue community compliance
- Pursue development/refinement of and compliance with accepted interoperability standards for autonomous systems
- Ensure air-land-sea range infrastructure for TEV&V of and experimentation with autonomous systems
- Leverage private sector R&D in low-cost aerial systems, data analysis software, cyber defense, human-machine interaction, and efficiency-related technologies



Autonomy Col
Recommended future S&T Investments



- **Areas that require DoD S&T lead and concerted effort to achieve objectives**
 - Data collection, dissemination, and secure storage infrastructure
 - Common Development Environment & Architecture
 - High fidelity modeling and simulation
 - TEV&V methods, infrastructure, and policies

- **Areas where we leverage commercial S&T investment to address unique DoD modernization and/or unique Service needs**
 - Augmented reality/gaming, autonomous vehicles, commercial space

- **Areas requiring limited DoD/service Autonomy S&T Investment**
 - Smartphones, IoT infrastructure, cyber assistants

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The DoD Autonomy Roadmap

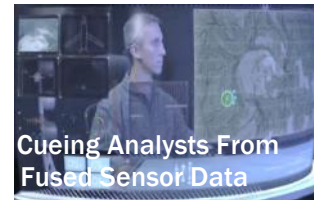
Autonomy can transform the DoD by expanding operational capabilities with improved safety, effectiveness and manpower efficiencies. It could become our greatest offset...or deficit.

Operating Safely & Efficiently



Present - 2021

Machine-Assisted Operations



2021 - 2024

Man-Unmanned Teams



2025 - 2028+

Near-Term

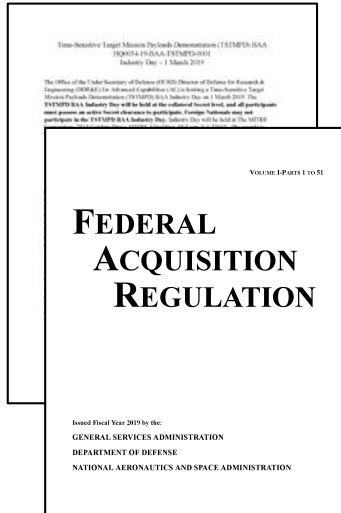
Mid-Term

Far-Term

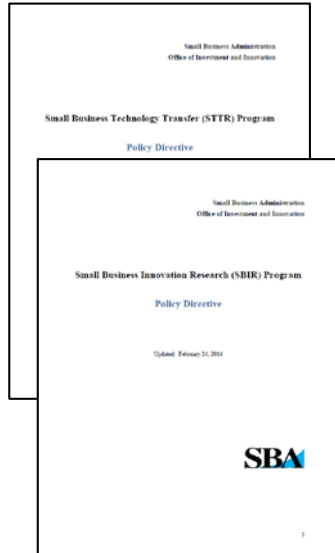
Teaming of Humans and "Intelligent Machines" to Expand Capabilities

Potential Engagement Opportunities: Authorities, Funding Sources, and Partnerships

Traditional FAR Contracts



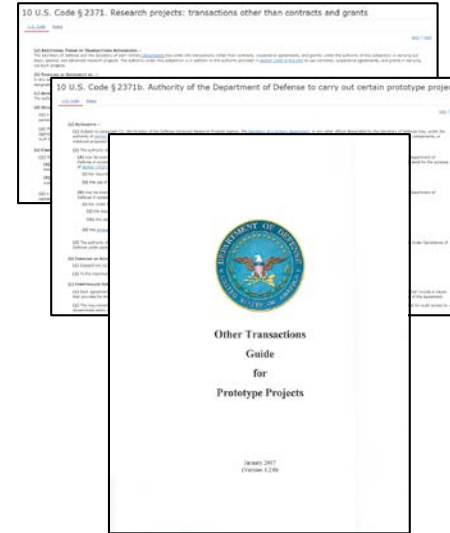
SBIR/STTR



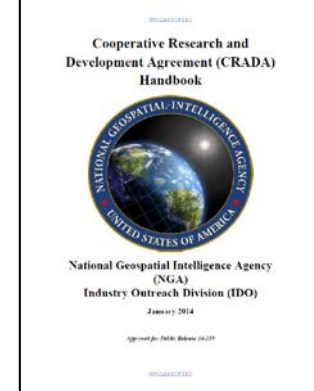
IRAD



Other Transaction Authorities



CRADA



Exploring Ways To Change The Way We Do Business

- USAF
- USA
- USN
- USMC
- USD(R&E)
 - Advanced Capabilities
 - Strategic Capabilities Office
 - DARPA
 - DIU/MD5
 - MDA
- OSD
 - DTRA
- USSOCOM

International Collaborations

Strengthening Alliances and Attracting New Partners

- **United Kingdom**
 - US/UK Stocktake Autonomy/AI Working Group
- **Australia**
 - Acquisition and Technology Development Working Group (ATDWG) that includes Autonomy
- **Republic of Korea**
 - Joint research Project Agreement in Autonomy
- **Others Collaborations in Autonomy**
 - US, Australia, Korea, and Japan Multilateral Agreement
 - India
 - Singapore

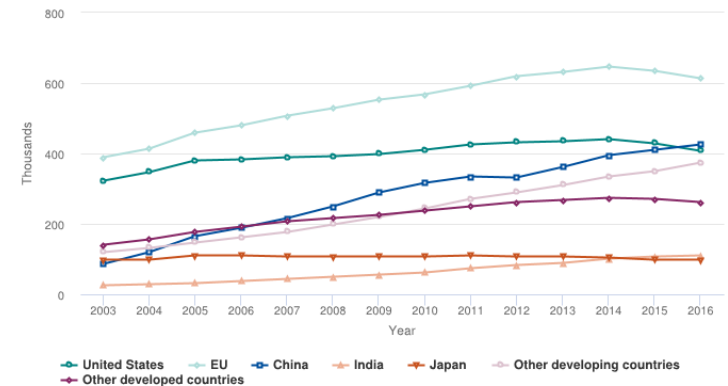
Technology is Transforming the Battlespace

How Do We Maintain A Competitive Advantage?

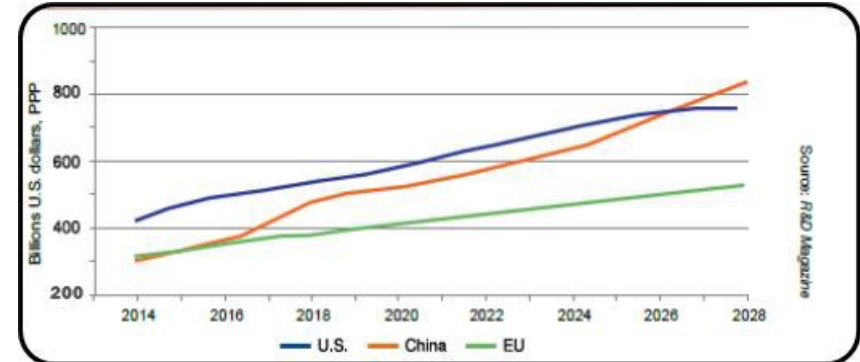
Science and Engineering Indicators 2018
National Science Board

- Easy proliferation of knowledge and technology has eroded US historic advantages
- Increased rate of investment in military R&D from near-peers
- Increasingly Competitive National Security Technical Environment

S&E articles, by selected region, country, or economy: 2003–16



2017 GLOBAL R&D FUNDING FORECAST WINTER 2017
Industrial Research Institute, R&D Magazine



“China’s 2017 (R&D) growth is basically twice the percentage change and twice the dollar amount of change as the growth forecast for the U.S.’s 2017 R&D spending”

Need to find pragmatic solutions to technology protection that still foster our competitive edge

Questions?