AT THE HEART OF THE MISSION

NDIA

1919 2019



20TH ANNUAL SCIENCE AND ENGINEERING TECHNOLOGY CONFERENCE

Enabling the National Defense Strategy Through Science & Technology

April 2 – 4, 2019 | San Diego, CA | NDIA.org/SET19

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WHO WE ARE

The National Defense Industrial Association is the trusted leader in defense and national security associations. As a 501(c)(3) corporate and individual membership association, NDIA engages thoughtful and innovative leaders to exchange ideas, information, and capabilities that lead to the development of the best policies, practices, products, and technologies to ensure the safety and security of our nation. NDIA's membership embodies the full spectrum of corporate, government, academic, and individual stakeholders who form a vigorous, responsive, and collaborative community in support of defense and national security. NDIA is proud to celebrate 100 years in support of our warfighters and national security. The technology used by today's modern warfighter was unimaginable 100 years ago. In 1919, BG Benedict Crowell's vision of a collaborative team working at the intersection of science, industry, government and defense began what was to become the National Defense Industrial Association. For the past century, NDIA and its predecessor organizations have been at the heart of the mission by dedicating their time, expertise and energy to ensuring our warfighters have the best training, equipment and support. For more information visit **NDIA.org**



SCHEDULE AT A GLANCE

TUESDAY APRIL 2, 2019

Registration
Rio Vista Foyer
7:00 am - 5:45 pm

Display and Posters Open
Rio Vista Pavilion
7:00 am - 7:15 pm

General Session
Rio Vista Ballroom
8:00 am - 5:30 pm

Networking Reception
Rio VIsta Pavilion
5:30 - 7:15 pm

WEDENSDAY APRIL 3, 2019

Registration
Rio Vista Foyer
7:00 am - 4:00 pm

Concurrent Breakout Session
Rio Vista Ballroom and Rio Vista Pavilion
8:00 am - 4:00 pm

THURSDAY APRIL 3, 2019

Bus Transportation to Admiral Kidd Center
6:30 am - 4:00 pm

Registration
Admiral Kidd Center - pre-registration required
7:00 am - 4:00 pm

Slassified Session
Admiral Kidd Center - pre-registration required
7:00 am - 4:00 pm



LEADERSHIP AND COMMITTEES

James Chew
Division Chair

SCIENCE ENGINEERING & TECHNOLOGY DIVISION

WHO WE ARE

The Science & Engineering Technology Division was formed to examine all aspects of science and technology affecting national defense. The division provides a venue for discussion of the nation's defense needs by examining existing capabilities and suggesting ways to overcome deficiencies in defense research and development (R&D). Individuals from industry, government and academia have the opportunity to examine vital information in an open forum on technical needs and planned efforts. The division is dedicated to raising interest in meeting Department of Defense technology requirements through creative research and advanced development across industry, government and academia.

EVENT INFORMATION

LOCATION

San Diego Marriott Mission Valley
8757 Rio San Diego Drive
San Diego, CA 92108

EVENT WEBSITE

NDIA.org/SET19

EVENT THEME

Enabling the National Defense Strategy Through Science & Technology

ATTIRE

Civilian: Business Casual
Military: Uniform of the day

SURVEY AND PARTICIPANT LIST

You'll receive via email a survey and list of attendees (name and organization) after the conference. Please complete the survey, which helps make our event even more successful in the future.

EVENT CONTACT

Britt Sullivan, CMP
Associate Director, Meetings & Special Projects
(703) 298-1514
bsullivan@ndia.org

PLANNING COMMITTEE

James Chew
Event Chair

Raj Aggarwal

Dr. Michelle Atchison

Bob Baker

Charles Botello

Roger Garay

Dr. David Lambert

Charles Marchefsky

Brian Reinhardt

Jeffrey Singleton

Mark Stephen

Dr. David Walker

SPEAKER GIFTS

In lieu of speaker gifts, a donation is being made to the Fisher House Foundation.

HARASSMENT STATEMENT

NDIA is committed to providing a professional environment free from physical, psychological and verbal harassment. NDIA will not tolerate harassment of any kind, including but not limited to harassment based on ethnicity, religion, disability, physical appearance, gender, or sexual orientation. This policy applies to all participants and attendees at NDIA conferences, meetings and events. Harassment includes offensive gestures and verbal comments, deliberate intimidation, stalking, following, inappropriate photography and recording, sustained disruption of talks or other events, inappropriate physical contact, and unwelcome attention. Participants requested to cease harassing behavior are expected to comply immediately, and failure will serve as grounds for revoking access to the NDIA event.

AGENDA

TUESDAY, APRIL 2

7:00 am – 5:45 pm

REGISTRATION
RIO VISTA FOYER

7:00 – 8:00 am

CONTINENTAL BREAKFAST
RIO VISTA FOYER

8:00 – 8:30 am

WELCOME REMARKS
RIO VISTA BALLROOM

James Chew
Chair, NDIA Science & Engineering Technology Division
Group Director, Aerospace and Defense, Cadence Design Systems

General Hawk Carlisle, USAF (Ret)
President and CEO, NDIA

OUSD (R&E) DIRECTOR KEYNOTES
RIO VISTA BALLROOM

8:30 – 9:15 am

Focus of the DoD S&T Program and the FY 2020 DoD S&T Budget Request

Mary Miller
Principal Deputy to the Director of Defense Research and Engineering for Research and Technology (PD, DDR&E for R&T)

9:15 – 10:00 am

Prototyping, Integration and Open Architecture Development

James Faist
Director of Defense Research & Engineering (Advance Capabilities)

10:00 – 10:30 am

NETWORKING BREAK AND DISPLAYS/POSTERS OPEN
RIO VISTA PAVILION

SESSION 1: OPPORTUNITIES FOR COLLABORATION
RIO VISTA BALLROOM

Dr. Raj Aggarwal
Session Chair
President & CEO, RK Global Technology Consulting, LLC

10:30 – 11:00 am

NAVAL INFORMATION WARFARE CENTER – PACIFIC
Christopher Raney
Deputy Executive Director/Technical Director, Naval Information Warfare Center - Pacific

11:00 – 11:30 am

THE DOD TEST & EVALUATION / SCIENCE & TECHNOLOGY PROGRAM

George Rumford
Test & Evaluation/Science & Technology Program Manager, Defense Test Resource Management Center

11:30 am – 12:00 pm

DEFENSE INNOVATION UNIT – COMMERCIAL INNOVATION

Steve Butow
Space Portfolio Director

12:00 – 1:00 pm

NETWORKING LUNCH

WEST LAWN

1:15 – 1:45 pm

DEFENSE THREAT REDUCTION AGENCY (DTRA)

Dr. Rhys Williams
Director, Research & Development, Defense Threat Reduction Agency

1:45 – 2:30 pm

STRATEGIC ASSESSMENT AND TECHNOLOGY FUTURES

George Galdorisi and Rachel Volner
Corporate Strategy Group, Naval Information Warfare Center - Pacific

SESSION 2: SERVICE SCIENCE & TECHNOLOGY PROGRAMS

RIO VISTA BALLROOM

Mark Stephen
Session Chair
Strategic Technology Development, Lockheed Martin Missiles & Fire Control

2:30 – 3:15 pm

THE ARMY SCIENCE & TECHNOLOGY PROGRAM

Dr. Thomas Russell
Deputy Assistant Secretary of the Army (Research & Technology) and Chief Scientist

3:15 – 4:00 pm

NETWORKING BREAK AND DISPLAYS/POSTERS OPEN

RIO VISTA PAVILION

4:00 – 4:45 pm

THE NAVAL SCIENCE & TECHNOLOGY PROGRAM

Dr. David Walker
R&D Portfolio Director, Office of Naval Research

4:45 – 5:30 pm

THE AIR FORCE SCIENCE & TECHNOLOGY PROGRAM

Jeffrey Stanley
Deputy Assistant Secretary of the Air Force for Science, Technology and Engineering

5:30 – 7:15 pm

NETWORKING RECEPTION

RIO VISTA PAVILION

WEDNESDAY, APRIL 3

7:00 am – 5:00 pm

REGISTRATION

RIO VISTA FOYER

7:00 – 8:00 am

CONTINENTAL BREAKFAST

RIO VISTA PAVILION

SESSION 3: COI PRESENTATIONS CONCURRENT SESSIONS

RIO VISTA PAVILION

Robert Baker
Session Chair

8:00 – 8:30 am

The Role of the Communities of Interest

Mr. Dale Ormond
Director, Science and Technology, OUSD (R&E)

8:30 – 8:55 am

Space

Dr. Thomas Cooley
AFRL Sensors, U.S. Air Force Research Laboratory

8:55 – 9:20 am

Air Platforms

Layne Merritt
Director, Aviation Development, U.S. Army Futures Command

9:20 – 9:45 am

Advanced Electronics

Dr. Romeo Del Rosario
Associate Director, Sensors & Electron Devices Directorate, U.S. Army Research Laboratory

DOD S&T PRIORITY AREAS CONCURRENT SESSIONS

RIO VISTA BALLROOM

Dr. Michelle Atchison
Session Chair

8:00 – 8:15 am

Welcome Remarks

Dr. Michelle Atchison
University of Texas System

8:15 – 9:00 am

Cyber

Dr. Daniel Ragsdale
Assistant Director for Cyber

9:00 – 9:45 am

Quantum Science

Paul Lopata
Assistant Director for Quantum Science

9:45 – 10:15 am

NETWORKING BREAK AND DISPLAYS/POSTERS OPEN

RIO VISTA PAVILION

10:15 – 10:40 am

MATERIALS & MANUFACTURING PROCESSES

Dr. Tim Bunning
Chief Scientist, Materials & Manufacturing Directorate, U.S. Air Force Research Laboratory

10:40 – 11:05 am

Weapons Technologies

Dr. David E. Lambert,
Chief Scientist, Munitions Directorate, U.S. Air Force Research Laboratory

11:05 – 11:30 am

Ground & Sea Platforms

Alfred Grein
Executive Director, Research & Technology Integration, Ground Vehicle Systems Center

11:30 – 11:55 am

Autonomy

Jean-Charles Lede
U.S. Air Force Office of Scientific Research

11:55 am – 1:00 pm

NETWORKING LUNCH

WEST LAWN

1:00 – 1:25 pm

Cyber

Giorgio Bertoli
Director, C5ISR Center, Intelligence and Information Warfare Directorate, U.S. Army Combat Capabilities Development Command

1:25 – 1:50 pm

Electronic Warfare

Jeffrey Boksiner
U.S. Army Futures Command

1:50 – 2:15 pm

Energy and Power Technology

Dr. Edward C Shaffer, PE
Chief, Energy & Power Division, Sensors & Electron Devices Directorate, Army Research Laboratory, Combat Capability Development Command

2:15 – 2:45 pm

NETWORKING BREAK AND DISPLAYS/POSTERS OPEN

RIO VISTA PAVILION

10:15 – 11:00 am

Machine Learning/Artificial Intelligence

Dr. Mark H. Linderman
Senior Scientist for Command and Control, Decision Support, Information Directorate, Air Force Research Laboratory

11:00 – 11:45 am

Space

Dean Ridgely
Assistant Director for Space

1:00 – 1:45 pm

Autonomy

Wayne Nickols
Assistant Director for Autonomy

2:45 – 3:10 pm **C4I**

Mark Linderman
Senior Scientist for Command & Control, Decision Support and Information, U.S. Air Force Research Laboratories

3:10 – 3:35 pm **Human Systems**

Dr. John Tangney
Director, Human & Bioengineering Systems Division, Office of Naval Research

3:35 – 4:00 pm **Sensors and Processing**

Dr. James Campbell
U.S. Army Futures Command

THURSDAY, APRIL 4 – SEPARATE PRE-REGISTRATION REQUIRED

CLASSIFIED SESSION AT THE ADMIRAL KIDD CONFERENCE CENTER, NAVAL BASE POINT LOMA

Bus transportation will be provided between the Marriott and the Base*

7:00 am – 2:45 pm **REGISTRATION OPEN**
POINT LOMA PREFUNTION SPACE

7:00 – 8:00 am **CONTINENTAL BREAKFAST**
HARBOR LOUNGE

8:00 – 8:10 am **WELCOME REMARKS**

James Chew
Chair, NDIA Science & Engineering Technology Division
Group Director, Aerospace and Defense, Cadence Design Systems

SESSION 4: CAPABILITIES NEEDED BY THE COMBATANT COMMANDERS

POINT LOMA

Roger Garay
Session Chair
Enterprise Portfolio Analyst, Defense Technical Information Center

8:10 – 8:55 am **USCENTCOM**

Martin Drake
Science Advisor, USCENTCOM

8:55 – 9:40 am **USINDOPACOM**

Cynthia Holland
Science Advisor, USINDOPACOM

9:40 – 10:10 am **NETWORKING BREAK**

10:10 – 10:55 am **USSOUTHCOM**
Dr. Andrew Higier
OUSD (R&E) LNO, SOUTHCOM

10:55 – 11:40 am **USTRANSCOM**
Lou Bernstein
RDT&E Program Director, USTRANCOM

11:40 am – 1:00 pm **NETWORKING LUNCH**

1:00 – 1:45 pm **USSTRATCOM**
Mike Byington
Technology/Experimentation Support Branch, USSTRATCOM

1:45 – 2:30 pm **USNORTHCOM**
Col Gregg Jerome, USAF
Chief, J8 Science and Technology, NORAD and USNORTHCOM

2:30 - 3:15 pm **USEUCOM**
Stephen Spehn
Deputy Science Advisor, USEUCOM

3:15 – 3:45 pm **HYPERSONICS**
Michael White
Assistant Director for Hypersonics, OUSD (R&E)

3:45 – 4:00 pm **CLOSING REMARKS**
James Chew
Chair, NDIA Science & Engineering Technology Division
Group Director, Aerospace and Defense, Cadence Design Systems

*A Shuttle bus will run between the hotel and base every hour.

The NDIA has a policy of strict compliance with federal and state antitrust laws. The antitrust laws prohibit competitors from engaging in actions that could result in an unreasonable restraint of trade. Consequently, NDIA members must avoid discussing certain topics when they are together at formal association membership, board, committee, and other meetings and in informal contacts with other industry members: prices, fees, rates, profit margins, or other terms or conditions of sale (including allowances, credit terms, and warranties); allocation of markets or customers or division of territories; or refusals to deal with or boycotts of suppliers, customers or other third parties, or topics that may lead participants not to deal with a particular supplier, customer or third party.

DISPLAYER DESCRIPTIONS

CAL POLY COLLEGE OF ENGINEERING

Nationally, the College of Engineering at Cal Poly Pomona ranks top five among undergraduate engineering programs in non-doctorate-granting institutions, according to the U.S. News & World Report. With 12 ABET-accredited undergraduate programs and 7 graduate programs, we enroll nearly 5,800 students and graduate approximately 1,300 every year. Our undergraduate student body is ethically and socioeconomically diverse—37 percent of its students are from underrepresented groups and nearly 50 percent of our recent graduates are first-generation and low-income. The college's learn by doing education philosophy links theory with practice to graduate day-one professionals that are highly sought after by industry. Students participate in real-world engineering problem solving through internships, senior class projects and senior capstone design experiences.

DARPA SBIR/STTR

The Defense Advanced Research Projects Agency (DARPA) was established in 1958 to prevent strategic surprise from negatively impacting U.S. national security and create strategic surprise for U.S. adversaries by maintaining the technological superiority of the U.S. military. To fulfill its mission, the Agency relies on diverse performers to apply multi-disciplinary approaches to both advance knowledge through basic research and create innovative technologies that address current practical problems through applied research. DARPA's scientific investigations span the gamut from laboratory efforts to the creation of full-scale technology demonstrations in the fields of biology, medicine, computer science, chemistry, physics, engineering, mathematics, material sciences, social sciences, neurosciences and more. As the DoD's primary innovation engine, DARPA undertakes projects that are finite in duration but that create lasting revolutionary change.

DSIAC

The Defense Systems Information Analysis Center (DSIAC) is a component of the U.S. Department of Defense's (DoD's) Information Analysis Center with a focus on nine communities of practices. As an information and knowledge resource for DoD, DSIAC leverages expertise and knowledge from other Government agencies, research laboratories, industry, and academia to help solve the toughest scientific and technical problems of the Defense Systems community. To support this community, DSIAC offers several products and services, such as a four-hours of free technical inquiries, task orders, scientific and technical information uploads, training and events, information research products, and promotions.

DTIC

The Defense Technical Information Center (DTIC) is the DoD's central authority for collecting, safeguarding, analyzing, and disseminating defense-related scientific and technical information to a broad spectrum of authorized users. Its flagship product, the R&E Gateway (https://www.dtic.mil), is the DoD's one-stop source for controlled-unclassified (NIPR) collections/workspaces to help military lab scientists, engineers, and researchers reduce duplication of efforts and build on past successes. Its classified (SIPR) site (https://dtic.smil.mil) support the requirements of the Combatant Commands (CCMDs). DTIC also manages the Information Analysis Centers (IAC) which provide essential technical analysis and data support to the CCMDs, the Office of the Secretary of Defense, other defense and federal agencies. Through the IACs, DTIC actively partners and collaborates with defense research and engineering focus groups and communities of interest in cyber, homeland defense, and defense systems.

GSA AAS / FEDSIM

GSA AAS & FEDSIM are the only full service, government-wide assisted acquisition organization that provides federal agencies with hands-on strategic direction and development through all phases of the federal government acquisition process. Each client receives tailor-made strategies, dedicated customer service, and unmatched technical expertise. Our comprehensive, integrated approach enables clients to focus accomplishing their agency mission, while we focus on the details.

MICROWAVE APPLICATIONS GROUP (MAG)

Microwave Applications Group (MAG) provides unique microwave components and subsystems to government, aerospace, and commercial markets worldwide. MAG's goal is to find creative, cost-effective solutions to customer requirements. Early growth of the company was fueled by development of the Phase Shifter Suite for the AWACS and the Phase Control Module for the B1-B. These efforts led MAG into the development of numerous Phased Array Antenna Systems where MAG built the antenna, electronic control circuitry and the Beam Steering Computer. MAG's core design concept naturally transitioned into the development of a line of single, double pole and up to four throw High Power Switches.

ZMICRO, INC.

ZMicro provides military grade computers, displays, storage, and video enhancements systems. We are committed to providing rugged computing solutions that meet your requirements for durability, reliability, and optimal performance. All our products are designed to be highly customizable to accommodate program specifications. Our extensive on-site engineering and manufacturing capabilities combined with our proven line of products enable us to provide fast turnaround on standard and build to spec products.

NOTES

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BIOGRAPHIES



MR. JAMES "JIM" A. FAIST

Director of Defense Research and Engineering for Advanced Capabilities
Office of the Secretary of Defense

Mr. James "Jim" A. Faist is the Director of Defense Research and Engineering for Advanced Capabilities, reporting directly to the Under Secretary of Defense Research and Engineering within the Office of the Secretary of Defense. Jim directs an organization whose mission is to recognize, explore, and accelerate the development and integration of new technology to maintain U.S. technological superiority. He is responsible for establishing a Department of Defense joint mission engineering capability, oversight of developmental testing and test facilities as well as demonstration and validation of technology prototype and rapid fielding activities. Jim serves as the mission area advisor for warfighter portfolios in hypersonics, space, autonomy, and networked command, control, and communication architectures. He also provides independent technical risk assessments of major acquisition programs.

Jim has an extensive career in industry and government in national defense, including progressive responsibilities and experience in military operations, advanced technologies, system development, engineering leadership, and program management. He is a recognized expert in advanced sensors, weapons, and electronic warfare for space, air, and ground capabilities.

Faist was a chief engineer for the Northrop Grumman and Harris Corporations. He held senior executive positions at Schafer Corporation, Trident Systems Incorporated, and System Planning Corporation. Prior to his work in the industry, he served in the United States Air Force as a Weapons Systems Officer and an Electronic Warfare Officer in the F-4D/E Phantom II fighter aircraft.

Jim earned a Bachelor of Science in Electrical Engineering from Virginia Military Institute in Lexington, Virginia, and a Master of Science in Electrical Engineering from Cornell University in Ithaca, New York, with emphasis on microwave and power systems. During his career he received numerous performance awards and honors from the U.S. Air Force, academia, and industry.



MARY MILLER

Performing the Duties of the Assistant Secretary of Defense for Research and Engineering (ASD(R&E))

Ms. Mary J. Miller is currently Performing the Duties of the Assistant Secretary of Defense for Research and Engineering (ASD(R&E)). In April 2016, she joined the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics as the Principal Deputy (PD) Assistant Secretary of Defense for Research and Engineering. As the PD, she is responsible for the Department of Defense (DoD) research and development strategies and plans to develop and leverage technologies needed to ensure U.S. technological superiority. She provides leadership and establishes guidance for the development and execution of the DoD Science and Technology (S&T) enterprise as well as lead joint prototyping and experimentation efforts, systems engineering and developmental test policies and procedures with an annual budget in excess of $12 billion. Ms. Miller oversees research efforts at 63 DoD laboratories, warfare centers, and engineering centers, in addition to prototyping, systems engineering, and developmental test efforts for the Department – all focused on delivering next generation capabilities to the U.S. warfighter. She promotes coordination and cooperation across DoD components, between DoD and other federal and non-federal agencies and organizations, and ensures technological exchange with allied and partner nations. Ms. Miller also serves as the U.S. Principal for The Technical Cooperation Program (TTCP), an international organization that collaborates in defense scientific and technical information exchange; program harmonization and alignment, and shared research activities between Australia, Canada, New Zealand, United Kingdom, and the U.S.

Prior to her current assignment, she served three years as the Deputy Assistant Secretary of the Army for Research and Technology (DASA(R&T)). In that role, she was responsible for policy and oversight of the research and technology programs, which span 16 Laboratories and Research, Development and Engineering Centers, employs nearly 12,000 scientists and engineers and had a yearly budget that exceeded $2.4 billion. Ms. Miller was charged with identifying, developing, and demonstrating technology options that informed and enabled effective and affordable capabilities for Soldiers. She was also responsible for developing an S&T strategy responsive to Army needs- near term (5 years) to far term (more than 20 years). Her S&T portfolio covered basic research through the development and demonstration of components, subsystems, Manufacturing Technology, and technology system prototypes.

Between 2010-2013, Ms. Miller served as the Deputy Program Executive Officer for Soldier, where she was the principal civilian for the Department of the Army responsible for the design, development, procurement, fielding, and sustainment of a portfolio with more than 460 products/systems and a $3 billion budget. Her work encompassed virtually everything a Soldier wears or carries. From 2005-2010, Ms. Miller served as the Director for Technology, within the Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology. She was responsible for oversight and coordination of Army's S&T efforts to transition technology in support of acquisition programs.

Ms. Miller received a B.S. in Electrical Engineering from the University of Washington, an M.S. in Electrical Engineering, Electro-Physics, from George Washington University, and an M.B.A. from the University of Tennessee. She was selected in 2005 to the Senior Executive Service and is Defense AcquisitionWorkforce Level III certified in Program Management; Engineering; and Science and Technology Management.











DDR&E Advanced Capabilities Overview

NDIA Science & Engineering Technology Conference

April 02, 2019

James A. Faist

Director of Defense Research & Engineering
for Advanced Capabilities

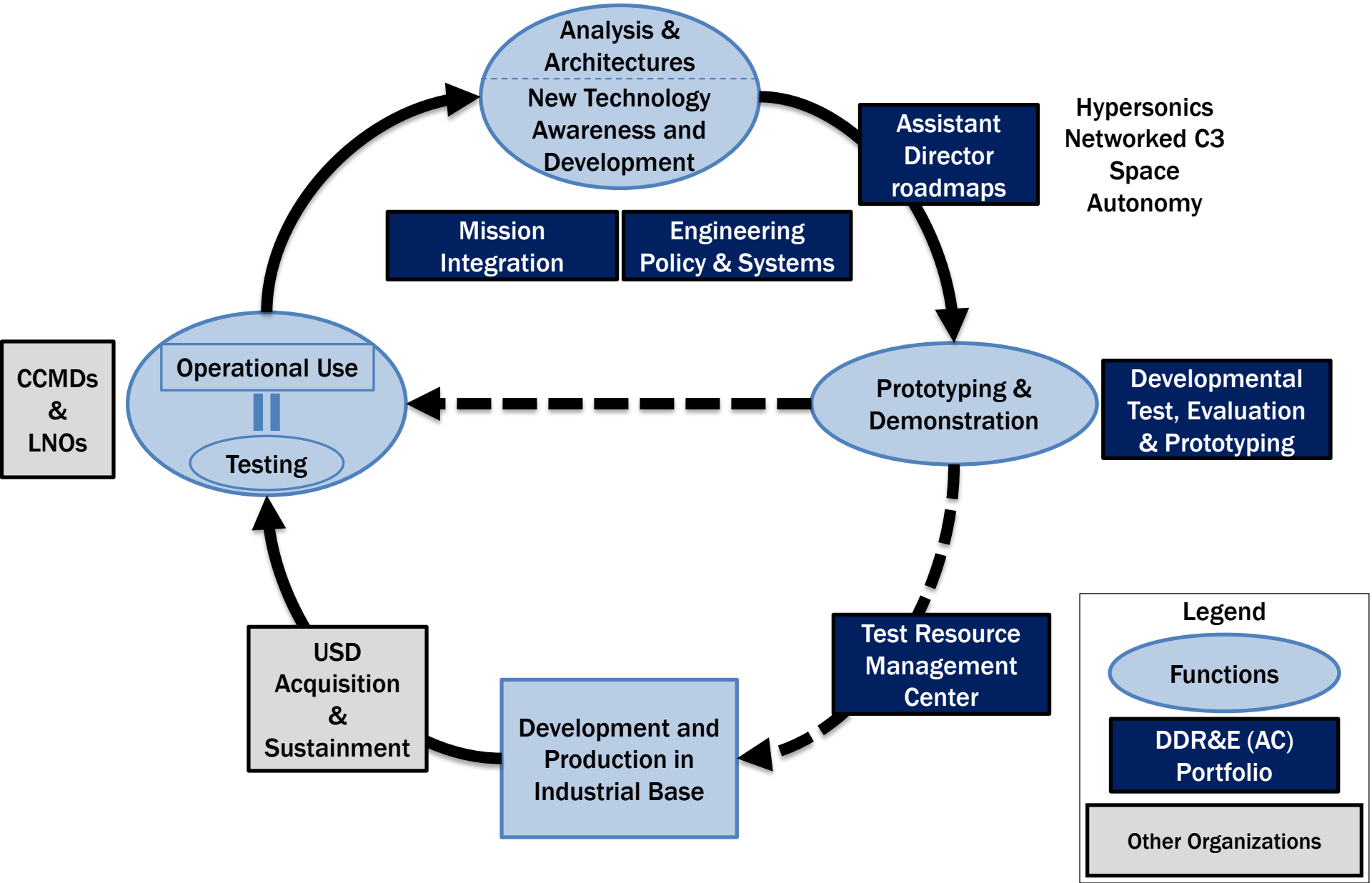
DISTRIBUTION STATEMENT A. APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

DDR&E AC: Aligned to the National Defense Strategy

- **National Defense Strategy Focus:** Era of Great Power Competition, Modernization Priorities in Response
  - Lethality, Partnerships, Reform
- **USD(R&E) Mission:** Creating the Technologies of the Future Fight
  - Ensure Technological Superiority for the U.S. Military
  - Focus on Modernization
- **DDR&E Advanced Capabilities Role:**
  - Accelerate Modernization
  - Mature Technology to Capability, from Prototyping to Acquisition
  - Focus Areas: Hypersonics, Networked C3, Space, Autonomy

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How We Operate: High-level Development Cycle

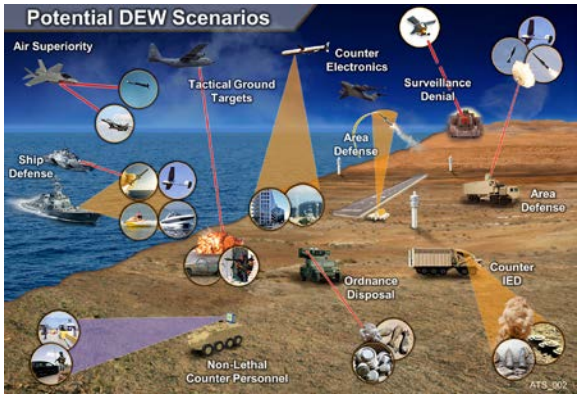


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How We Test: Test Resource Management Center

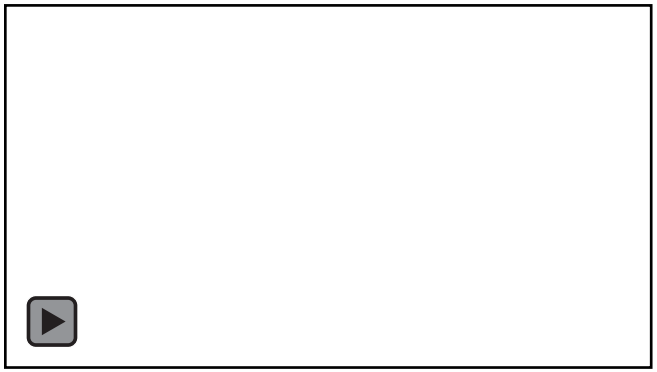
Ensures that DoD test ranges and facilities have the infrastructure, capabilities, funding, and workforce in place to support the development, acquisition, fielding, and sustainment of Defense systems.

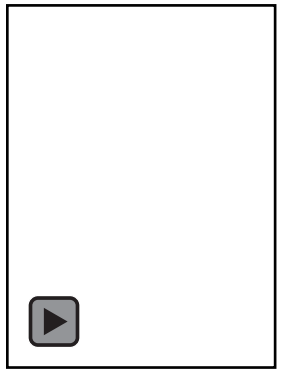
- **Strategize future test needs**
  - Aligned to R&E Priorities
  - Prioritize capabilities needed
  - Lower the cost of testing
- **Modernize test infrastructure**
  - New technologies & capabilities
  - Multi-facility integration
  - Enhance cyber test ranges
- **Ensure adequate funding to maintain National test assets**
  - Certify Service T&E budgets



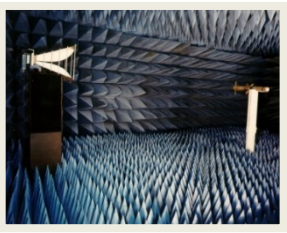














DISTRIBUTION STATEMENT A. APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

Mobile Land-Based Anti-Ship Fires - FCT



Mobile, Land-Based, Over the Horizon Anti-Ship Warfare Capability

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Soldier Borne Sensor Systems (SBS) - FCT







SBS provides on demand Situational Awareness for the Squad

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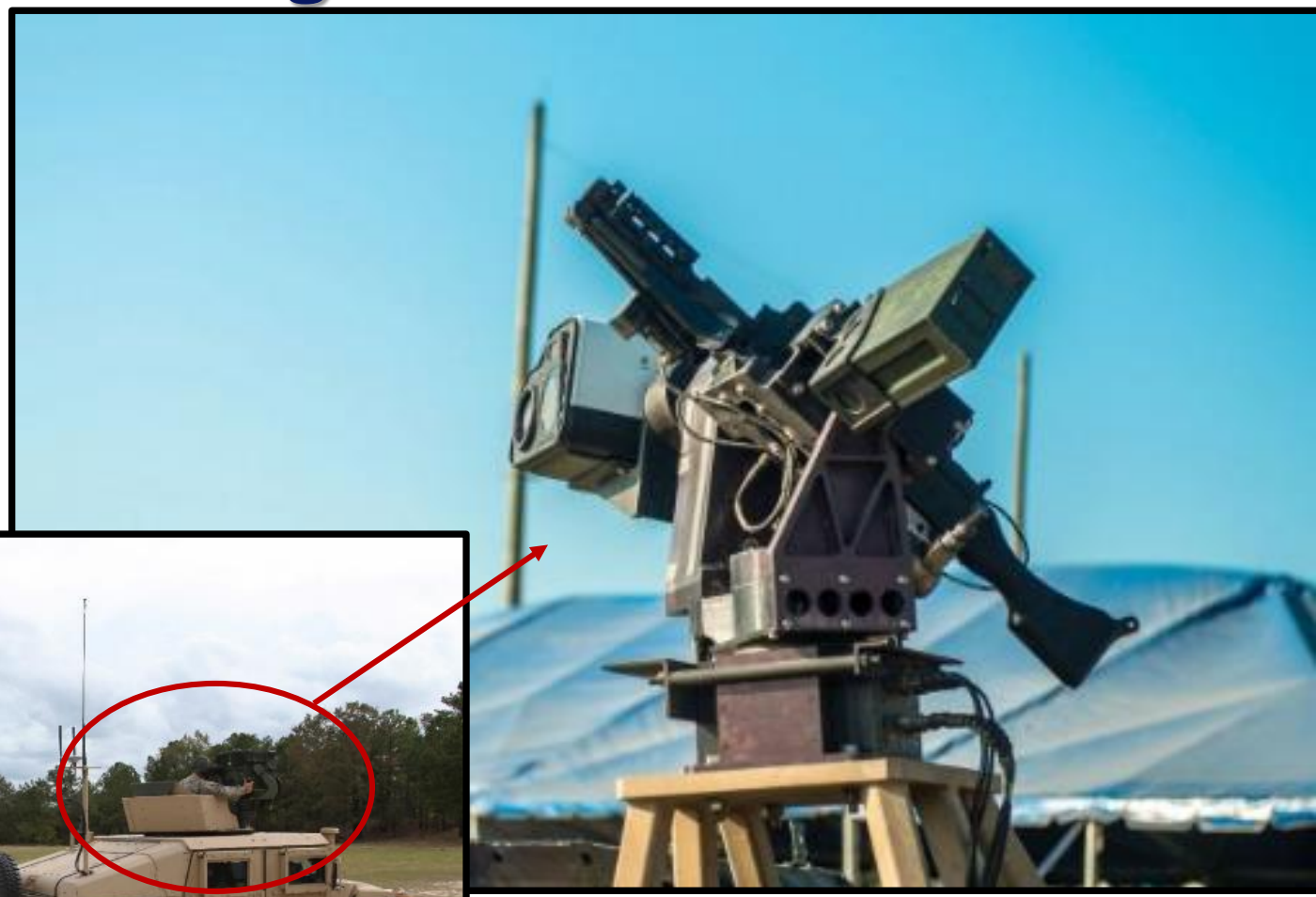
Low Cost Attritable Strike Demonstrator (LCASD) JCTD





The XQ-58A Valkyrie prototype demonstrator, a long-range, high subsonic unmanned air vehicle completed its inaugural flight March 5, 2019 at Yuma Proving Grounds, Arizona

Wingman JCTD

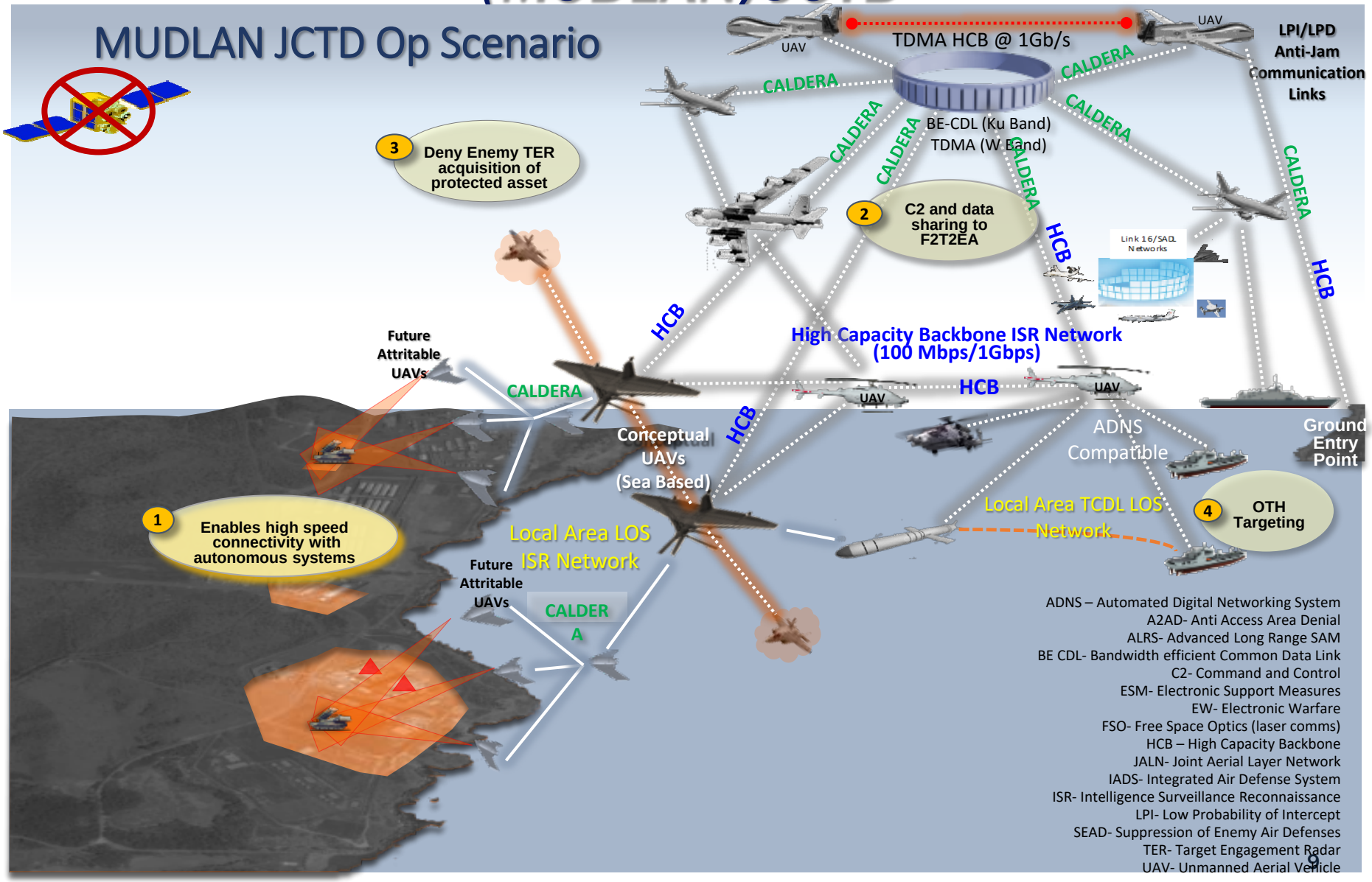




The Autonomous Remote Engagement System is a subsystem of the that reduces the time to identify targets using vision-based automatic target detection

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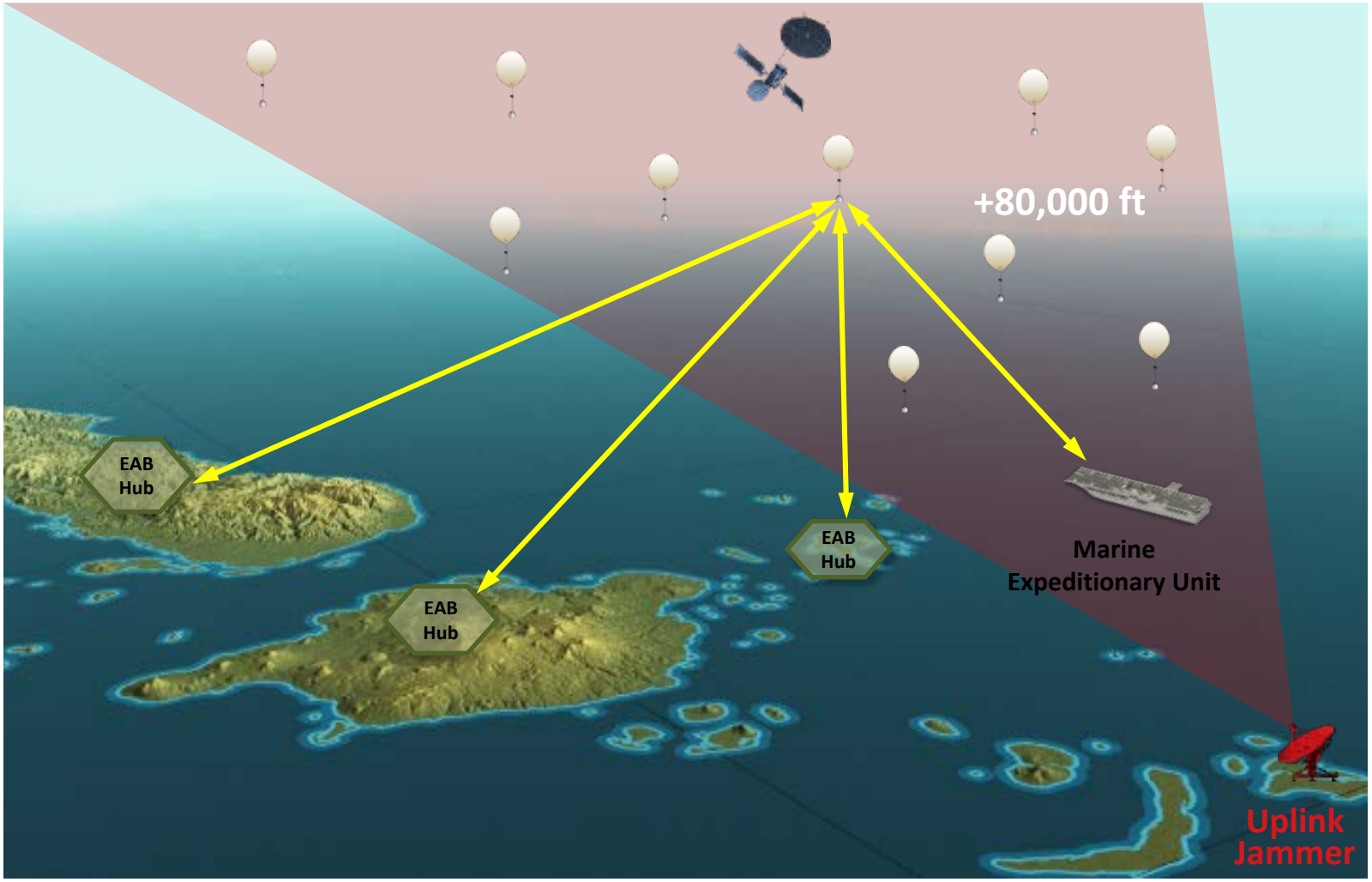
Mobile UAV Distributed Lethality Airborne Network (MUDLAN) JCTD



ADNS – Automated Digital Networking System
A2AD- Anti Access Area Denial
ALRS- Advanced Long Range SAM
BE CDL- Bandwidth efficient Common Data Link
C2- Command and Control
ESM- Electronic Support Measures
EW- Electronic Warfare
FSO- Free Space Optics (laser comms)
HCB – High Capacity Backbone
JALN- Joint Aerial Layer Network
IADS- Integrated Air Defense System
ISR- Intelligence Surveillance Reconnaissance
LPI- Low Probability of Intercept
SEAD- Suppression of Enemy Air Defenses
TER- Target Engagement Radar
UAV- Unmanned Aerial Vehicle

DISTRIBUTION STATEMENT A. APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

HALO Low-Cost Resilient Communications JCTD



HALO provides low-cost resilient communications for operation in denied communications areas (A2AD)

DISTRIBUTION STATEMENT A. APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

Questions?













OUSD(R&E)/DDRE(R&T) Research, Technology and Laboratories

Dale Ormond

Director, Science and Technology

NDIA 20th Annual Science & Engineering Technology Conference
April 3, 2019

Distribution Statement A: Approved for public release; distribution is unlimited.

Reliance 21

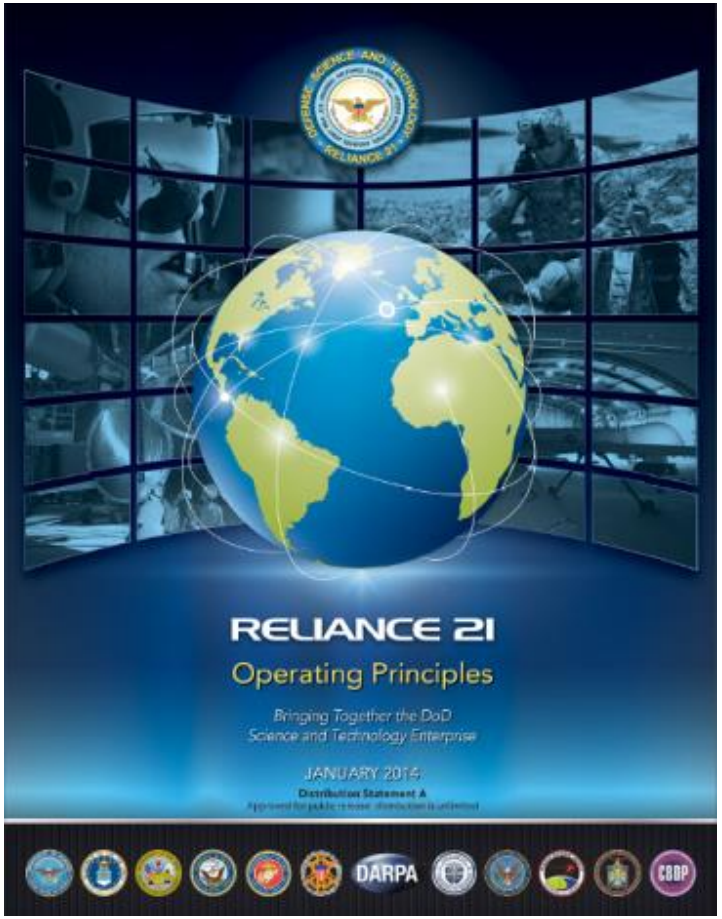
Reliance 21 is the overarching framework of the DOD's S&T joint planning and coordination process

Joint Planning - S&T Oversight

- Mitigate existing or emerging threats
- Generate affordability in the systems the Department acquires and operates
- Develop technology based surprise for our adversaries

Joint Coordination - S&T Delivery

- 17 Communities of Interest (CoIs)
- CoI S&T Roadmap Reviews
- CoI Information Exchange Meetings
- CoI Steering Groups
  - All Services and DoD Agencies Represented



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Reliance 21 Overview

Reliance 21 is led by the S&T Executive Committee (S&T ExCom)

- Comprised of the major Department Components (Services, Agencies, Commands)
- Provides executive oversight and overarching guidance on S&T investments
- Ensures a collective understanding of the priorities, capability gaps, and opportunities of the DoD organizations that manage critical S&T resources

Reliance 21 is implemented through the Communities of Interest (CoIs)

- Established in 2009 as a mechanism for multi-agency coordination and collaboration
- Comprised of S&E subject matter experts in specific technology areas where there is substantial investment across multiple components
- Produces S&T Roadmaps and Reports in their technical area detailing program goals and objectives, capability gaps, and leveraging opportunities

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Communities of Interest

CoIs lead the innovation and the acceleration of advanced concepts and prototypes across three main focus areas:

Mission Focus
Capabilities enabled by advanced technologies & systems



ASBREM: Armed Services Biomedical Research Evaluation and Management

Systems / Capability Focus
Multiple technologies are integrated into complex systems to achieve mission impact



Human Systems



Sensors



Space



Air Platforms



Ground and Sea Platforms



Electronic Warfare



Kinetic Weapon Technologies



Autonomy



Cyber



Command, Control, Communication, Computers and Intelligence (C4I)



Directed Energy/ Non-Lethal Weapons (DE-NLW)

Technology Focus
Technology goals with multiple applications



Energy and Power Technologies



Advanced Electronics



Materials and Manufacturing Processes

Alumni CoIs: Engineered Resilient Systems; Counter-Improvised Explosive Devices (C-IED); Counter-Weapons of Mass Destruction (C-WMD)

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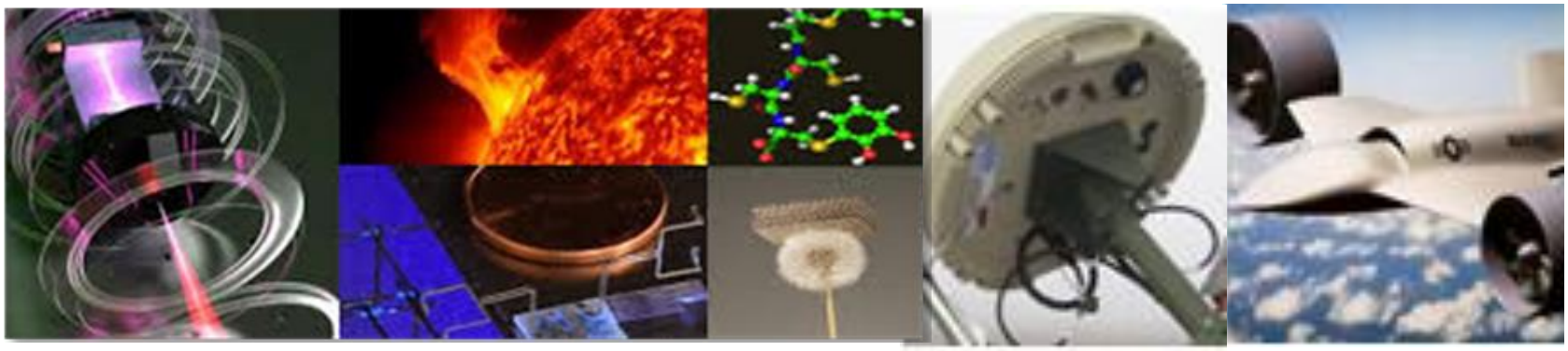
The Role of the CoIs

- **Enable the defense of the Department's S&T investments**
- **Create multi-Service / Agency collaborative efforts to reduce duplication**
- **Develop joint S&T roadmaps**
- **Monitor key technology developments and engagement opportunities**
- **Provide technology options and advice to DoD S&T senior leadership**
  - Provide recommendations to Service S&T Executives regarding opportunities to leverage other Services' investments
- **Facilitate engagement across the spectrum of stakeholders**
  - Combatant Command (CCMD), Intel Community, Academia, Industry

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Defend the Department's S&T Investments

- Describes the Department's S&T investment in detail
- Identifies opportunities and efficiencies that allow the Department to achieve maximum return on investment
- Provides data that confirms that the Warfighters are receiving the greatest benefit from DoD S&T resources and efforts



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Create Collaborative Opportunities to Mitigate Unnecessary Duplication

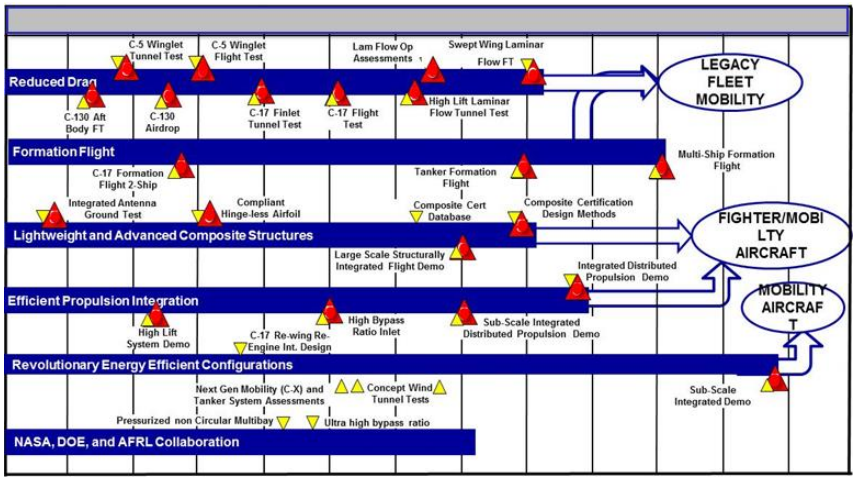
- Examine, comprehend, and quantify Service operational needs and explore multi-Service/ Agency collaborative opportunities
- Organize working groups across different organizations to investigate and understand inner connections and/or overlaps within the technology areas
- Create clear multi-Service/ Agency program dependencies - identified by 'Lead, Shape, or Follow' roles

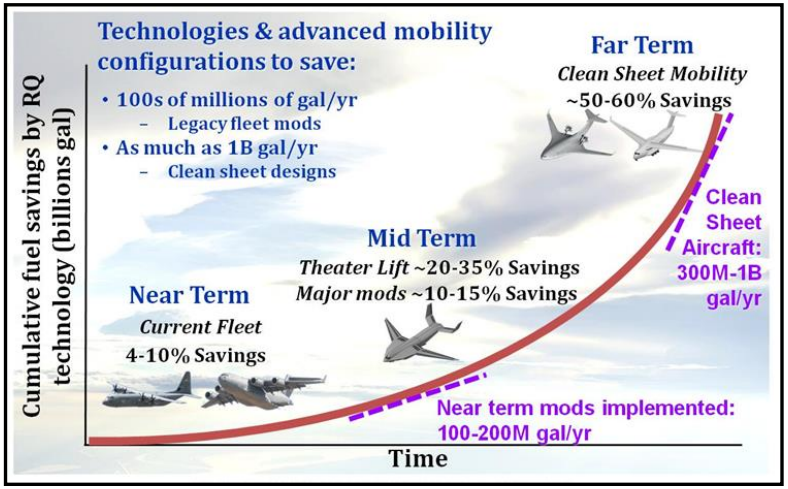
Distribution Statement A: Approved for public release; distribution is unlimited.

Develop Joint S&T Roadmaps

Roadmaps project a shared vision of DoD's S&T Portfolio

- Describe program objectives and key technical challenges
- Assess and address capability gaps and operational impact
- Indicate the capability gap timeline and threat development
- Propose potential Prototypes/Experiments to address the most challenging technology development needs





S&T Priorities Program

- **Program is executed out of the USD(R&E) - Research**
- **S&T Priorities program exists to:**
  - Enable high-payoff, cross-Component technology efforts
  - Develop integrated program execution plans (roadmaps) across the DoD
  - Execute Applied Research for Advancement of Priorities (ARAP) programs
    - Three-year programs, $10M-$15M/yr; two or three in each budget year
  - Fund seedlings to buy down risk in integrated plans
  - Allow fast start-ups in other areas
- **Augment Reliance 21 to foster increased collaboration**
- **Grow workforce in emerging technology areas**
- **Major program decisions involve all Components**

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Applied Research for the Advancement of Priorities (ARAP)

- ARAP enables high-payoff, cross-Component technology efforts
  - Three-year programs, $10M-$15M/year; two or three in each budget year
  - Allows for fast start-ups in other areas
- Fosters Joint-Service research focused on common elements of cross-cutting S&T areas
- Facilitates concept exploration efforts and studies of alternative concepts
- Strengthens in-house laboratory research efforts and workforce

ARAP Portfolio

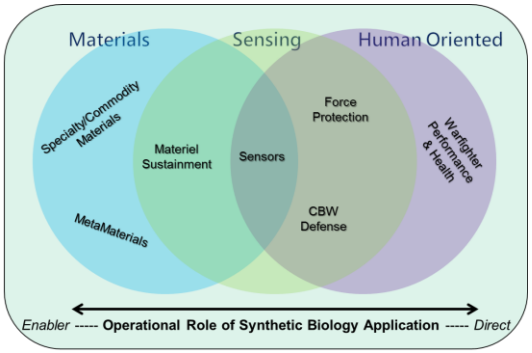
- NEW: Enhanced Energetic Effects (EEE)
- Defense Optical Channel Program (DOC-P)
- Synthetic Biology for Military Environments (SBME)
- Quantum Science and Engineering Program (QSEP)
- Data To Decision (D2D)*
- Autonomy Research Pilot Initiative (ARPI)*
- Engineered Resilient Systems (ERS)*

*Completed program

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A Winning ARAP Proposal

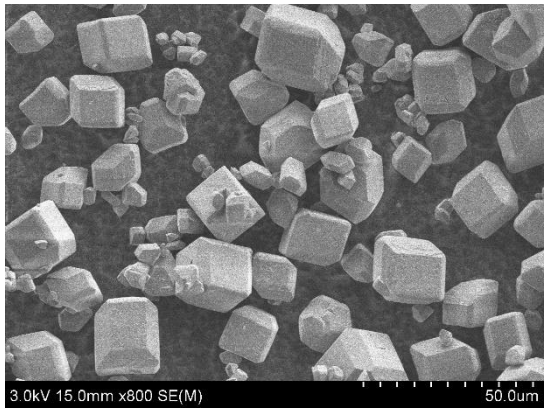
- Meets the definition of Budget Activity 2 (Applied Research) funded work
- A new, emerging area of science and/or engineering where the potential exists to develop future capabilities that will give the joint warfare a technological edge in the fight
- Technically sound but pushes the leading edge(s) of science/engineering with reasonable risk to achieve success
- Multiple Services/Labs working together
- Majority of the work will be performed by DoD scientists and engineers



Synthetic Biology for Military Environments (SBME)



Defense Optical Channel Program (DOC-P)



Enhanced Energetic Effects (EEE)

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Maintain Vital Engagements to Maximize Capability Development

CoI engagements are vital to addressing wide-ranging S&T needs

- Combatant Command (CCMD) S&T Advisors (Operator Community)
  - Provide a forum to articulate S&T priorities and investments with the potential to address CCMD capability gaps
- Intelligence Community
  - Evaluate intelligence information regarding current and future threats as well as emerging technologies to best align research and acquisition priorities
- Basic Research Community (Academia, DoD Labs and Centers)
  - Review Basic Research priorities and identify opportunities to engage future scientists and engineers
- Industry Independent Research and Development
  - Industry can use CoI Roadmaps to identify technical challenges

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Basic Research Community Engagement (Academia, DoD Labs and Centers)

- Ensure an understanding of DoD's Basic Research investment priority in basic science
- Maintain awareness of emerging opportunities for transition to applied research and the CoIs
- Inform Basic Research of potential areas for investment that could resolve technical challenges in capability development (e.g., materials and hypersonics)

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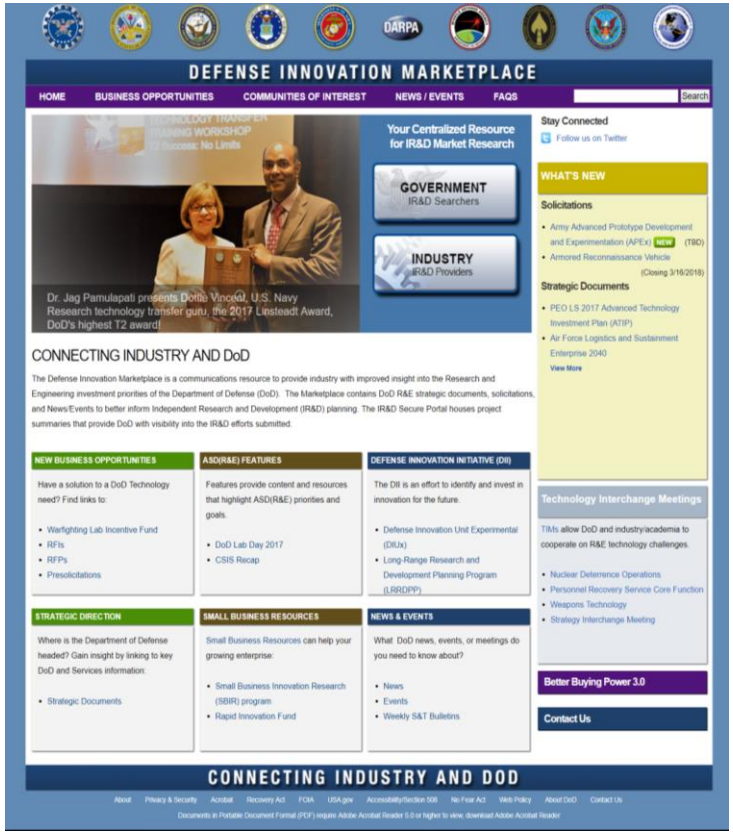
Defense Innovation Marketplace

Provides Industry:

- DoD R&E Strategic Guidance
- Service-specific S&T priorities, Virtual Technology Interchanges, events and solicitations are posted.
- DoD Investment Strategies and Technology Roadmaps
- Secure Portal to share IR&D Project Summaries

Provides DoD:

- Research for approved DoD S&T, R&D and Acquisition professionals
- >19,000 IR&D Project Summaries on Portal
- Technical Maturity and Surveillance
- Guide DoD R&E investments
- Potential for risk / cost reduction
- Opportunity to grow and expand new relationships and partnerships



Communities of Interest (CoI) (Distro A) pages available at: http://www.defenseinnovationmarketplace.mil/coi.html

Access to DoD

One of the great strengths of DoD is our distributed network of program managers across various different Components

- **All DoD funding opportunities are posted to: https://www.grants.gov/**
  - Each opportunity will have the name and contact information of a person associated with the program.
- **OSD and all of the Components have websites that detail their programs and all of the pertinent information including topics of interest, funding cycles, calls for proposals, etc.**
  - OUSD: http://basicresearch.defense.gov
  - AFOSR: http://afrl.dodlive.mil/funding
  - ARO: https://www.arl.army.mil/www/default.cfm?page=29
  - ONR: https://www.onr.navy.mil/en/Contracts-Grants
  - DARPA: https://www.darpa.mil/work-with-us/opportunities
- **OUSD Basic Research office communication strategy aims to improve access and navigation in these various websites to make the most of community engagement.**
- **Program officers are afforded the flexibility to develop outreach strategies to identify scientific communities of interest and broadcast their program goals**
- **DoD has representation at many of the professional societies and symposia and is eager to engage**

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Finding Grant and Cooperative Agreement Funding Opportunities

Grants.gov is the common website for Department of Defense (DoD) and the other 25 federal grant-awarding agencies to post discretionary funding opportunities and for entities to search and apply for them.

Searching for Funding Opportunities on Grants.gov

- Any member of the public may search for funding opportunities at Grants.gov.
- Users who register with Grants.gov also have the ability to save their searches, and have updated search results emailed to them by signing up for subscriptions. Registered users may also subscribe to receive notifications about Grants.gov news, all new funding opportunities, and when changes are made to specific funding opportunities they identify.

Applying for Funding Opportunities

- Registered users must be associated with an organization and be assigned the proper applicant roles in order to apply for a funding opportunity. Users should contact their organization's business office to determine the process used in their organization.

DoD Grants.gov Manager:

- Ms. Barbara Orlando, barbara.j.orlando.civ@mail.mil, 571-372-6413



https://blog.grants.gov/



@grantsdotgov



https://www.youtube.com/user/GrantsGovUS

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Summary

- **Established in 2009, CoIs have grown from mechanisms of information sharing and multi-agency coordination to an infrastructure that identifies opportunities for collaboration to reduce duplication**
- **CoIs enable the S&T ExCom to deliver maximum S&T impact with reduced risk:**
  - Coordinate S&T strategies
  - Share new ideas, technical directions, and technology opportunities
  - Jointly plan programs
  - Measure technical progress
  - Report on the general state of health of technology areas
- **Joint S&T Roadmaps project a shared vision of the Department's S&T portfolio, showcase joint activities, and enable defense of investments**
- **CoIs are in a unique position to engage with industry through NDIA to promote innovation in DoD and maintain awareness of the rapid technology development taking place in the commercial sector**

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DoD R&E Enterprise

Solving Problems Today – Designing Solutions for Tomorrow







DoD Research Enterprise
https://www.acq.osd.mil/rd/

Twitter
@DoDInnovation

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Space – Assistant Director Perspectives

Dean Ridgely, Acting Assistant Director for Space, OUSD(R&E)

NDIA S&ET Conference
San Diego, CA | April 3, 2019

Distribution Statement A: Approved for public release. Distribution is unlimited. DOPSR Case #19-S-1163

Introduction

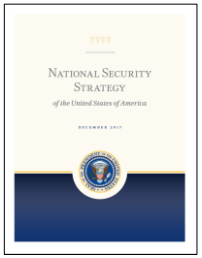
- The United States must maintain our leadership and freedom of action in space
- The threat is evolving
- We must take a new approach to equipping the Space Force to maintain U.S. competitive advantage …

"It is not about speed of discovery, it is about speed of delivery to the field."

USD(R&E) Michael D. Griffin, February 2019

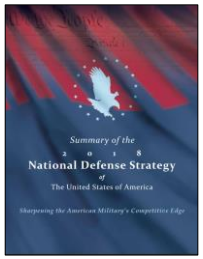
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Strategic Space Guidance



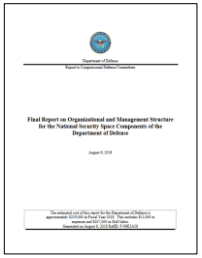
National Security Strategy

- The United States must maintain our leadership and freedom of action in space
- Advance space as a priority domain
- Promote space commerce
- Maintain lead in exploration



National Defense Strategy

- Today, every domain is contested – air, land, sea, space, and cyberspace.
- The Department will prioritize investments in resilience, reconstitution, and operations to assure our space capabilities.
- Investments will prioritize ground, air, sea, and space forces that can deploy, survive, operate, maneuver, and regenerate in all domains while under attack.



*Section 1601 Report**

- Transform to more resilient space architectures
- Strengthen deterrence and warfighting options
- Improve foundational capabilities, structure, and processes
- Foster conducive domestic and international environments for space development



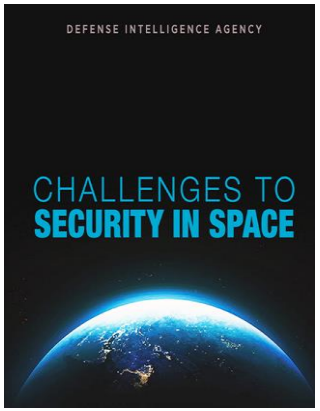
Space Policy Directive 4

- Space is integral to our way of life… national security, and modern warfare.
- Potential adversaries are now advancing their space capabilities and actively developing ways to deny our use of space in a crisis or conflict.
- Imperative that the United States adapt its national security organizations, policies, doctrine, and capabilities to deter aggression and protect our interests.
- **Directs DoD to develop a legislative proposal to establish a U.S. Space Force**

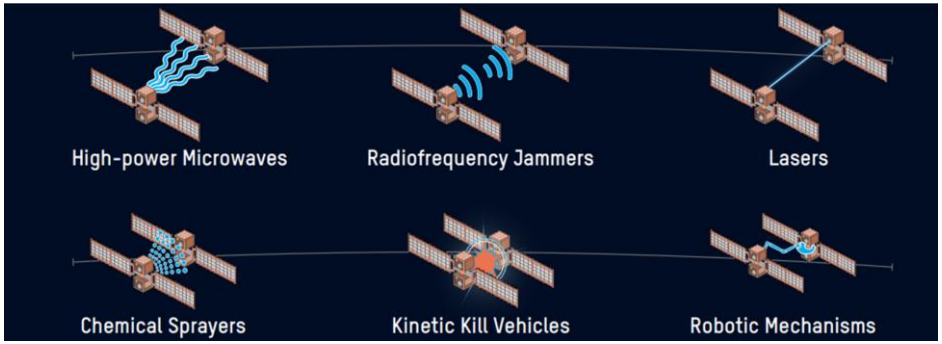
*Final Report on Organizational and Management Structure for the National Security Space Components of the Department of Defense, August 9, 2018 in response to National Defense Authorization Act for Fiscal Year 2018 Section 1601.

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Evolving Threat



- China and Russia "view counter-space capabilities as a means to reduce U.S. and allied military effectiveness." ("Challenges to Security in Space," U.S. Defense Intelligence Agency, 2019)
- "China and Russia, our strategic competitors, are explicitly pursuing space warfighting capabilities to neutralize U.S. space capabilities during a time of conflict. Other potential adversaries are also pursuing counter-space capabilities such as jamming, dazzling, and cyber-attacks." (1601 Report)



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New Approach

- Today's space threat environment and commercial space ventures are driving the Department to think differently
- Space architectures with small number of large, exquisite satellites are not responsive to expanding space capability needs and emerging space threats
- DoD sees great potential in diversified and proliferated small satellite constellations to provide a cost effective approach for:
  - Inserting new space capabilities
  - Timely responsive solutions to changing threats
  - A resilient approach to assuring space capabilities for the joint warfighter

The emerging threat environment drives the need for a new, focused approach to equipping tomorrow's Space Force more quickly, at lower cost than offered by legacy approaches.

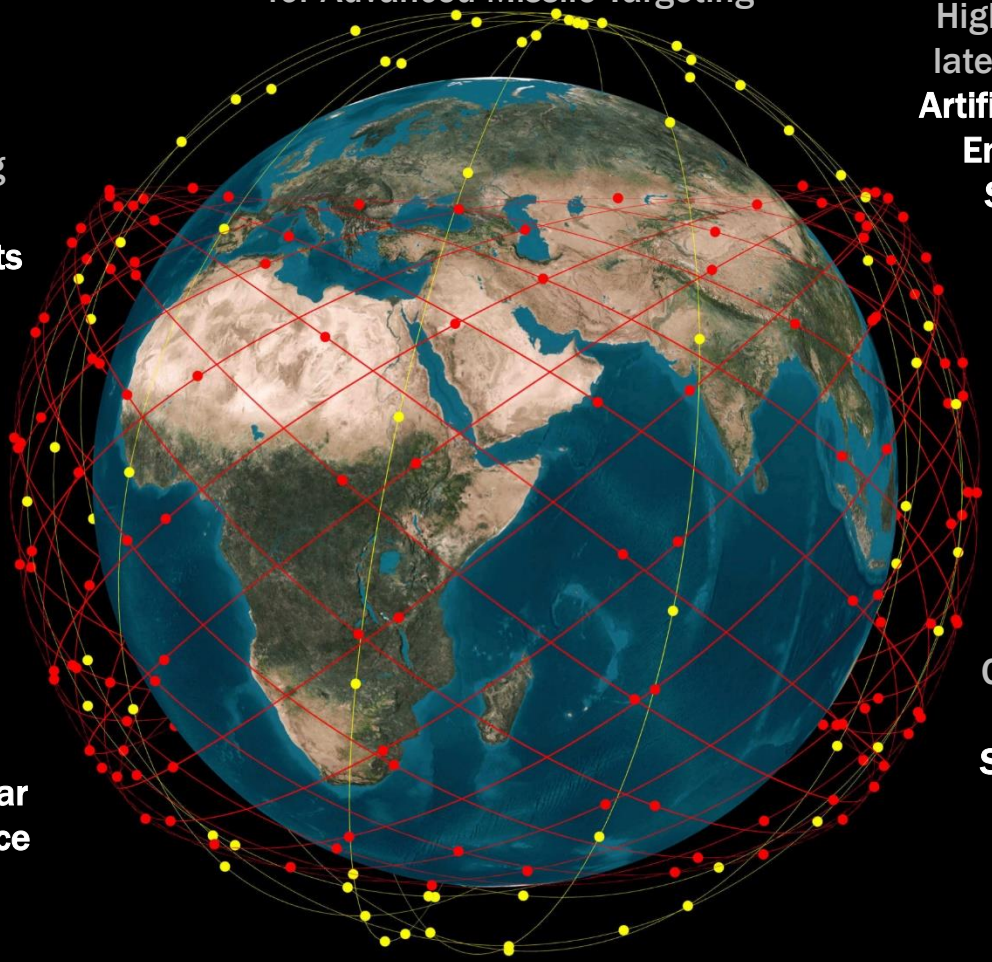
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DoD Space Vision

Persistent Global Surveillance for Advanced Missile Targeting

Highly-scaled, low-latency, persistent, **Artificial-Intelligence Enabled Global Surveillance**

Indications, Warning, Targeting, and Tracking for **Defense Against Advanced Missile Threats**



Cross-Domain, Fully Networked, Node-Independent **Battle Management C3**

Alternate Position, Navigation, and Timing for GPS-Denied Environment

Common, Proliferated **Ground-based Space Support Infrastructure**

Global and Near Real-time Space Situational Awareness (SSA)

Strong Deterrent Capability

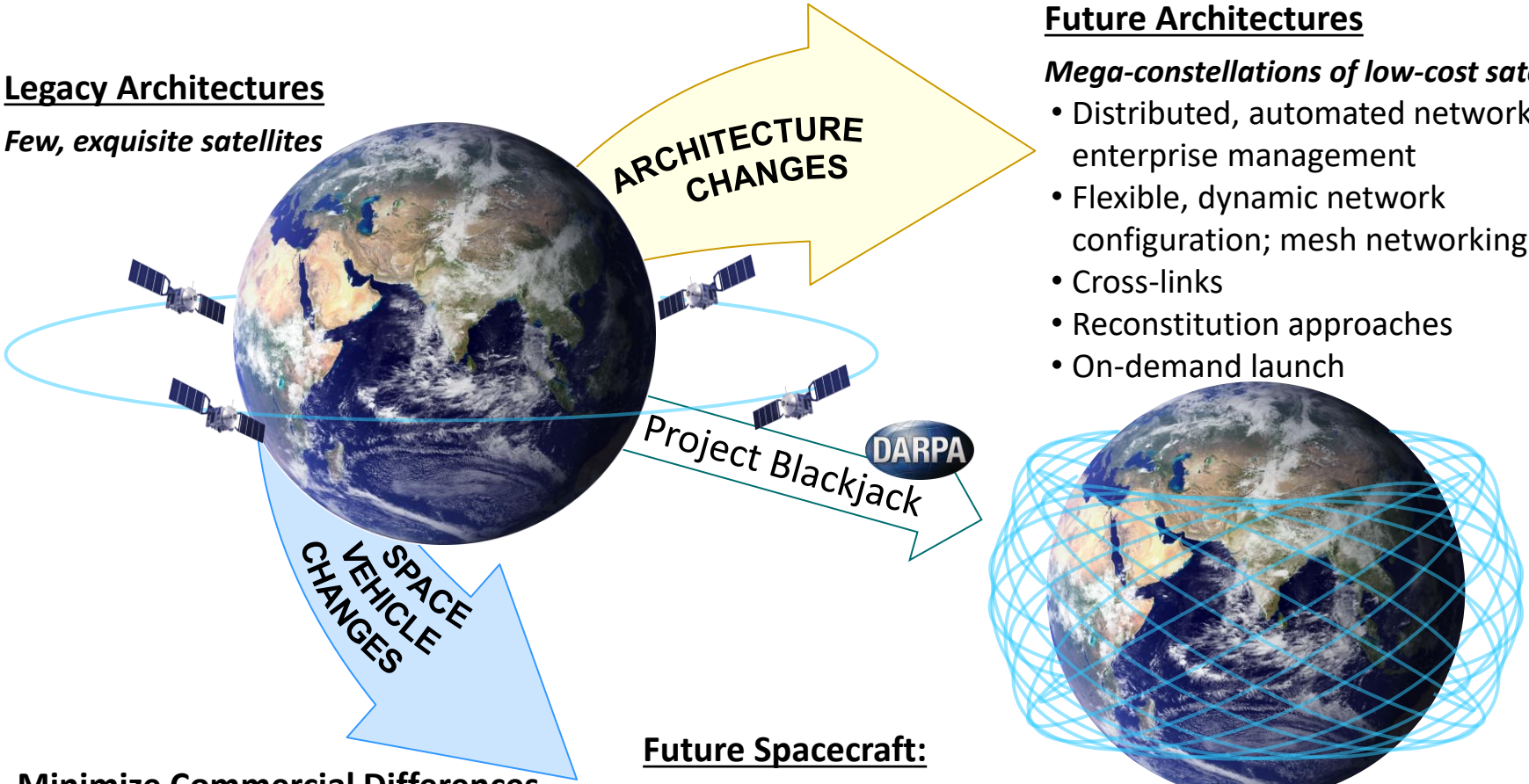
Source: Section 1601 Report to Congress

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Closing the Business Case: DoD and Commercial Shared Interest

Legacy Architectures

Few, exquisite satellites



Future Architectures

Mega-constellations of low-cost satellites

- Distributed, automated network & enterprise management
- Flexible, dynamic network configuration; mesh networking
- Cross-links
- Reconstitution approaches
- On-demand launch

Minimize Commercial Differences

- Threat environment
- Radiation hardening
- Assured cyber-resiliency

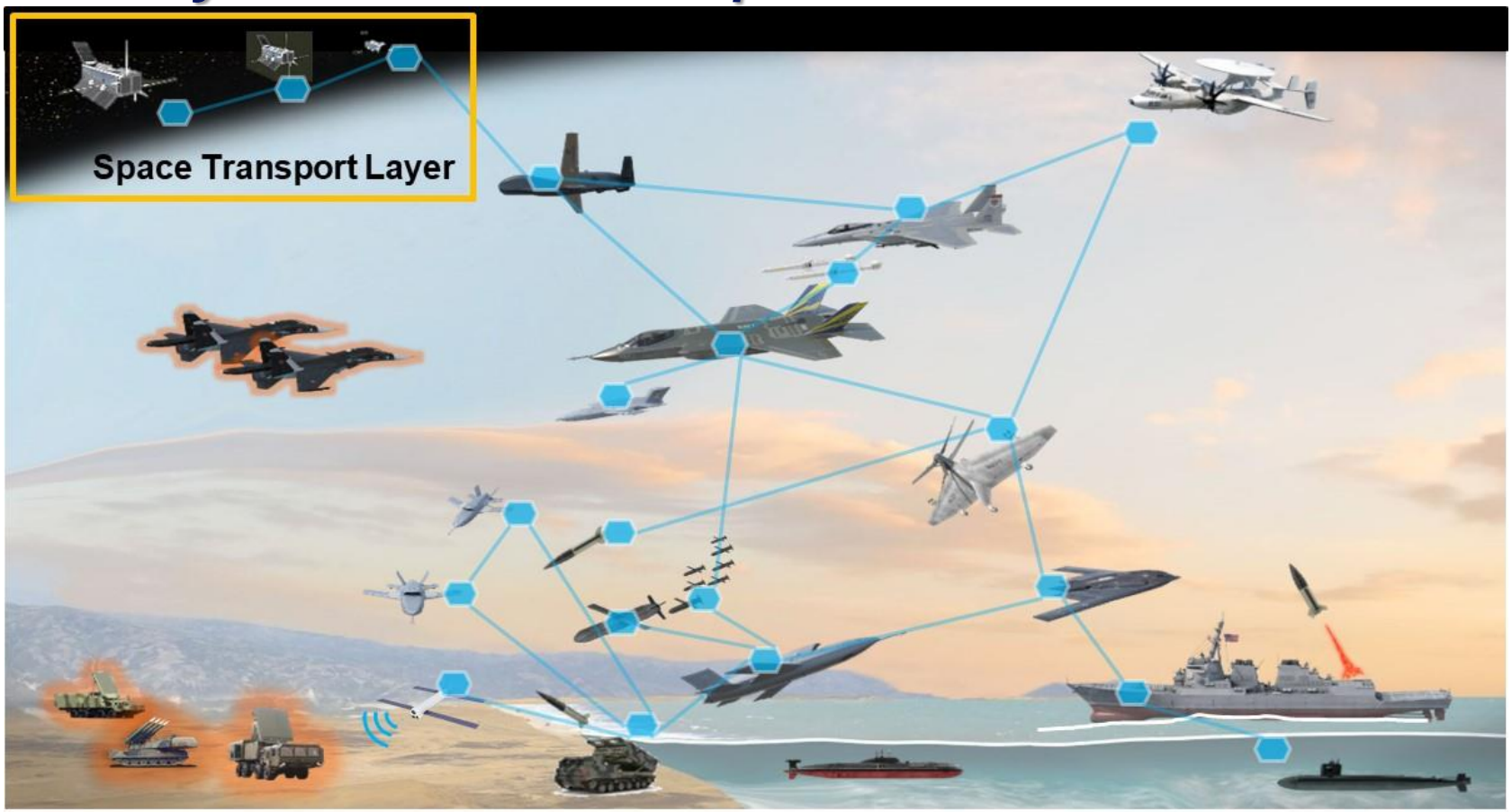
Future Spacecraft:

- Software-defined radios & networking
- Mass-produced commodity hardware
- Optical and hybrid RF/optical communications
- Standardized components and interfaces
- Spacecraft hosted battle management and navigation

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Communications Vision

Fully Connected Interoperable Multi-Domains

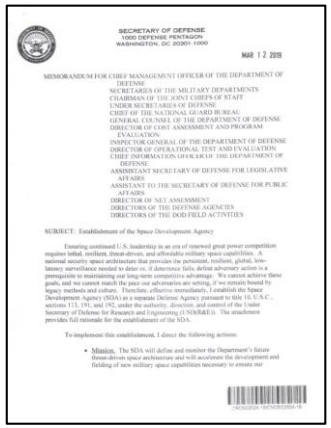


- Open architecture and standards ensure interoperability between DoD networks, our partner systems, and the commercial services we use
- Each owner's networks meet their Quality of service and security requirements

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Space Development Agency Mission

- **Develop and deploy a new threat-driven space architecture to preserve and extend our military advantage in space**
- **Scope:**
  - Collaborate with the joint warfighter to address operational requirements
  - Establish the next-generation space architecture
  - Unify and integrate space capability development and deployment
  - Reduce overlap and inefficiency
  - Foster growth in the U.S. space industrial base
  - Leverage commercial and allied space technology, where practical



SECRETARY OF DEFENSE
1000 DEFENSE PENTAGON
WASHINGTON, DC 20301-1000

MAR 12 2019

MEMORANDUM FOR CHIEF MANAGEMENT OFFICER OF THE DEPARTMENT OF DEFENSE
SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARIES OF DEFENSE
CHIEF OF THE NATIONAL GUARD BUREAU
GENERAL COUNSEL OF THE DEPARTMENT OF DEFENSE
DIRECTOR OF COST ASSESSMENT AND PROGRAM EVALUATION
INSPECTOR GENERAL OF THE DEPARTMENT OF DEFENSE
DIRECTOR OF OPERATIONAL TEST AND EVALUATION
CHIEF INFORMATION OFFICER OF THE DEPARTMENT OF DEFENSE
ASSISTANT SECRETARY OF DEFENSE FOR LEGISLATIVE AFFAIRS
ASSISTANT TO THE SECRETARY OF DEFENSE FOR PUBLIC AFFAIRS
DIRECTOR OF NET ASSESSMENT
DIRECTORS OF THE DEFENSE AGENCIES
DIRECTORS OF THE DOD FIELD ACTIVITIES

SUBJECT: Establishment of the Space Development Agency

Ensuring continued U.S. leadership in an era of renewed great power competition requires lethal, resilient, threat-driven, and affordable military space capabilities. A national security space architecture that provides the persistent, resilient, global, low-latency surveillance needed to deter or, if deterrence fails, defeat adversary action is a prerequisite to maintaining our long-term competitive advantage. We cannot achieve these goals, and we cannot match the pace our adversaries are setting, if we remain bound by legacy methods and culture. Therefore, effective immediately, I establish the Space Development Agency (SDA) as a separate Defense Agency pursuant to title 10, U.S.C., sections 113, 191, and 192, under the authority, direction, and control of the Under Secretary of Defense for Research and Engineering (USD(R&E)). The attachment provides full rationale for the establishment of the SDA.

To implement this establishment, I direct the following actions:

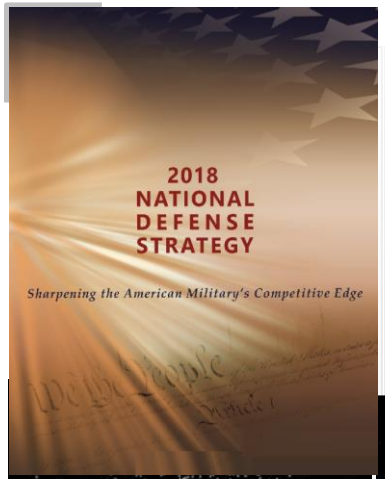
- Mission. The SDA will define and monitor the Department's future threat-driven space architecture and will accelerate the development and fielding of new military space capabilities necessary to ensure our

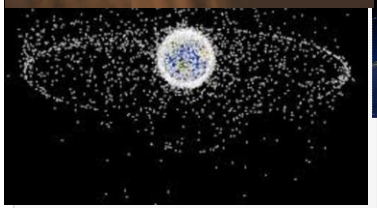
SDA established by SecDef memo March 12, 2019

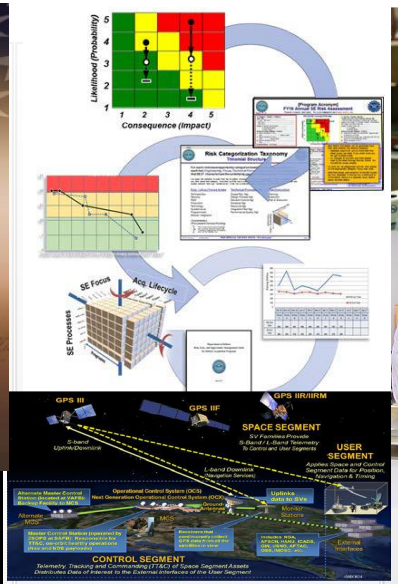
A joint organization to develop and field next-generation military space capabilities for the DoD Space Vision

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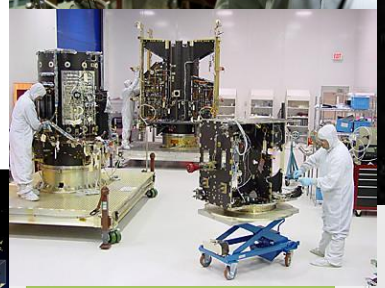
Mature Technology to Capability Paradigm

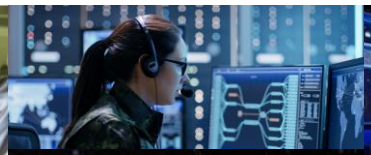
















Review Strategic Priorities

Identify Critical Gaps

ONGOING

White Paper & Quad Chart Phase

30 DAYS

Concept Design Study Phase

90 DAYS

Demonstration Phase

24 MONTHS

Transition Capability to Warfighter

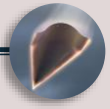
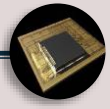
ASAP!

Gaps Identified, Concepts Developed, Technologies Matured, Prototypes Demonstrated, Capability Transitioned!

New paradigm accelerates impact on lethality and combat readiness

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USD(R&E) Modernization Priorities

- Networked C3 
- Autonomy 
- Hypersonics 
- Space 
- Micro-Electronics 
- Cyber 
- Quantum Science 
- Directed Energy 
- Artificial Intelligence 

Align prototyping and experiments to modernization priorities

- Rapid Prototyping Program
- Rapid Prototyping Fund
- Rapid Innovation Fund
- Defense Innovative Unit
- Small Business Innovative Research
- Joint Capability Technology Demonstration
- …Others…

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Example: Recent Broad-Area Announcement:
Time-Sensitive Target Mission Payloads Demonstration

Advance space-based or high altitude-based sensor concepts or enabling technologies to support operations against time sensitive targets through analysis, experimentation, and demonstration

- Mission payload solutions that support Services long-range fires development and testing by 2021
- Creative, non-traditional approaches
- Individual offerings that solve or contribute to the end-to-end mission
- Industry cost sharing mutual investment in the mission

Phase 1: White Paper submission and assessment (complete)
Phase 2: Concept Design - 90-day, in-depth analysis
Phase 3: Demonstration - Two-year effort to demonstrate payload concepts

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Summary

- Space is now a Warfighting Domain
- We need architectures and capabilities that are responsive to expanding space capability needs and emerging space threats
- We need to work together to address the challenges
  - Relying on our industry partners to bring innovative solutions
  - Lots of opportunities to get involved through rapid prototyping

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DoD Research and Engineering Enterprise

Solving Problems Today – Designing Solutions for Tomorrow












DoD Research and Engineering Enterprise
https://www.acq.osd.mil/chieftechnologist/

Defense Innovation Marketplace
https://defenseinnovationmarketplace.dtic.mil

Twitter
@DoDInnovation

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For Additional Information

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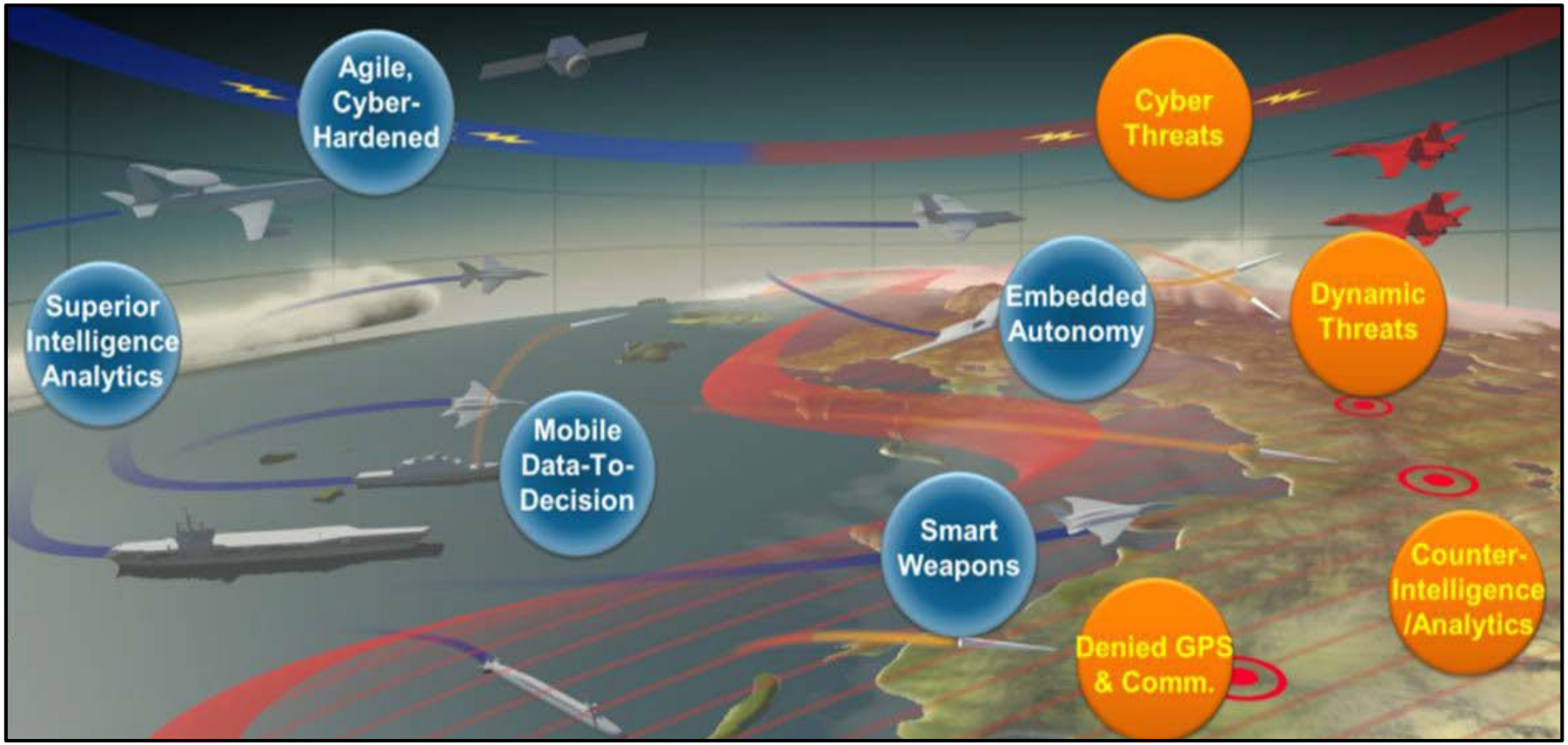
Autonomy and the National Defense Strategy

April 3, 2019

Wayne Nickols
Assistant Director for Autonomy
Undersecretary of Defense for Research & Engineering

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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

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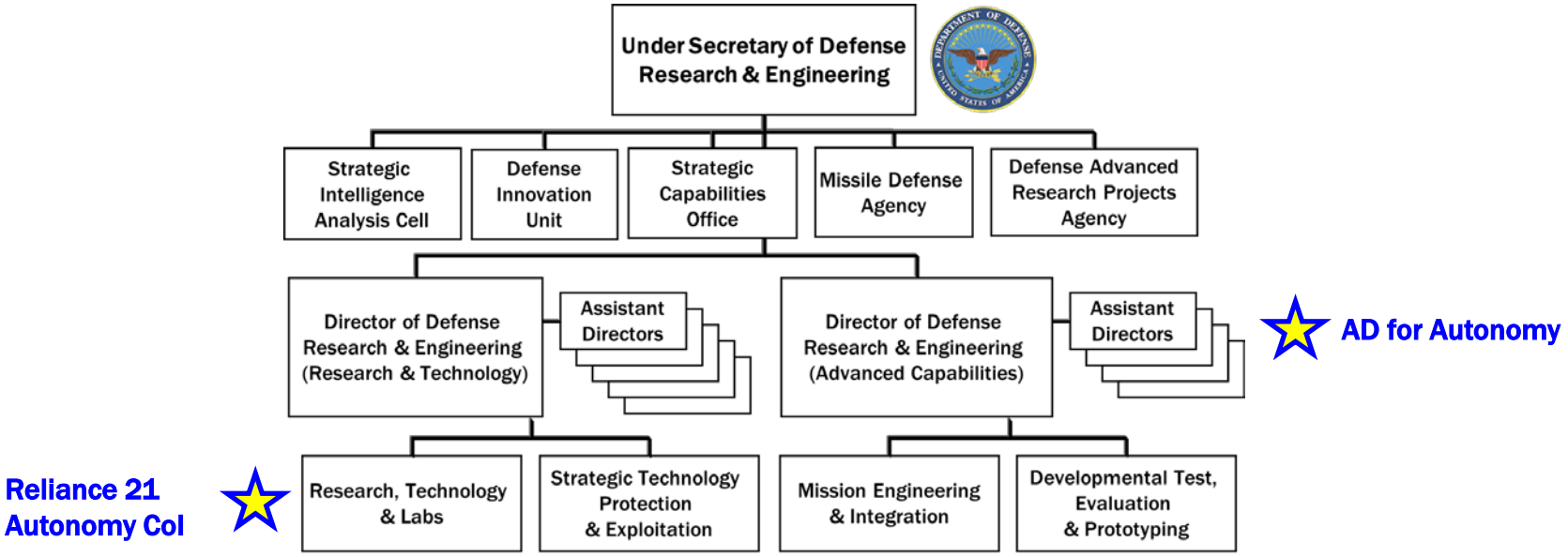
… and Challenges of Autonomy

- **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

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Role of the Assistant Directors

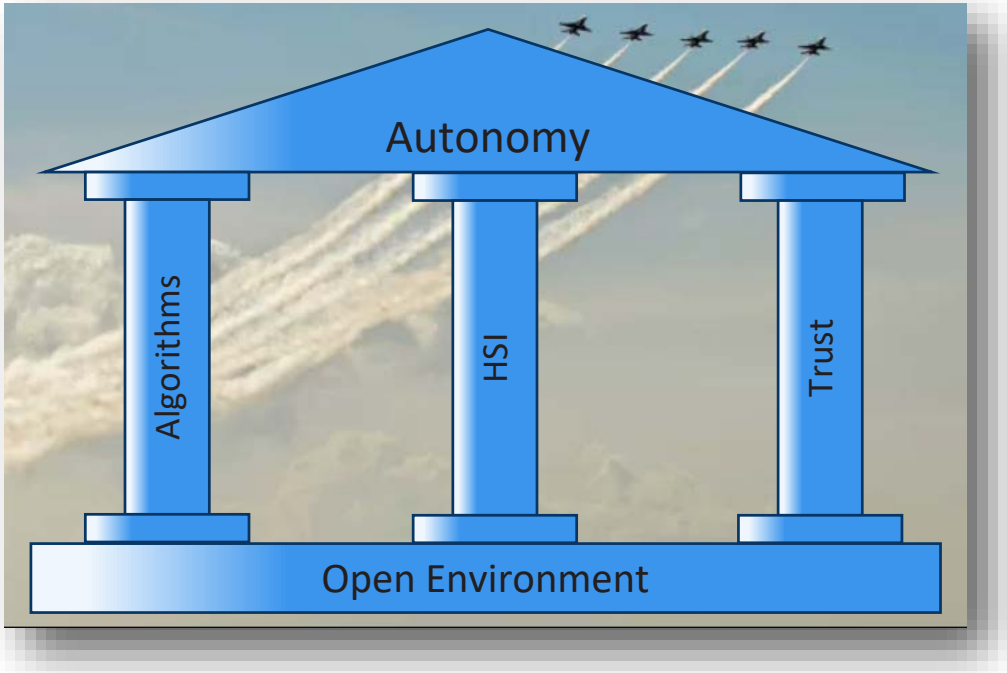
- **USD(R&E) Mission**
  - Ensure Technological Superiority for the U.S. Military
  - Bolster Modernization
- **Assistant Directors**
  - Develop DoD-wide vision and strategy for modernization priorities
  - Develop technology roadmaps
  - Collaborate with DoD/federal partners, industry, academia, and, international partners
  - Support Senior Leadership with technical expertise



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Autonomy CoI Overview

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



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

CoI Goal

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

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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





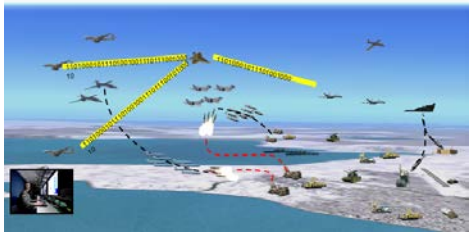


Mitigate Risk
- Capabilities for C-IED
- Capabilities for CBRNE
- Air collision avoidance



- 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



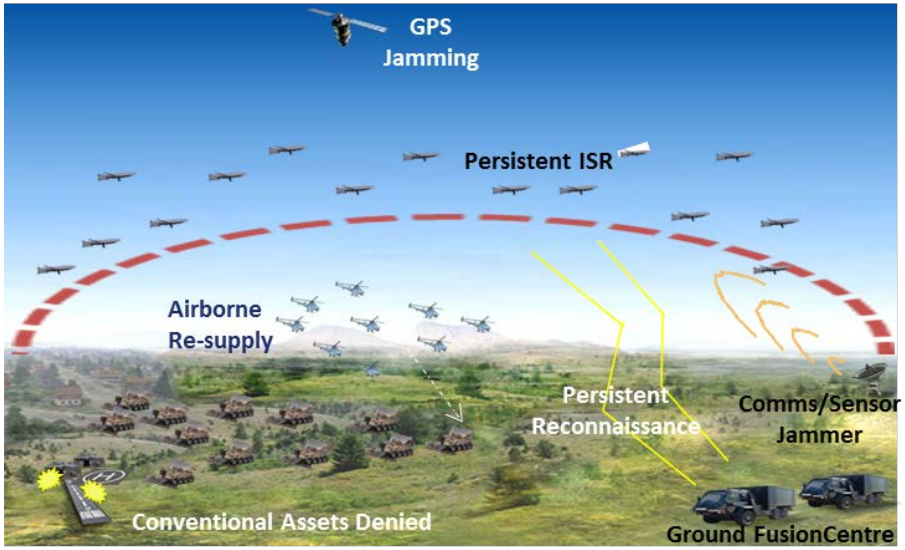
Dynamic Engagement
- Enable Command and Control
- Provide robust and resilient communications in the tactical field

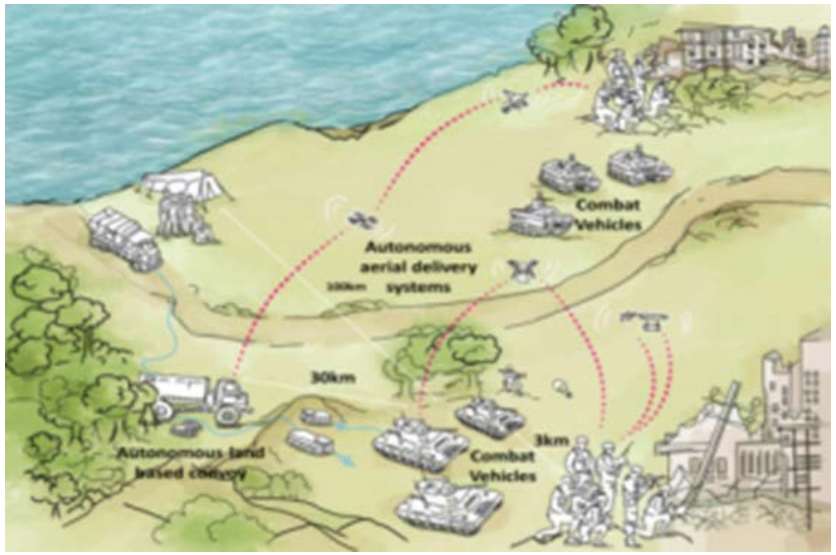
Teaming of Humans and "Intelligent Machines" to Expand Capabilities

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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

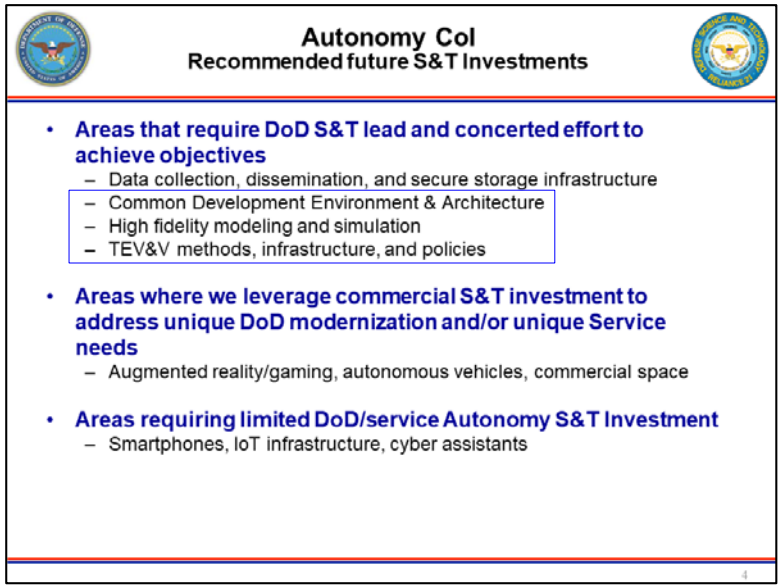




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LOE 3: Accelerate DoD adoption of autonomous capabilities

- 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



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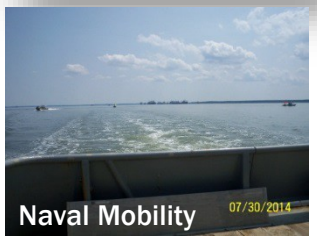
The DoD Autonomy Roadmap

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





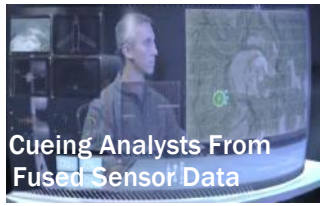




Present - 2021

Machine-Assisted Operations









2021 - 2024

Man-Unmanned Teams





2025 - 2028+

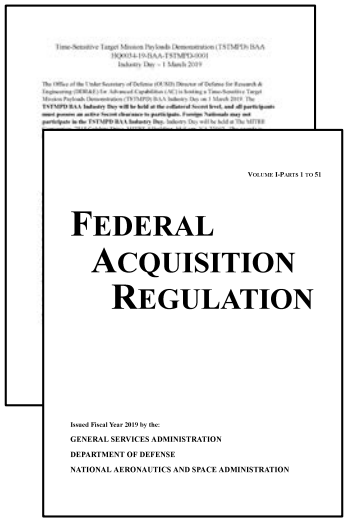
Near-Term → Mid-Term → Far-Term

Teaming of Humans and "Intelligent Machines" to Expand Capabilities

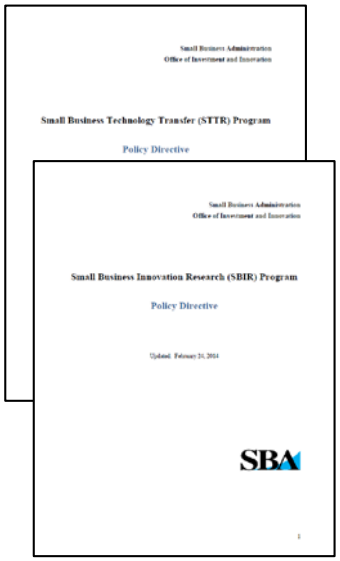
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Potential Engagement Opportunities: Authorities, Funding Sources, and Partnerships

Traditional FAR Contracts



SBIR/STTR



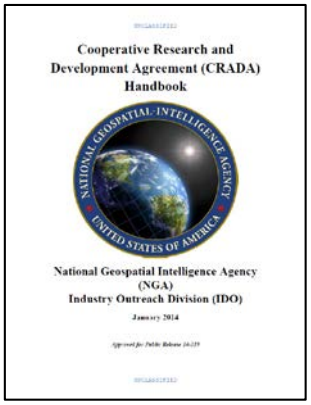
IRAD



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**

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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

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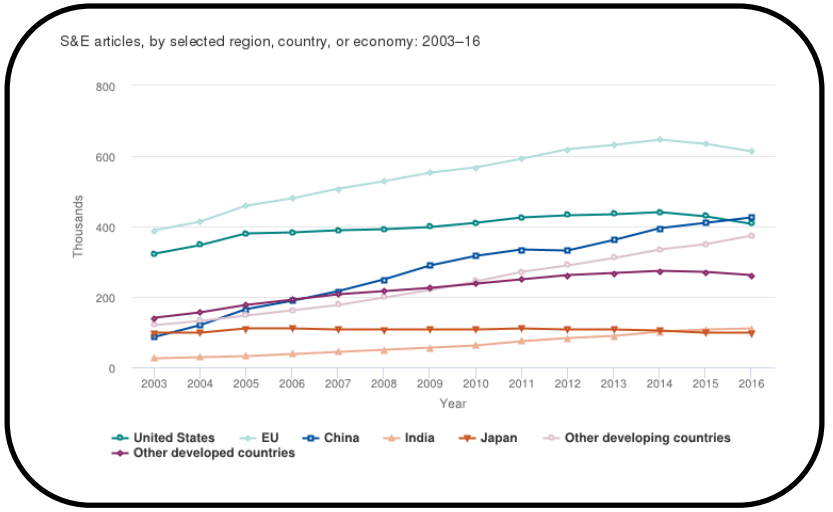
Technology is Transforming the Battlespace

How Do We Maintain A Competitive Advantage?

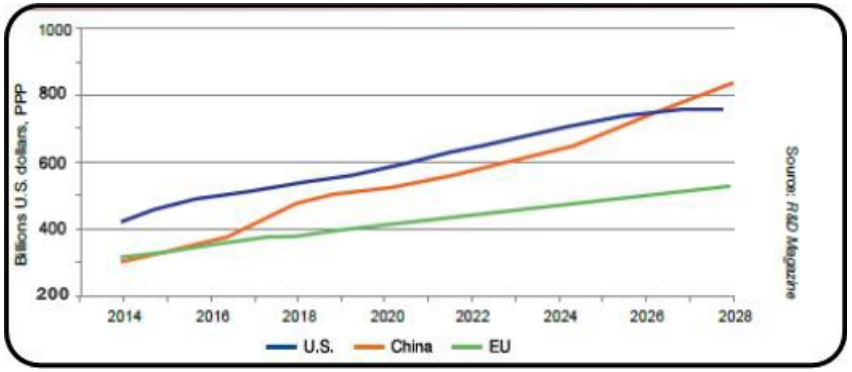
- Easy proliferation of knowledge and technology has eroded US historic advantages
- Increased rate of investment in military R&D from near-peers
- Increasingly Competitive National Security Technical Environment

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

Science and Engineering Indicators 2018
National Science Board



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"

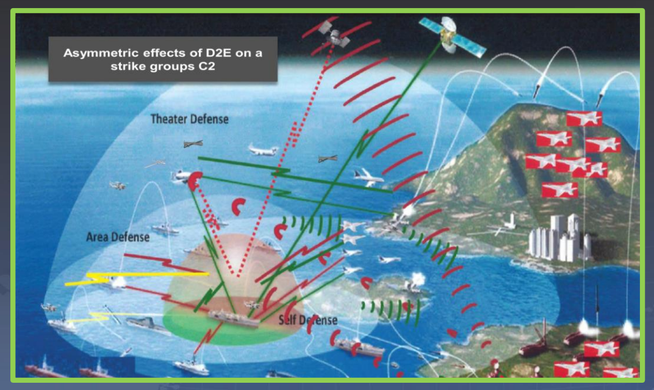
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Questions?

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Reliance 21 – DoD Communities of Interest

Command, Control, Communications, Computers & Intelligence (C4I)



Scope/Trust Areas

Information Systems Technology	Algorithmic Warfare
Data Access, Architectures, HW, and SW	Complex Data Processing, Decision Making and Reasoning for Planning, Execution & Assessment
Optimizing Human Decision Making	Networks and Communications
Effective, Natural Human-Machine Collaboration	Adaptive, Resilient Fully-Networked Comms

Impact on Capability Needs

- Behavioral Cyber (Integrates human and sensor observations by illustrating cognition and behaviors of friendly/adversary actors): Emerging Partnerships (ARL, CYBERCOM, AFRL, Army Cyber Institute, Naval Surface Warfare Center-Crane)
- Autonomy Research Pilot Initiative (C4I-Autonomy) (ARL-AFRL-SPAWAR) resulted in two brain-computer interface demonstrations in ARL MIND Lab
- ARL/NRL scientist exchange to strengthen collaboration on ARL's Internet of Battlefield Things (IoBT) Collaborative Research Alliance
- Delivered an early prototype of an Emissions Control (EMCON) conflict detection Tactical Decision Aid (TDA) for the U.S. Navy's Operational Planning Tool (OPT)

Success Stories

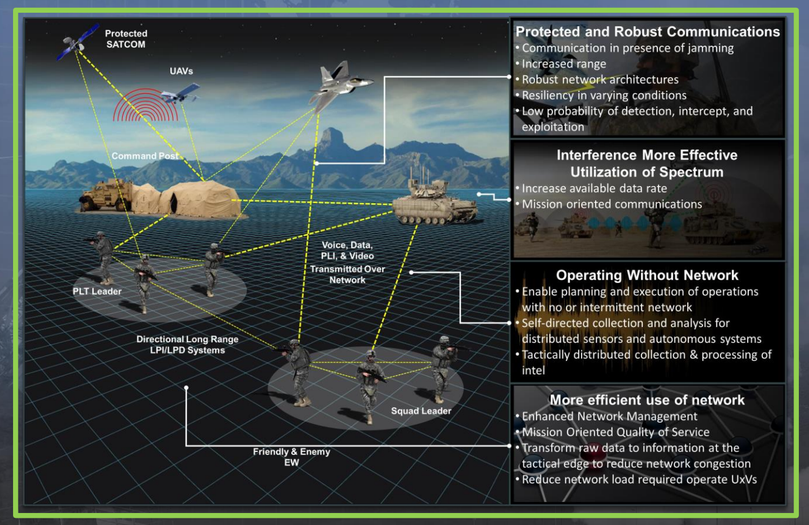
- Numerous technologies demonstrated/transitioned (i.e. Android Tactical Assault Kit/TAK Server Technology; Open Standards for Unattended Sensors (OSUS) to PdM EOIR; Tactical Cloud Reference Implementation transitioned to CANES PoR and deployed; Secure Cross-domain Orchestration Engine; …)
- Demonstrated a cost effective phased-array through 3D printing
- Delivered Automated Test and Analysis capability to Marine Corps Tactical Services Oriented Architecture (TSOA) POR. Using the NRL-developed Sentry Agent Framework (SAGE), demonstrated a 90% reduction in test planning, setup, and execution time. Ongoing SAGE extensions by ARL.

Engagement Opportunities for Industry

- Numerous Broad Agency Announcements
- DoDIIS Worldwide Conference
- Air Warfare Symposium/AFA
- GeoInt Conference
- WorldComp Conference
- SPIE Defense and Commercial Sensing
- Military Communications Conference (MILCOM)
- Int'l Conf on Computing, Networking and Comms
- AFCEA New Horizons
- Wright Dialogue with Industry
- I/ITSEC (http://www.iitsec.org/)
- Others

Focus Going Forward

- Assess the current portfolio, identify gaps, establish priorities, and maintain a set of S&T roadmaps to guide DoD research program investments, and provide future resource recommendations to leadership
- Trends include:
  - Increasing application of AI to intelligence and C2, including focus on data
  - Increasing demands for rapid prototyping
  - Emergence of the Internet of Battlefield Things (IoBT)
- Establish mechanisms to encourage coordination between researchers to facilitate information exchange, and promote collaboration



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