Critical Technologies Panel

2024 PACIFIC OPERATIONS SCIENCE & TECHNOLOGY (POST) CONFERENCE

Mr. Maynard Holliday
PTDO Assistant Secretary of Defense for Critical Technologies
Office of the Assistant Secretary of Defense for Critical Technologies (OASD(CT))
February 2024

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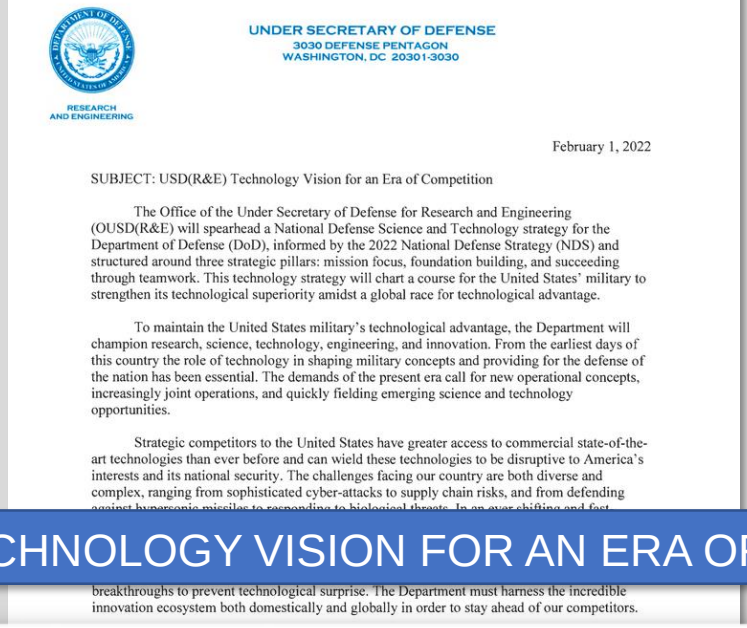
OUSD(R&E) STRATEGIC VISION



UNDER SECRETARY OF DEFENSE
3030 DEFENSE PENTAGON
WASHINGTON, DC 20301-3030

RESEARCH AND ENGINEERING

February 1, 2022

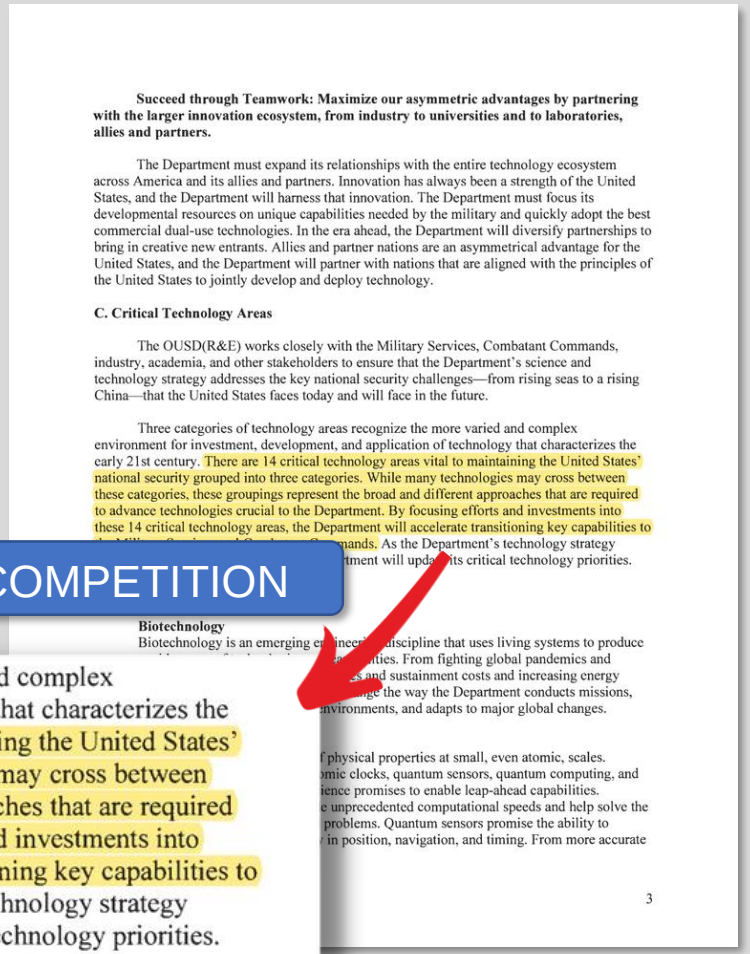
SUBJECT: USD(R&E) Technology Vision for an Era of Competition

The Office of the Under Secretary of Defense for Research and Engineering (OUSD(R&E) will spearhead a National Defense Science and Technology strategy for the Department of Defense (DoD), informed by the 2022 National Defense Strategy (NDS) and structured around three strategic pillars: mission focus, foundation building, and succeeding through teamwork. This technology strategy will chart a course for the United States' military to strengthen its technological superiority amidst a global race for technological advantage.

To maintain the United States military's technological advantage, the Department will champion research, science, technology, engineering, and innovation. From the earliest days of this country the role of technology in shaping military concepts and providing for the defense of the nation has been essential. The demands of the present era call for new operational concepts, increasingly joint operations, and quickly fielding emerging science and technology opportunities.

Strategic competitors to the United States have greater access to commercial state-of-the-art technologies than ever before and can wield these technologies to be disruptive to America's interests and its national security. The challenges facing our country are both diverse and complex, ranging from sophisticated cyber-attacks to supply chain risks, and from defending

breakthroughs to prevent technological surprise. The Department must harness the incredible innovation ecosystem both domestically and globally in order to stay ahead of our competitors.



Succeed through Teamwork: Maximize our asymmetric advantages by partnering with the larger innovation ecosystem, from industry to universities and to laboratories, allies and partners.

The Department must expand its relationships with the entire technology ecosystem across America and its allies and partners. Innovation has always been a strength of the United States, and the Department will harness that innovation. The Department must focus its developmental resources on unique capabilities needed by the military and quickly adopt the best commercial dual-use technologies. In the era ahead, the Department will diversify partnerships to bring in creative new entrants. Allies and partner nations are an asymmetrical advantage for the United States, and the Department will partner with nations that are aligned with the principles of the United States to jointly develop and deploy technology.

C. Critical Technology Areas

The OUSD(R&E) works closely with the Military Services, Combatant Commands, industry, academia, and other stakeholders to ensure that the Department's science and technology strategy addresses the key national security challenges—from rising seas to a rising China—that the United States faces today and will face in the future.

Three categories of technology areas recognize the more varied and complex environment for investment, development, and application of technology that characterizes the early 21st century. There are 14 critical technology areas vital to maintaining the United States' national security grouped into three categories. While many technologies may cross between these categories, these groupings represent the broad and different approaches that are required to advance technologies crucial to the Department. By focusing efforts and investments into these 14 critical technology areas, the Department will accelerate transitioning key capabilities to

mands. As the Department's technology strategy
tment will upda its critical technology priorities.

Biotechnology
Biotechnology is an emerging e ineeri discipline that uses living systems to produce
ities. From fighting global pandemics and
and sustainment costs and increasing energy
ge the way the Department conducts missions,
nvironments, and adapts to major global changes.

physical properties at small, even atomic, scales.
mic clocks, quantum sensors, quantum computing, and
ience promises to enable leap-ahead capabilities.
unprecedented computational speeds and help solve the
problems. Quantum sensors promise the ability to
in position, navigation, and timing. From more accurate

3

TECHNOLOGY VISION FOR AN ERA OF COMPETITION

Three categories of technology areas recognize the more varied and complex environment for investment, development, and application of technology that characterizes the early 21st century. There are 14 critical technology areas vital to maintaining the United States' national security grouped into three categories. While many technologies may cross between these categories, these groupings represent the broad and different approaches that are required to advance technologies crucial to the Department. By focusing efforts and investments into these 14 critical technology areas, the Department will accelerate transitioning key capabilities to the Military Services and Combatant Commands. As the Department's technology strategy evolves and technologies change, the Department will update its critical technology priorities.

CRITICAL TECHNOLOGY AREAS

The creation of the Office of the Assistant Secretary of Defense for Critical Technologies was informed by the 2022 and 2019 National Defense Strategies, which initially established the previous modernization priority areas. Expanding on the original priorities, there are now 14 critical technology areas that are vital to maintaining the United States' national security, grouped into three categories.

Seed Areas of Emerging Opportunity

- Advanced Materials
- Biotechnology
- FutureG
- Quantum Science

These CTAs are aligned under the ASD for Science & Technology

Effective Adoption Areas

- Advanced Computing & Software
- Human-Machine Interfaces
- Integrated Network Systems-of-Systems
- Microelectronics
- Renewable Energy Generation & Storage
- Space Technology
- Trusted AI & Autonomy

Defense-Specific Areas

- Directed Energy
- Hypersonics
- Integrated Sensing & Cyber

OUSD(R&E) ORGANIZATIONAL STRUCTURE

UNDER SECRETARY OF DEFENSE RESEARCH & ENGINEERING/CTO

MISSILE DEFENSE AGENCY

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

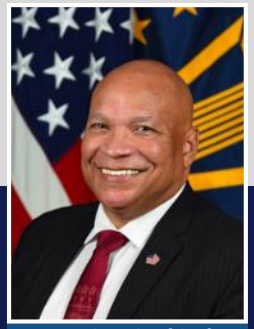
ASSISTANT SECRETARY OF DEFENSE FOR SCIENCE & TECHNOLOGY

ASSISTANT SECRETARY OF DEFENSE FOR CRITICAL TECHNOLOGIES

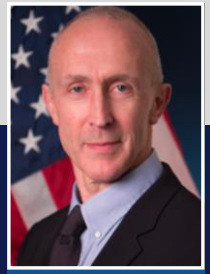
ASSISTANT SECRETARY OF DEFENSE FOR MISSION CAPABILITIES

- DASD, S&T FOUNDATIONS
- DASD, S&T FUTURES
- DASD, S&T PROGRAM PROTECTION
- DASD, APPLIED TECHNOLOGY
- DASD, ENABLING TECHNOLOGY
- DASD, MULTI-DOMAIN JOINT OPERATIONS
- DASD, PROTOTYPING & EXPERIMENTATION
- DASD, MISSION INTEGRATION

ASD(CT) LEADERSHIP



PTDO ASD(CT)
MR. HOLLIDAY



PD ASD
DR. HIGHNAM

DSD, APPLIED TECH.
VACANT

DSD, ENABLING TECH.
VACANT

PD AD. COMPUTING
DR. SHULL

PD DIRECTED ENERGY
DR. PETERKIN

PD HUM-MACH INT
DR. PALMER

PD HYPERSONICS
DR. WEBER

PD INSS
MS. SCHOENBERG

PD IS & CYBER
MR. HARR

PD ME
DR. SHENOY

PD REN. ENERGY
DR. MANTZ

PD SPACE TECH
MR. ECCLES

PD TRUSTED AI & AUTONOMY
DR. SABLON

OUR MISSION

To drive the critical technological vision for the DoD, to accelerate the transition of key capabilities, and to maximize our technological advantage for the future fight.

"We cannot expect success fighting tomorrow's conflicts with yesterday's weapons or equipment."

- 2018 National Defense Strategy

CRITICAL TECHNOLOGY AREAS & TRANSITIONS

Effective Adoption Areas

- Trusted AI & Autonomy
- Microelectronics
- Space
- Integrated Network System-of-Systems
- Human Machine Interfaces
- Renewable Energy Generation & Storage
- Advanced Computing & Software

310+ transitions tracked in last 3 years

60% already delivered to COCOM & Components direct from innovation unit or as commercial-off-the-shelf (COTS)

40% baselined in acquisition programs for future delivery to COCOMs & Components

20% to multiple COCOMs

15% COCOM unique

65% to IC and whole-of-US government support to COCOMs & Components

Defense-Specific Areas

- Integrated Sensing & Cyber
- Hypersonics
- Directed Energy

TRUSTED AI & AUTONOMY (TAI&A)

83+ successful transitions. Machines with logic, rules, knowledge bases and/or learning algorithms to assist human decision-making or performing autonomously. Focus on trusted AI and autonomous systems.

Already delivered to COCOMs directly from innovation unit or as commercial purchase:

Automatically detect, attribute, and characterize falsified media disinformation attacks via DARPA Semantic Forensics (SemiFor)

Persistent maritime surveillance from wind-powered Sail Drones via the DIU Persistent Maritime ISR project

Networked manned-unmanned aircraft and munitions via AFRL's Skyborg and Golden Horde

Low-cost kinetic strike capability from UAV swarms launched from long-endurance UUVs via ONR's LOCUST launcher tube

Baselined in acquisition programs for future delivery as/or part of weapon system:

Accelerated kill chain for mine countermeasures when DIU/NAVSEA AI-enabled automated target recognition delivered via Navy LIONFISH small class UUV in FY24

DIRECTED ENERGY

9+ successful transitions. Rapid responses and engagement at the speed of light to counter wide variety of current and emerging threats. Focus on high-power lasers and high-power microwave technologies.

Already delivered to COCOMs directly from innovation unit or as commercial purchase:

Protect munitions from Directed Energy countermeasures and weapons using AFRL's Directed Energy Survivable Standoff Munitions (DESSM) JCTD

Defeat UAVs by pairing surface-to-air missiles with 10 kW High Energy Laser (HEL) delivered by Air Force HEL Weapon System (HELWS)

Characterize laser lethality effects on targets using Laser Vulnerability Models developed by multiple services and R&E

Real-time alerts to prevent fratricide and avoid collateral damage from R&E's predictive Deconfliction Safety Software (DSS) available in industry

Baselined in acquisition programs for future delivery as/or part of weapon system:

Offense and defense capability from 300 kW HEL with R&E High Energy Laser Scaling Initiative (HELSI) lasers delivered by Army, Navy and Air Force Programs beginning FY24

INTEGRATED NETWORK SYSTEM-OF-SYSTEMS (INSS)

15+ successful transitions. Integration of diverse systems for resilient and secure command, control & communications. Focus on interoperability across electromagnetic spectrum, software defined systems, and information exchange layer.

Already delivered to COCOMs directly from innovation unit or as commercial purchase:

Commercial software defined radios with reduced latency/power that use the DARPA Software Defined Radio 4.0 open-source code

Disseminate tactical C2 across variety of heterogenous radio systems from ONR's Communication as a Service (CaaS)

Reduced power/weight by collapsing disparate EW, EO, radar into single RF system from DARPA's Converged Collaborative Elements for RF Task Operations (CONCERTO)

Capability to connect any sensor in any domain to any shooter with a machine-to-machine messaging standard from SCO & Several Components FNC3 Universal C2 (UC2)

Improved Link 16 tactical data link resilience through the Link 16e software developed by R&E & Air Force PEO C3IN

INTEGRATED SENSING & CYBER (IS&C)

59+ successful transitions. Wideband sensors that operate at intersection of cyberspace, electronic warfare, radar, and communications in highly contested environments. Focused on elimination of stove-piped and single function sensors.

Already delivered to COCOMs directly from innovation unit or as commercial purchase:

Autonomously merge EW, cyber & info ops into courses of action (COAs) from Army SMDC's Digital Attack Surface Execution Environment (DASEE)

Prevent adversary censorship of websites from commercial VPN providers from NRL's Sauteed Onions

Find, report, & eliminate adversary activities on non-U.S. infrastructure from Hunt Forward Operational Kits developed by USCYBERCOM/Services

Baselined in acquisition programs for future delivery as/or part of weapon system:

Autonomous decision-making engine to improve cyber decisions for network defense when Army DEVCOM's Autonomous Cyber is delivered by Army PEO C3T

Detect, analyze & disrupt RF communications on small UAS when AFRL's Ninja Counter UAS is delivered by the Air Force Counter UAS Program

HYPERSONICS

22+ successful transitions. Overmatch against strategic competitors pursuing and rapidly fielding advanced hypersonic missiles. Focus on leap-ahead cost-effective technologies for air, land, and sea operational forces.

Baselined in acquisitions programs as/or part of weapon system

Land-launched intermediate range hypersonic strike when OSD's Common Hypersonic Glide Body (CHGB) delivered via the Army Long-Range Hypersonic Weapon (LRHW)

Air-launched medium-range hypersonic strike when the DARPA/AFRL's Tactical Boost Glide (TBG) delivered via the Air Force AGM-183 Air Launched Rapid Response Weapon (ARRW) Program

Sea-launched intermediate range hypersonic strike when OSD's Common Hypersonic Glide Body (CHGB) delivered via Navy Conventional Prompt Strike (CPS) weapon

Air-launched medium-range stand-off strike hypersonic capability when DARPA/AFRL's Hypersonic Air-Breathing Weapons Concept (HAWC) delivered via Air Force Hypersonic Attack Cruise Missile (HACM) Program

SPACE TECHNOLOGY

34+ successful transitions. Robust, proliferated architectures for resilient cross-domain operations. Focus on adaptive/reconfigurable space situational awareness/control, communications, on-orbit processing and autonomous capabilities.

Already delivered to COCOMs directly from innovation unit or as commercial purchase:

Automated real-time alerts from space assets via AFRL's Space Domain Characterization and Control System (SDCCS)

Low cost, high cadence commercial launch capabilities provided by DIU Small Responsive Launch program

Day/night, all-weather commercial SAR imaging from DIU's Peacetime Indications & Warnings.

Baselined in acquisition programs for future delivery as/or part of weapon system:

Better detection & warning of ballistic missile events when AFRL's large format focal plane array of 4 million pixels is launched by Space Force Next-Gen Overhead Persistent Infrared Program in FY25

More affordable, secure, higher bandwidth communication from SDA & DARPA's Optical Intersatellite Link & processor when launched in FY26

MICROELECTRONICS

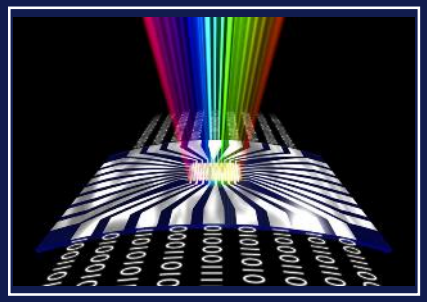
43+ successful transitions. Secure microelectronic sources for defense needs that leverage state-of-the-art (SOTA) commercial development and production. Focus on restoring diminished manufacturing in the U.S. and supply chain.

Already delivered to U.S. Industrial Base ensuring secure DoD and commercial supply chains for all COCOMs:

Defense primes Boeing and Northrop-Grumman Corps. leading physical design testing of Intel's 18A chip via R&E's Rapid Assured Microelectronics Prototypes – Commercial (RAMP-C)

Advanced communications, EW, and other applications from ONR's domestic large diameter Radio Frequency (RF) Gallium Nitride (GaN) semiconductors and DARPA's millimeter-wave GaN fabrication process

Security enhancements via AFRL and Intel's FPGA Security Enhancements effort to develop new cryptographic logic features for improved symmetric key encryption and asymmetric key authentication



Enhanced sensor capabilities via NRL & DoD Manufacturing Innovation Institute (MII) Ultra-Low Loss Silicon Nitride Photonics Platform

FutureG

2024 PACIFIC OPERATIONS SCIENCE & TECHNOLOGY (POST) CONFERENCE

Dr. Thomas W. Rondeau
Principal Director, FutureG
Office of the Assistant Secretary of Defense for Science & Technology (OASD(S&T))
February 2024

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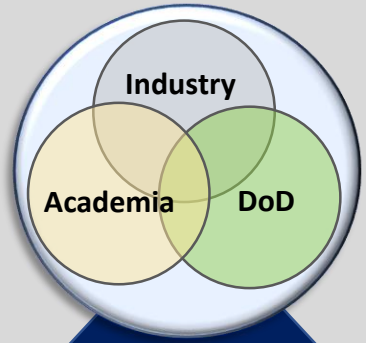
FUTUREG STRATEGIC PLANNING ELEMENTS

Drive select commercial wireless innovations to meet DoD technical and capability requirements

Ubiquitous, Secure and Instant Access

Deliver high availability systems with security assurance across all DoD operational settings



Resilient and Open Commercial Solutions

Leveraging open, standards-based systems with commercial impacts in defense applications

Cross-Cutting Capabilities

- Security
- Experimentation
- Open-source solutions
- Workforce development

Cross-Cutting Capabilities
Core framework/ecosystem using tested, open, and secure technology

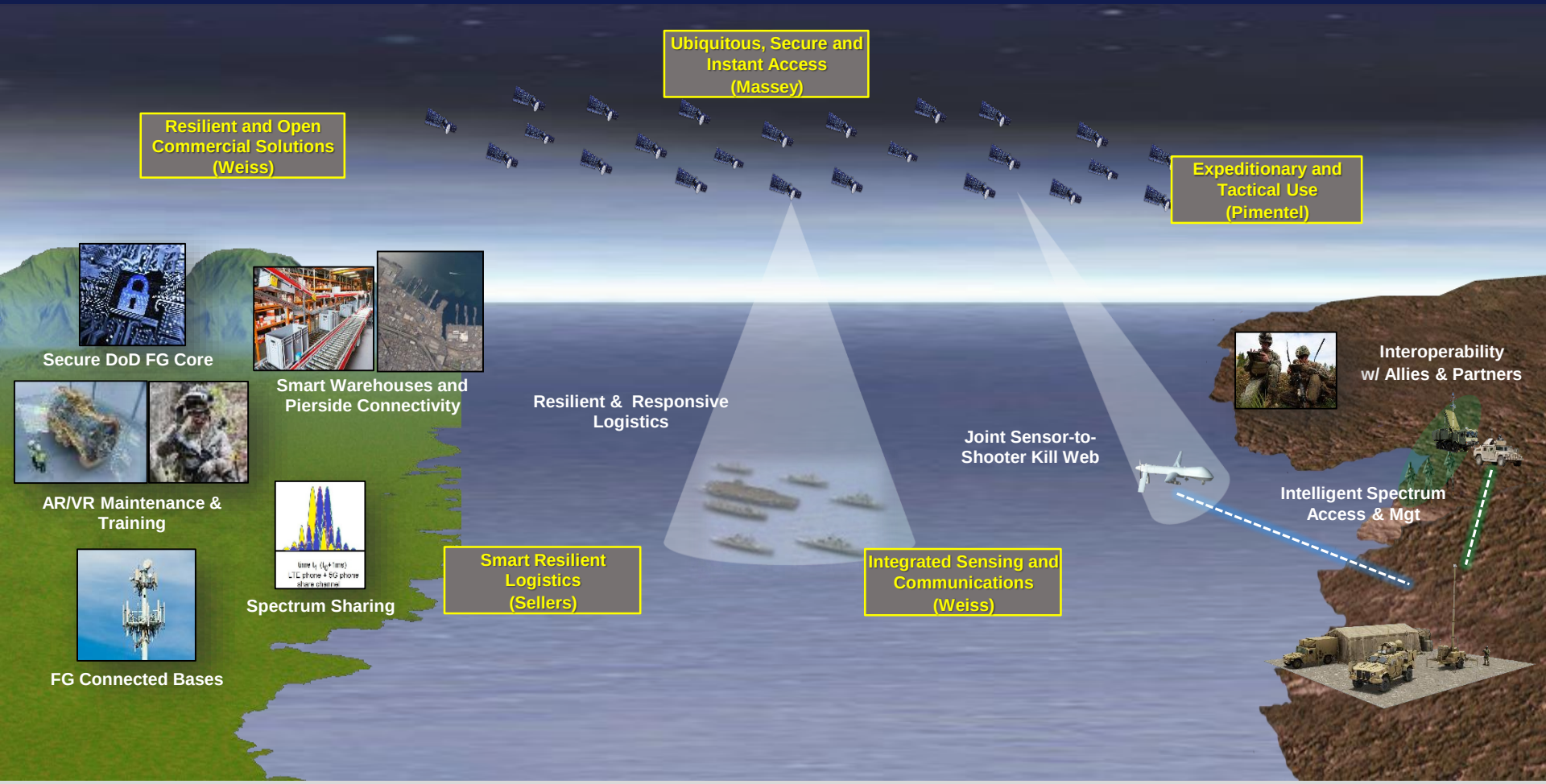
Expeditionary and Tactical Use

Innovations enabling commercial network technologies in tactical operations

Integrated Sensing and Communications

Leveraging new spectrum and novel signal processing for comprehensive situational awareness and multi-function utility

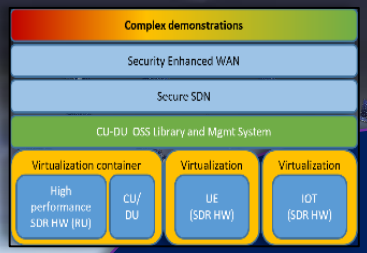
FUTUREG TECHNOLOGY ADDRESSES THE COMPLEXITY OF FUTURE



Battlespace control through decision superiority

FUTUREG PRIORITY EFFORTS FOR 2024

Open Centralized Unit Distributed Unit (OCUDU)



DoD RAN Sharing Project

Microelectronics Commons

MICROELECTRONICS COMMONS

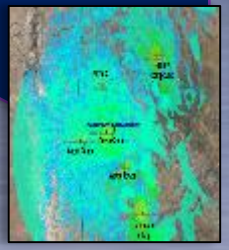
Resilient and Open Commercial Solutions

Ubiquitous, Secure and Instant Access

Workforce Development

Integrated Sensing and Communications

Expeditionary and Tactical Use



Playas Training and Research Center (PTRC) FutureG Build-out

Smart Resilient Logistics INDOPACOM Integration

NATO ACT / Latvian Range

Renewable Energy Generation & Storage

2024 PACIFIC OPERATIONS SCIENCE & TECHNOLOGY (POST) CONFERENCE

Dr. Robert Mantz
Principal Director, Renewable Energy Generation & Storage
Office of the Assistant Secretary of Defense for Critical Technologies (OASD(CT))
February 2024

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RENEWABLE ENERGY GENERATION & STORAGE

- Renewable Energy Generation and Storage (REGS) includes solar wind, bio-based and geothermal technologies, advanced energy storage, electronic engines, and power grid integration.
- Renewable energy generation and storage promises to decrease warfighter vulnerability and deliver new operational capabilities for the Department of Defense (DoD). From more efficient batteries to diversifying energy sources and reduced fuel transportation risks, renewable energy generation and storage will add resilience and flexibility in a contested logistics environment.

PREMISES

- **Secure Access to Energy:** Modern military capabilities need assured access to sufficient and secure supplies of energy.
- **Renewable Energy for the Warfighter:** REGS strategy outlines the technology advancements that will provide resilient and renewable/clean energy to the Joint warfighter.
- **Public-Private Partnerships:** DoD is not leading the R&D of renewable energy technologies. It must leverage the combined research investments within the commercial and academic sectors as well as other federal government agencies (e.g., DoE)


Photo Credit: Tesla / Canary Media

THREE MAIN FOCUS AREAS

- REGS for Deployed Operations
- REGS for Fixed Bases
- Reduce fuel/energy required to accomplish the mission

THRUSTS

- **REGS for Deployed Operations**
  - Lithium Batteries
  - Long Duration Energy Storage
  - New Advanced Batteries
  - Power Beaming
  - Production of Fuel at Forward Locations
  - Small Modular Reactors at Deployed Locations
- **REGS for Fixed Bases**
  - Microgrids
  - Long Duration Energy Storage
  - Next Gen Photovoltaics
  - Renewable Aviation Fuel
  - Small Modular Reactors
  - Geothermal
  - OTEC
- **Reduce fuel/energy required to accomplish the mission**
  - Aircraft Aerodynamic Modifications to Reduce Drag
  - Vehicle Hybridization/Electrification/Hydrogen
  - Blended Wing Body/Oblique Flying Wing
  - Advanced Air Breathing Engines

Space Technology

2024 PACIFIC OPERATIONS SCIENCE & TECHNOLOGY (POST) CONFERENCE

Mr. David Eccles
Principal Director, Space Technology
Office of the Assistant Secretary of Defense for Critical Technologies (OASD(CT))
February 2024

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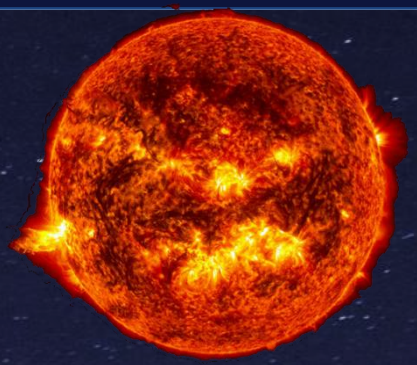
RECENT SPACE TECHNOLOGY HIGHLIGHTS

- 105 2023 launches, likely 150+ for 2024
- 7th X-37B Space Plane launch – 1st on Falcon Heavy
- Successful 1st Flight Vulcan rocket
- Starship/Super Heavy Launch vehicle tests
- VICTUS NOX (USSF/Firefly/Millennium) in 27 hours
- Amazon Kuiper and SpaceX both demonstrated Optical Inter-Satellite Links (OISLs) on orbit
- AUKUS: Deep Space Advanced Radar Capability
- SDA Tranche 0 Launches, Link-16 test from LEO
- Direct-to-Device Cell Phone (4G, 5G) Tests (e.g. AST SpaceMobile, Lynk Global)
- India 4th to land on moon (Chandrayaan-3)

TECHNOLOGY FROM EARTH TO THE MOON AND BEYOND



Autonomous systems, navigation, other AI/ML applications

Commoditized busses with high power generation, energy storage, power management, high performance computing, and adaptable payloads

Resiliency to space weather with high background radiation

Intelligent, low swap, local and wide volume search, detection, tracking, ID, and state prediction

Standards, interoperability with commercial, international partners

Facilities to simulate space, do digital engineering, and support rapid assessments

Focusing key investments today will drive technology improvements that flow to all orbital regimes

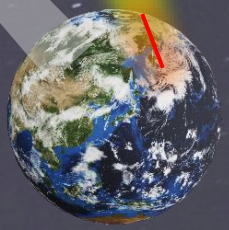
High bandwidth, path diverse, secure comm, PNT, Assured C3, ground

FOV

FOR

GEO

LEO



Launch and ISAM capabilities enabling joint operations and reconstitution

R&E SPACE ROADMAP

R&E Space Technology MISSION

Leverage commercial, foreign, and USG investments, and transition to (1) acquisition programs of record, (2) operators, and 3) commercial products and services

VISION :

- Empower National S&T Strategies
- Optimize DoD R&E investment
- Champion Service and OUSD(R&E) space priorities
- Perform independent assessments
- Push for revolutionary capability
- Pursue asymmetric projects

Tech Investment Areas

1. Space Domain Awareness
2. Agile Mission and Assured Command, Control, and Communications
3. Intelligent Systems
4. National and International Space Power Integration
5. Sustained Operations and Rapid Reconstitution
6. Space Control

Microelectronics

2024 PACIFIC OPERATIONS SCIENCE & TECHNOLOGY (POST) CONFERENCE

Dr. Devanand Shenoy
Principal Director, Microelectronics
Microelectronics Commons Executive Director
Office of the Assistant Secretary of Defense for Critical Technologies (OASD(CT))
February 2024

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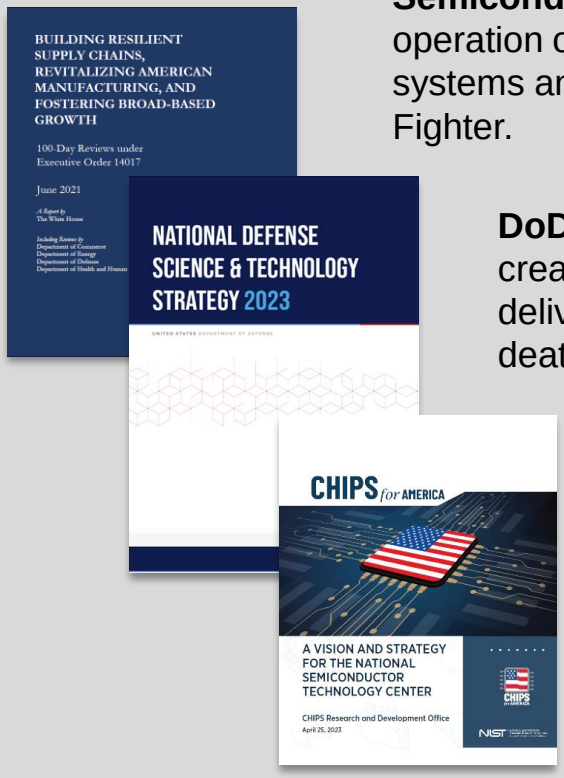
MICROELECTRONICS A "MUST-WIN" TECHNOLOGY FOR DOD

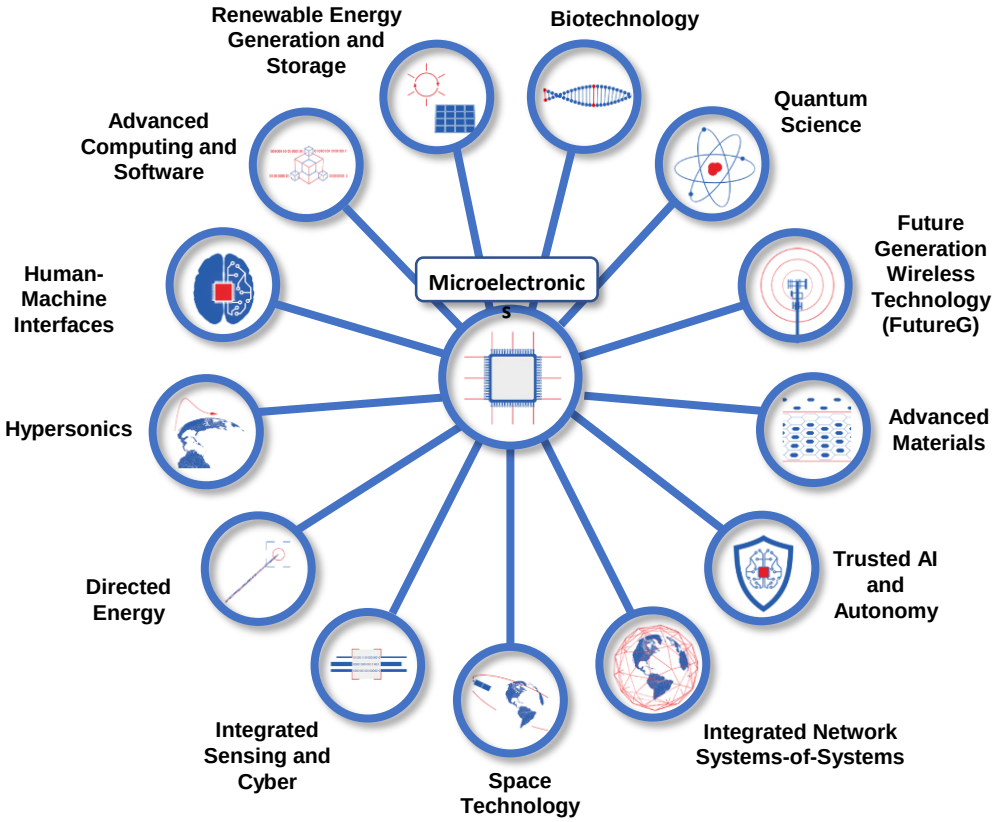


Semiconductors are essential to national security as they are fundamental to the operation of virtually every military system, including communications and navigations systems and complex weapons systems such as those found in the F-35 Joint Strike Fighter.

DoD will accelerate the process of turning ideas into capabilities by creating new pathways to rapidly experiment with asymmetric capabilities and deliver new technologies at scale. Doing so requires bridging the valley of death between prototypes and full-scale production.

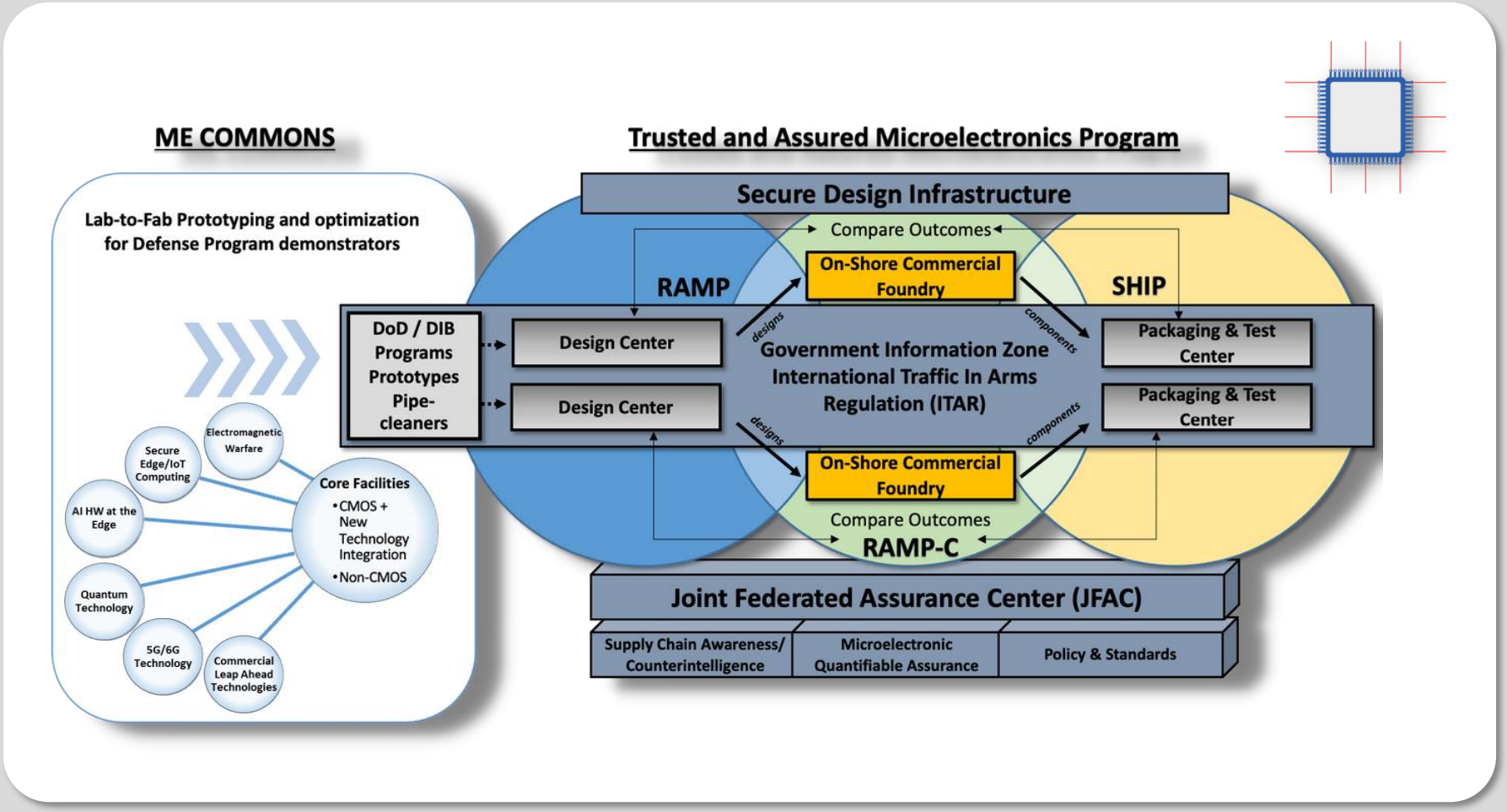
The NSTC will be able to support technologies emerging from the Commons and will collaborate closely with DOD to ensure program coordination and sharing of resources as part of the broader whole-of-government approach in alignment with the national strategy.

CRITICAL TECHNOLOGY SYNERGIES: MICROELECTRONICS



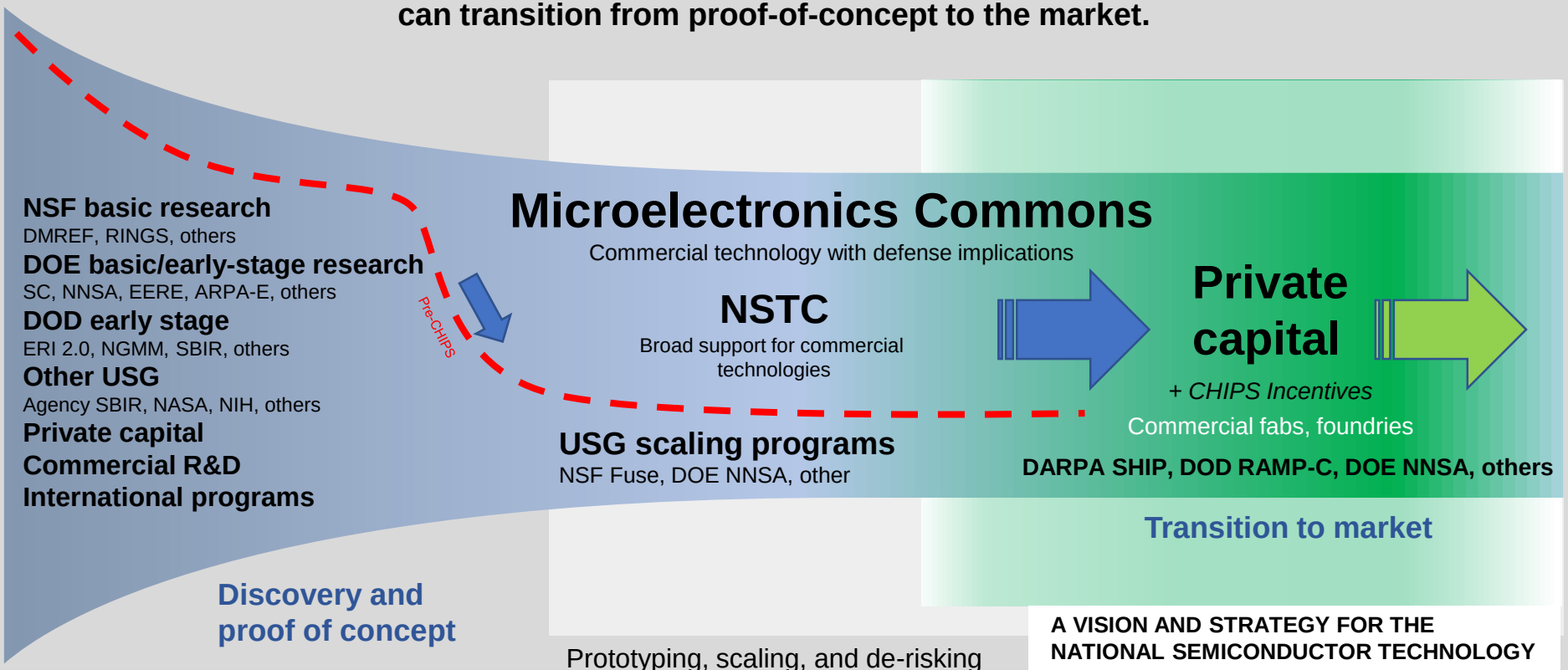
- Autonomous Drones
- AI Chips
- Self Driving Vehicles
- Energy Efficiency For Edge Computing
- Military Applications

T&AM PROGRAM ENABLING ACCESS TO STATE OF THE ART (SOTA)



CHIPS OFFERS A WHOLE OF GOVERNMENT APPROACH

The NSTC and Microelectronics Commons will expand the number of concepts and ideas that can transition from proof-of-concept to the market.



A VISION AND STRATEGY FOR THE NATIONAL SEMICONDUCTOR TECHNOLOGY CENTER
CHIPS Research and Development Office | April 25, 2023

MICROELECTRONCS COMMONS ACCOMPLISHMENTS

microelectronicscommons.org

Establishment of Microelectronics Commons Program

(U) Microelectronics Commons Request for Solution (RFS)

- The Microelectronics Commons RFS was released on November 30, 2022. Solutions were received and the RFS was closed on February 28, 2023
- Source Selection Determination Completed

(U) Microelectronics Commons Call for Projects (CFP)

- The Microelectronics Commons CFP was released and the Hub responses with proposals are due by 28 February 2024

(U) The Microelectronic Commons Leadership Performed on-site Hub visits to each of the 8 Hubs during late January and early February 2024

(U) Industry Days and Inaugural Microelectronics Commons Meeting

- Industry Days were successfully conducted on December 7 - 8, 2022. The event saw both senior leadership and significant interagency participation. There were **more than 900 participants** in attendance at this hybrid event held at the Ronald Reagan Building and International Trade Center in Washington, D.C.
- The **Inaugural Microelectronics Commons** Meeting was held on 17-18 October 2023 in Washington, DC

The Microelectronics Commons is Now a Reality

(U) The Deputy Secretary of Defense announced 8 Hub Award Winners on 20 September 2023

- Arizona State University led Southwest Advanced Prototyping or SWAP Hub – $39.8 million
- Midwest Microelectronics Consortium (MMEC) Hub – $24.3 million
- North Carolina State University led Commercial Leap Ahead for Wide Bandgap Semiconductors (CLAWS) Hub – $39.4 million
- The Applied Research Institute led Silicon Crossroads Microelectronics Commons Hub – $32.9 million
- Stanford University led California-Pacific-Northwest AI Hardware or Northwest AI Hub – $15.3 million
- The Massachusetts Technology Collaborative led Northeast Microelectronics Coalition Hub – $19.7 million
- The State University of New York led Northeast Regional Defense Technology or NORDTECH Hub – $40 million
- The University of Southern California led California Defense Ready Electronics and Microdevices Superhub (DREAMS) Hub – $26.9 million

MICROELECTRONICS ROADMAP OBJECTIVES

Access State of the Art (SOTA) Microelectronics	GOAL: Enable access to the best commercial technologies for military applications while implementing evidence-based assurance practices.
Access to Advanced Packaging and Test	GOAL: Enable military system modernization by providing sustained access to state-of-the-art (SOTA) customized advanced packaged microelectronics.
Access to Radiation Hardened (RadHard) Microelectronics	GOAL: Provide critical radiation-hardened technologies to DoD programs in four areas: Radiation Hardened (RH) by Process (RHBP), Radiation Hardened By Design (RHBD), Radiation Hardened Stand Alone Components, and Radiation Hardened Laboratory Modernization.
Microelectronics Assurance (MEA)	GOAL: Provide capabilities (tools, technologies, and techniques) to conduct verifications and validations to ensure the confidentiality and integrity of microelectronic components from an untrusted/commercial global supply chain.
Access RF-OE SOTA Microelectronics	GOAL: Develop domestic access to mature SOTA RF/OE materials, foundries, and packaging, which enables next generation sensors and communications; demonstrate ecosystem alignment via SOTA RF/OE devices and subsystems which transition USG S&T to the Defense Industrial Base and Programs of Record.
Education & Workforce Development	GOAL: Attract, develop, and maintain a skilled, clearable technical workforce to support design, development, fabrication, verification, validation, security, and modernization of microelectronics.
Microelectronics Commons	GOAL: Enable lab-to-fab prototyping – evolving microelectronics laboratory prototyping to foundry/fab prototyping – in domestic facilities, and fosters a pipeline of semiconductor talent.

DOD RESEARCH AND ENGINEERING ENTERPRISE

CREATING THE TECHNOLOGIES OF THE FUTURE FIGHT

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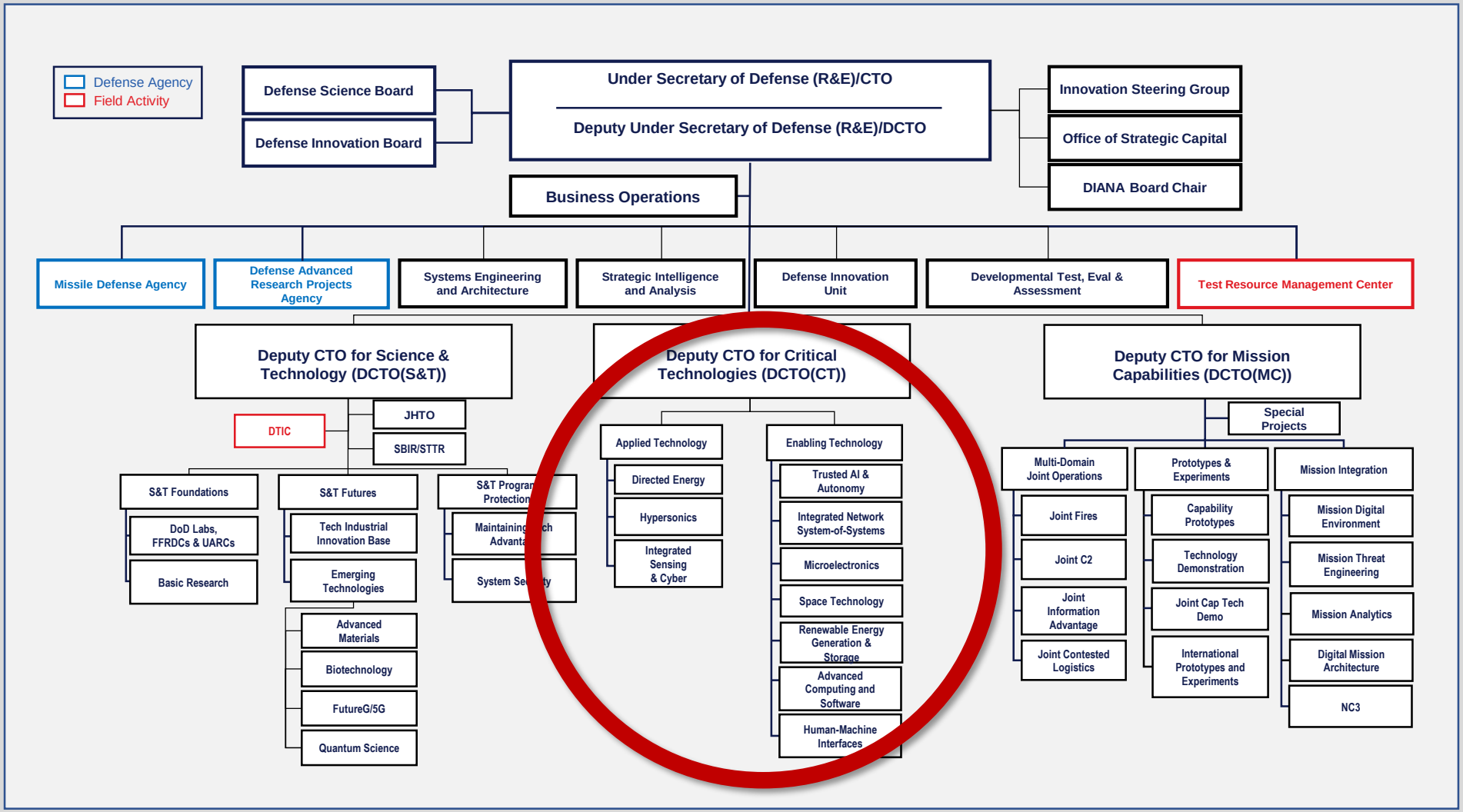
OUSD (R&E) ORG CHART



Appendix

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SUMMARY OF CTAs

Advanced Computing & Software	Includes supercomputing, cloud computing, data storage, computing architectures, and data processing. The speed at which software develops outpaces DoD's ability to stay up to date. We must rapidly modernize legacy software systems with resilient, affordable, and assured new software that has been designed, developed, and tested using processes that establish confidence in its performance.
Directed Energy	Directed energy systems will allow us to counter a wide variety of current and emerging threats with rapid responses & engagement at the speed of light. High-power lasers and high-power microwave technologies both offer new ways to counter diverse sets of threats.
Human-Machine Interfaces	Rapid advancements in this technology will have a multitude of benefits for our service members. Highly immersive realistic training environments provide real-time feedback to enhance warfighter performance. Intuitive interactive human-machine interfaces enable rapid mission planning and mission command by providing a common operational picture to geographically distributed operations.
Hypersonics	While strategic competitors are pursuing and rapidly fielding advanced hypersonic missiles, the DoD will develop leap-ahead and cost-effective technologies for our air, land, and sea operational forces.
Integrated Network Systems-of-Systems	An interoperable network that leverages emerging capabilities across the electromagnetic spectrum such as 5G, software defined networking and radios, and modern information exchange techniques will allow us to better integrate many diverse mission systems and provide fully networked command, control, and communication that is capable, resilient, and secure.
Integrated Sensing & Cyber	To provide advantage for the joint force in highly contested environments, we must develop wideband sensors to operate at the intersection of cyberspace, electronic warfare, radar, and communications. Sensors must be able to counter advanced threats and can no longer be stove-piped and single function.
Microelectronics	Diminishing microelectronics manufacturing in the U.S. and supply chain concerns have highlighted national economic and security risks. Working closely with industry, academia, and across the Government, we are addressing the need for secure microelectronics sources and will leverage state-of-the-art commercial development and production for defense microelectronic solutions.
Renewable Energy Generation & Storage	Renewable energy generation and storage promises to decrease warfighter vulnerability and deliver new operational capabilities for the Department. From more efficient batteries to diversifying energy sources and reduced fuel transportation risks, renewable energy generation and storage will add resilience and flexibility in a contested logistics environment.
Space Technology	Our space strategy must shift away from exquisite satellites to a more robust and proliferated architecture. Novel space technologies are necessary to enable resilient cross-domain operations. The space strategy must incorporate technologies that enhance our adaptive and reconfigurable capabilities in space situational awareness, space control, comms path diversity, on-orbit processing, and autonomy.
Trusted AI & Autonomy	Machine learning is an engineering subfield of AI that trains software models using example data, simulations, or real-world experiences rather than by direct programming or coding. Autonomy is the engineering discipline that expands robots' abilities to perform tasks while limiting the need for human interaction. Trusted AI with trusted autonomous systems are imperative to dominate future conflicts.

Hypersonics

2024 PACIFIC OPERATIONS SCIENCE & TECHNOLOGY (POST) CONFERENCE

Dr. James W. Weber
Principal Director, Hypersonics
Office of the Assistant Secretary of Defense for Critical Technologies (OASD(CT))
February 2024

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STRATEGIC APPROACH

- Hypersonics is one of 14 Critical Technology Areas (CTAs) for the Department of Defense.
- The Department's Hypersonics approach accelerates development and transition of transformational warfighting capability based on hypersonic systems to our Armed Forces and into the hands of the warfighter.
- The Department's development of hypersonic technology will deliver additional cutting-edge capabilities and strategic options to our Armed Forces, supplementing our existing unparalleled capabilities.
- Developing and delivering hypersonic capabilities, along with other advanced technologies and new operating concepts, will ensure the Department maintains the ability to deter potential adversaries and to defeat aggression, if necessary.

DoD has an integrated strategy to accelerate development and delivery of hypersonic systems to the warfighter.

DEFENSE CAPABILITY AREAS

- Defeat time critical and heavily defended land and sea targets from survivable standoff range

- Defeat adversary hypersonic threats

Deter and defend by 2025 and beyond

- Conduct responsive strike and ISR missions

Notional aircraft image is UNCLASSIFIED

ACCELERATED DELIVERY

- Accelerated development and transition of transformational warfighting capability based on hypersonic systems

OUSD R&E / Services → **OUSD A&S / Services**

Phase 1	Phase 2	Phase 3	Phase 4
Concept and Technology R&D	Rapid Prototypes	Accelerated Fielding	Program of Record
• Develop enabling technologies and concepts necessary to underpin future hypersonic systems	• Accelerate future transition through weapon system prototype development	• Field hypersonic prototype capabilities in meaningful numbers	• Programs of record to build warfighting inventory and capability phasing plans

Science & Technology, Workforce, Test & Evaluation, Industrial Base, Allied Partnerships

Critical Enablers

STAKEHOLDERS AND PARTNERS