DoD Cyber Technologies and Opportunities

ACSAC National Cybersecurity Research Directions Panel

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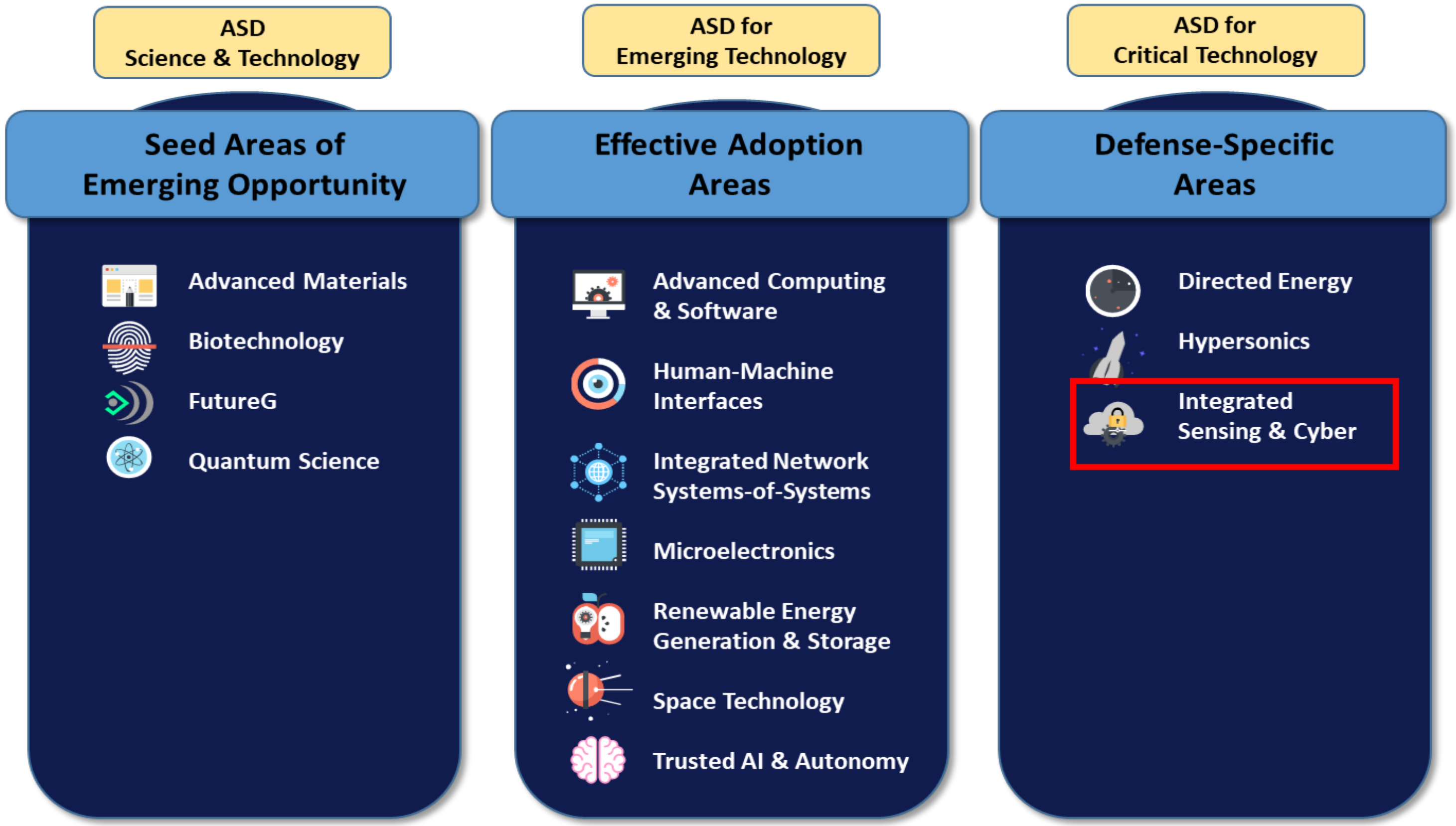
DoD Capability and Technology Demand Signals

Defense-Wide Capabilities/Technology

- National Defense Authorization Act
- National Security Strategy
- National Defense Strategy
- SECDEF Memos
- USD(R&E) Direction
  - 14 Critical Technology Areas



ASD Science & Technology

Seed Areas of Emerging Opportunity

- Advanced Materials
- Biotechnology
- FutureG
- Quantum Science

ASD for Emerging 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

ASD for Critical Technology

Defense-Specific Areas

- Directed Energy
- Hypersonics
- Integrated Sensing & Cyber

Integrated Sensing and Cyber

- National Cyber Strategy
- DoD Cyber Strategy
- CYBERCOM Command Challenges
- Section 1510 Non-Kinetic Force Development Plan

IS&C Strategic Vision

- Vision
  - Integration of platforms, sensors, and effects at the speed and scale of relevance
  - Sense, understand, react, and shape operations in the information environment (OIE) encountered by the joint force in highly contested environments

- Cyber - Major Focus Areas
  - Protect and innovate
  - See the battlespace
  - Support rapid decision making
  - Operations in the information environment

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Global Trends on Cyber S&T

Major Themes	Consequences (for both defense and offense)	Effect on S&T Strategy
TIMELINES SHRINKING	• ***Humans cannot fight at cyber speed without the right tools*** • Interactive ops are obsolete	• Emphasize mission assurance through trust and resilience over "monitor and react" • Use autonomy to extend reach of workforce
COMPLEXITY INCREASING	• Takes us further away from establishing and maintaining trust in our systems • Adds uncertainty, exacerbates security • Untrustworthy ecosystem (supply chain)	• Emphasize importance of trustworthy, automated tools and educated workforce • "Lone hacker" → "Experts with elite tools" • Manage complexity in blue systems
LANDSCAPES RAPIDLY CHANGING	• Constantly redefining battleground via new C4ISR technologies (e.g. 5G/6G, SDN, IoT, Autonomous Platforms, etc.). → New vulnerabilities surface all the time	• Proactively analyze emerging technologies • Continue to invest in broadly applicable tools to be able to rapidly adapt to new technologies and nation state adversaries
DOMAINS CONVERGING	• A tactical platform's attack surface extends out through all its apertures • Multi-domain stovepipes must end, need to use cyber to shape and deter conflict	• Study multi-domain interfaces, find 1+1>2 • Integration of SA / data streams, C2 for all-domain Information Operations (IO)

DoD Cyber S&T is the crucial enabler that ties together all-domain warfighting

Potential S&T Directions

- Tightly-coupled, mutually learning human-machine teams for cyber defense/offense
- Scalable formal methods and resilient architectures, modularity and composability
- Maneuver the cyber attack surface, orchestration of multiple simultaneous functions
- ML/AI for greater automation in cyber problems (tools-centric, human-assisted) Especially useful in expanding the "range of practicality" on Cyber's many undecidable problems
  - Program analysis, reverse engineering, and vulnerability discovery
  - Design and characterization of cyber effects
  - Characterizing attack-defense cycles
- Designed-in simplicity and minimalism: SW, FW, protocols, and architecture
  - Stretch goal: every line of code in memory should be contributing to the mission
- Self-aware and self-correcting SW, FW, and protocols
- Roles of next-gen computing and communications technologies in cyber operations (6G, new microelectronics architectures, autonomous platforms and complex sensors, brain-machine/brain-brain communications, etc.)
- Broad spectrum of coordinated cyber obfuscation and deception technologies
- Ubiquitous sensors feeding integrated Cyber-EW-Kinetic operations
- Seamlessly leverage all-domains in operations to create digital effects (esp. Cyber-EW)

<u>Helps us deal with:</u>

TIMELINES SHRINKING

COMPLEXITY INCREASING

LANDSCAPES RAPIDLY CHANGING

DOMAINS CONVERGING

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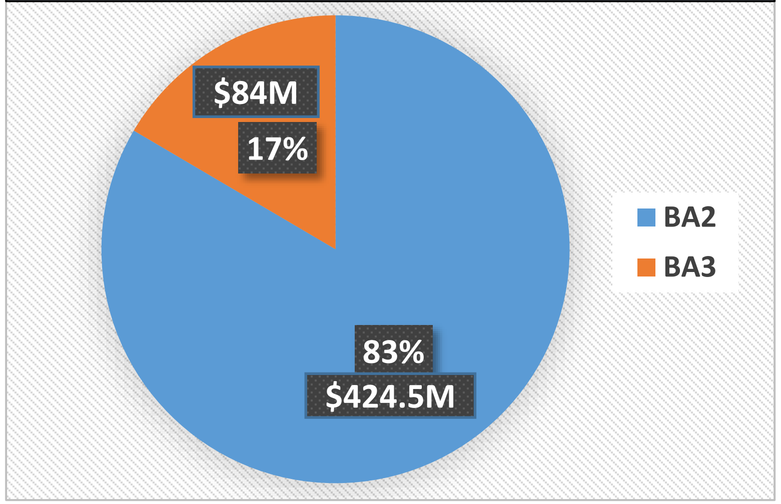
Typical (Past) Cyber Budget and Performer Base

PB20: BY BUDGET ACTIVITY

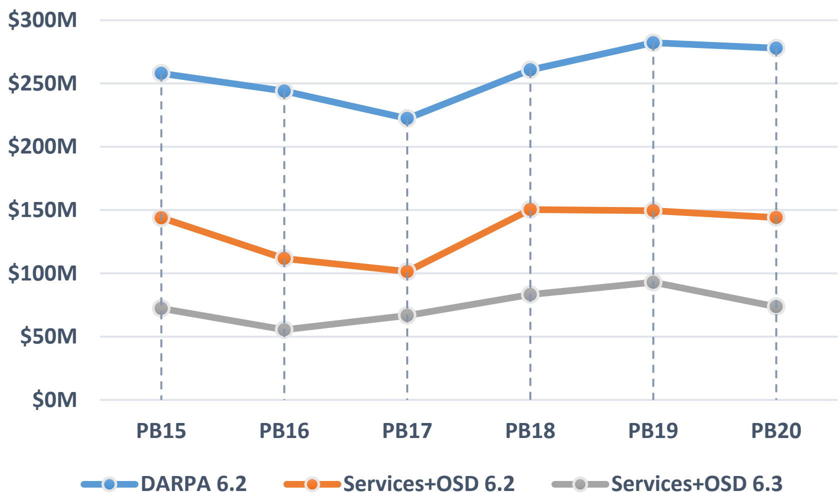


PERFORMERS FOR DOD CYBER S&T

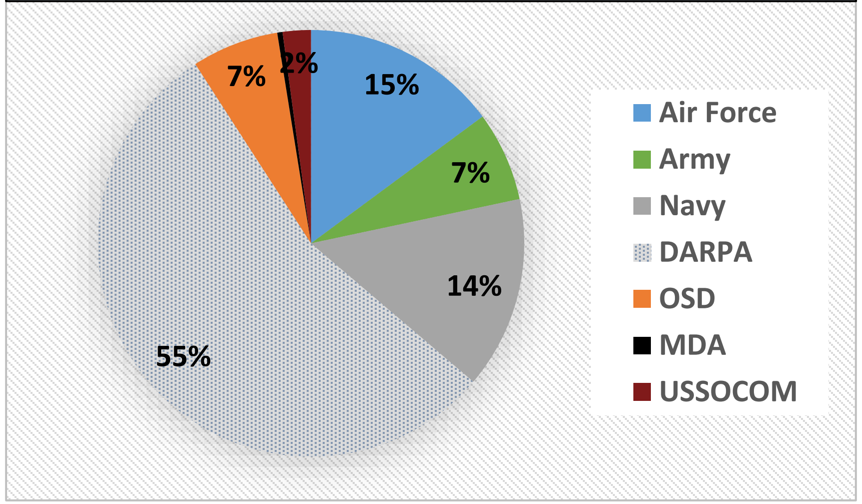
- Services & Agencies S&T Labs: AFRL, NRL, Warfare/Systems Centers, NSA/R, CCDC , MDA
- DOE Labs, FFRDCs, & UARCs
- Academia
- Industry Players
  - Defense Industrial Base
  - Non-traditional
  - Small Companies with Key Expertise & Products
- About 80% Extramural

HISTORICAL TRENDS

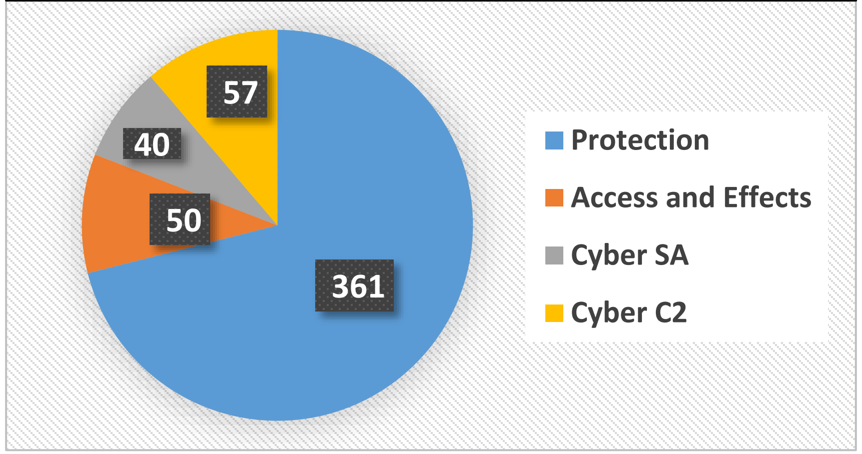
(IN THEN-YEAR DOLLARS)



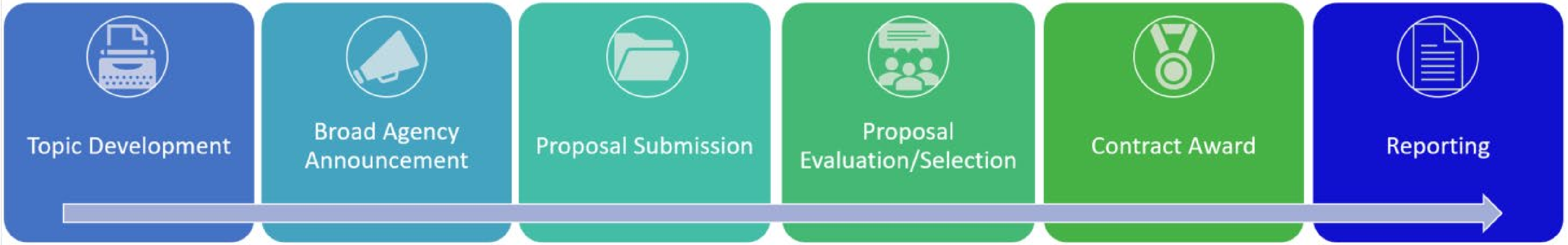
PB20: BY SERVICE / AGENCY (of $508.5M)



PB20: BY TIER 1 TAXONOMY AREA



Industry Engagement: DoD SBIR/STTR Process and Components



- Department of the Army
- Department of the Navy
- Department of the Air Force
- Defense Advanced Research Projects Agency
- Defense Health Agency
- Defense Logistics Agency
- Defense Microelectronics Activity
- Defense Threat Reduction Agency
- Chemical and Biological Defense
- Missile Defense Agency
- National Geospatial-Intelligence Agency
- Office of Secretary of Defense
- Space Development Agency
- United States Special Operations Command

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

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

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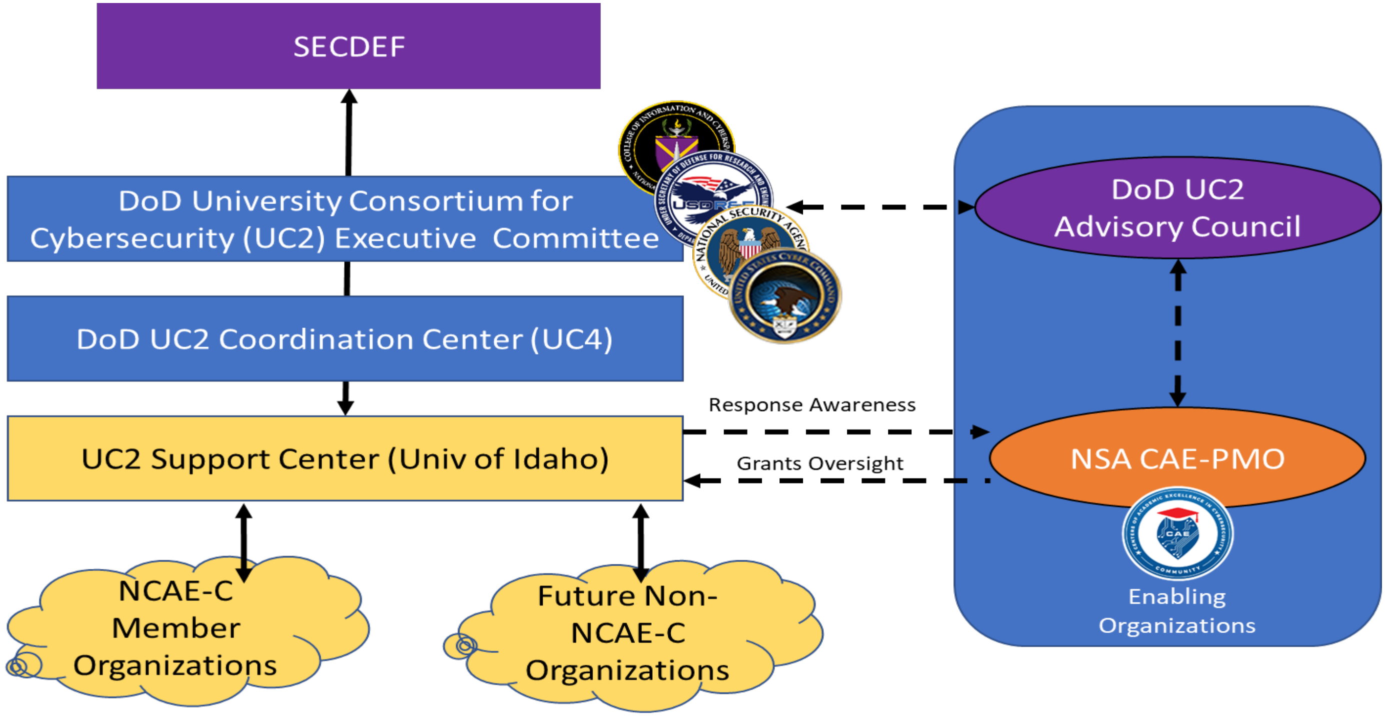
DoD University Consortium for Cybersecurity (UC2)

https://cic.ndu.edu/UC2/Work-With-Us/

Mission: Establish a consortium of universities to assist the Secretary of Defense on cybersecurity matters

- **Advise the Secretary on the needs of academic institutions** related to cybersecurity and research conducted on behalf of the Department
- **Serve as focal point for closer collaboration between academia and the Department of Defense (DoD)** on cybersecurity matters
- **Provide SECDEF timely access to the expertise of the institutions** of the consortia on matters relating to cybersecurity
- **Align support efforts of consortia members** in support of DoD


SECDEF
DoD University Consortium for Cybersecurity (UC2) Executive Committee
DoD UC2 Coordination Center (UC4)
UC2 Support Center (Univ of Idaho)
NCAE-C Member Organizations
Future Non-NCAE-C Organizations
DoD UC2 Advisory Council
Response Awareness
Grants Oversight
NSA CAE-PMO
Enabling Organizations

Accomplishments

- Three RFIs released covering 5 priority DoD topics
- 24 responses from academia // 8 invited presentations
- Webcast and follow-up matchmaking discussions

Work with DoD - Helpful Websites

- Defense SBIR/STTR Innovation Portal (DSIP) - https://www.dodsbirsttr.mil/submissions
- DoD SBIR/STTR - https://rt.cto.mil/rtl-small-business-resources/sbir-sttr/
- Federally Funded Research and Development Centers - https://www.nsf.gov/statistics/ffrdclist/
- Minerva Research Institute - https://minerva.defense.gov/
- National Security Innovation Network (NSIN) - https://www.nsin.mil/
- System for Award Management (SAM) registration - www.sam.gov

- Defense Counterintelligence and Security Agency (DCSA) facility and personnel clearance procedures and requirements - https://www.dcsa.mil/mc/ctp/fc/
- Export Control - https://www.pmddtc.state.gov/ddtc_public
- Invention Reporting - www.iedison.gov
- Technical Reporting - https://discover.dtic.mil/submit-documents/
- Defense Contract Audit Agency - https://www.dcaa.mil/Guidance/Audit-Process-Overview/
- Procurement Technical Assistance Centers - https://www.aptac-us.org/

Backup