CySER Virtual Seminar Series

Cyber Overview and Opportunities of the Air Force Research Laboratory Information Directorate (AFRL/RI)

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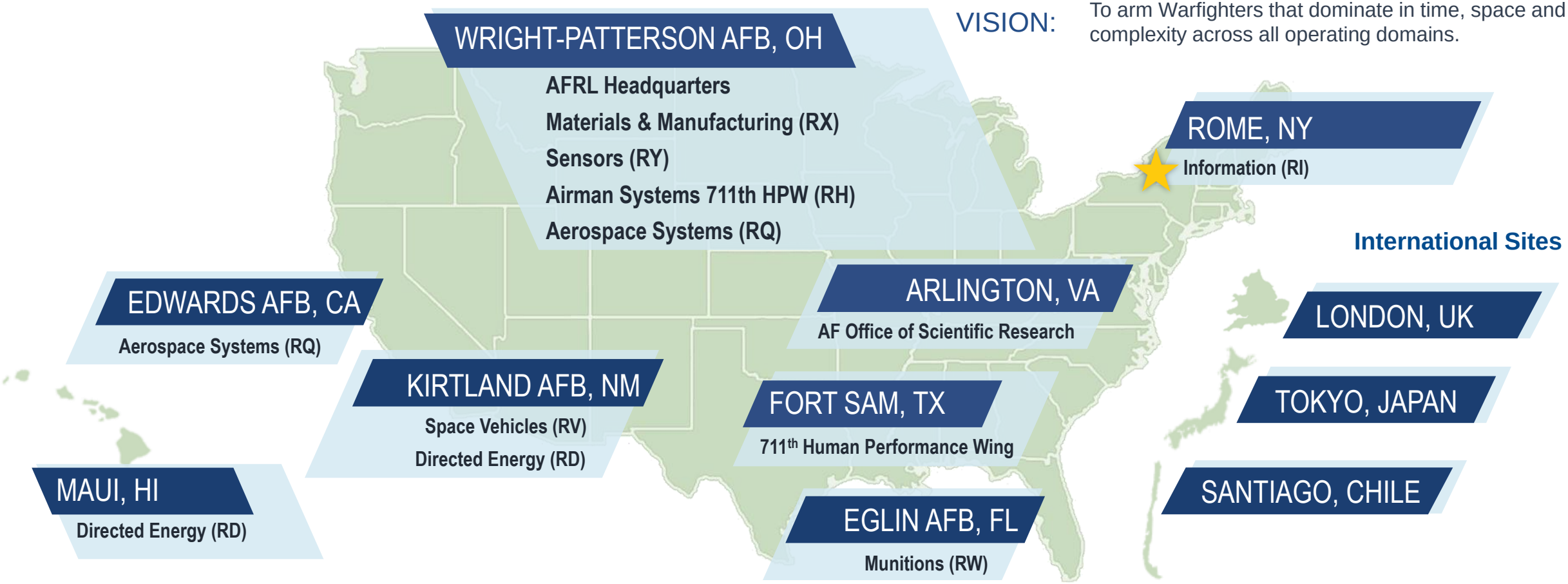
Agenda

- Introduce AFRL/RI
- Overview of Cyber Area
- Share AFRL/RI Cyber Research and Internship Opportunities

Air Force Research Laboratory (AFRL)

MISSION: We lead, discover, develop and deliver science, technology and innovation for Warfighters.

VISION: To arm Warfighters that dominate in time, space and complexity across all operating domains.



Information Directorate (AFRL/RI)

ROME, NY

Information (RI)

MISSION:

To explore, prototype, and demonstrate high-impact, game changing technologies that enable the Air Force and Nation to maintain its superior technical advantage.

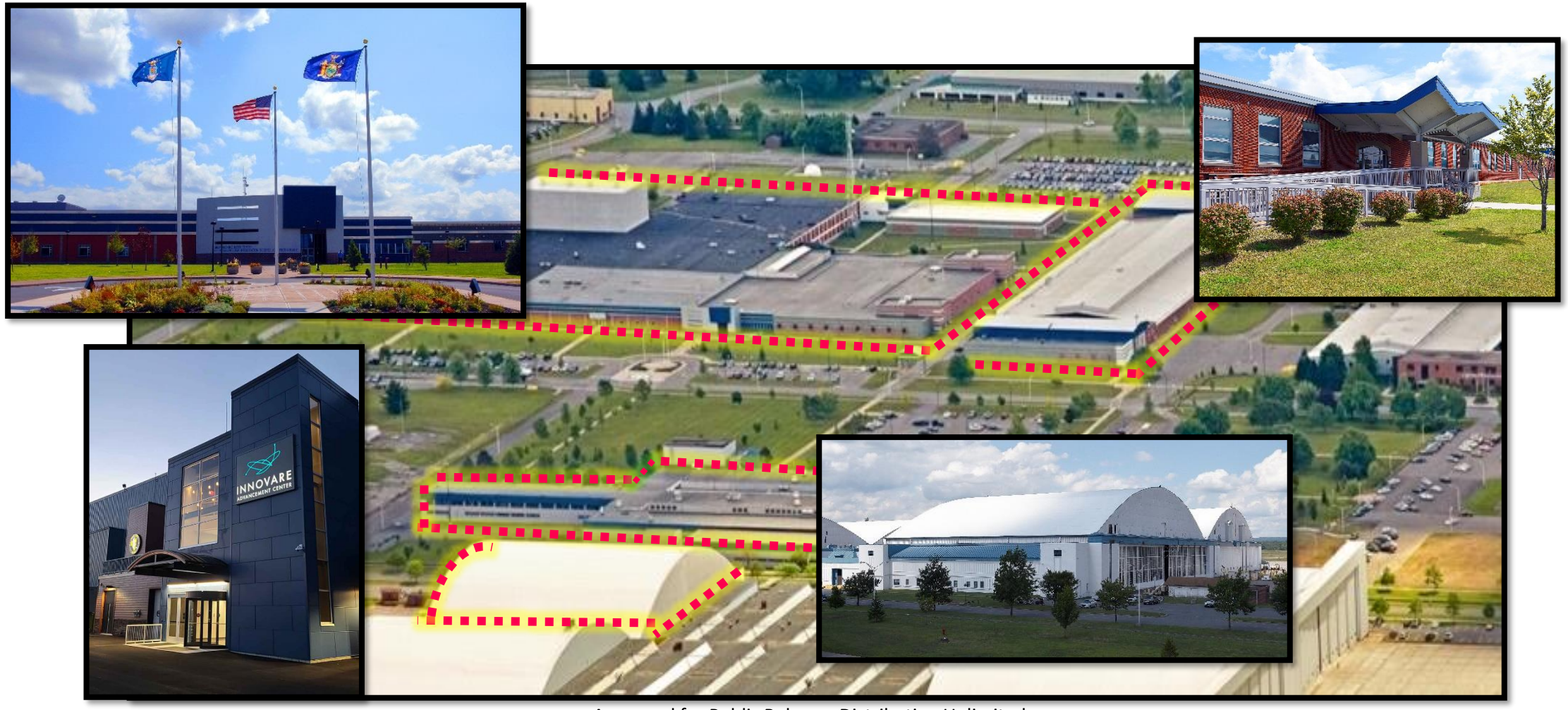
VISION:

To lead the Air Force and Nation in command, control, communications, computers, and intelligence (C4I) and cyber science, technology, research and development.

ROME = C⁴I&Cyber

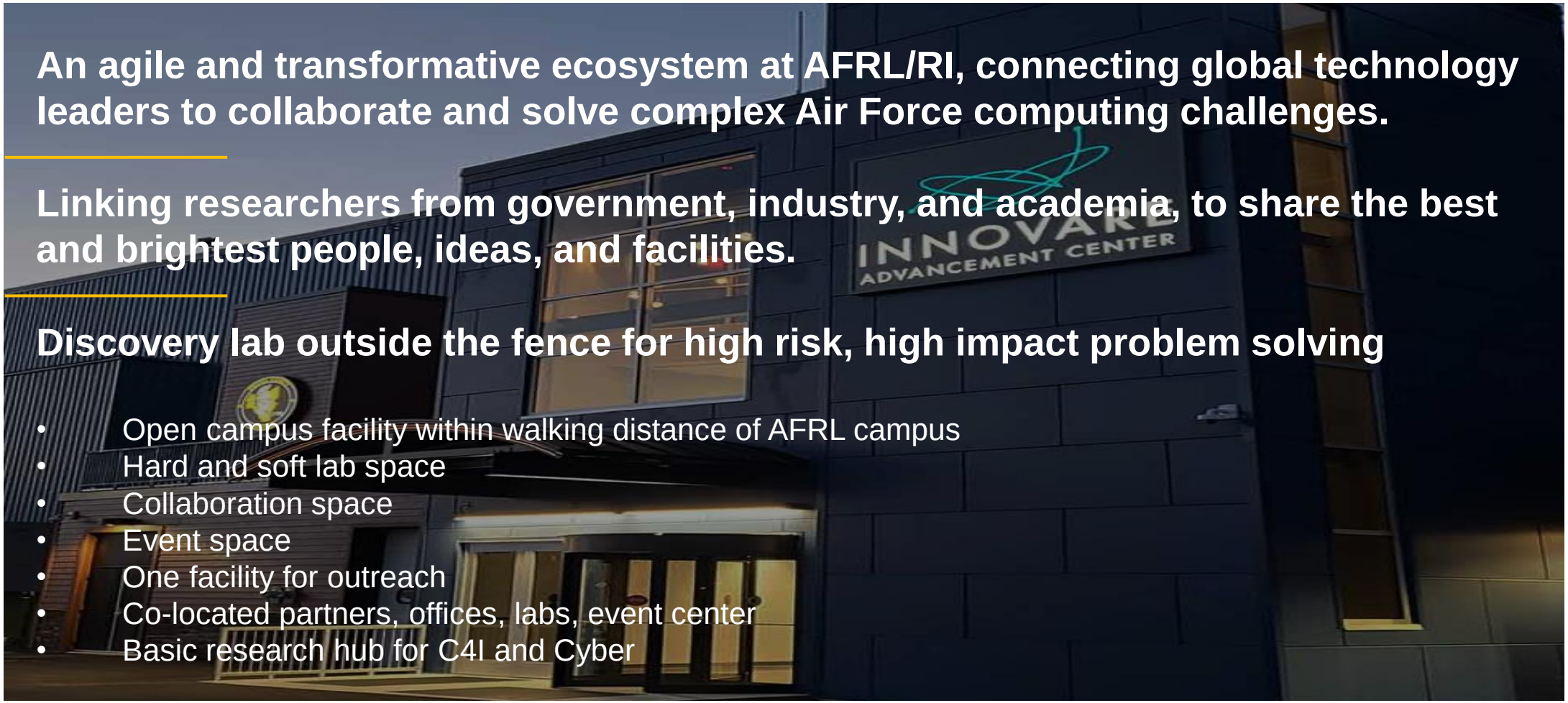
Information Directorate (AFRL/RI) Campus

65 Acre Campus, 30 Laboratories & Facilities, And 882,000 Sq Ft Floor Space



Innovare Advancement Center

65 Acre Campus, 30 Laboratories & Facilities, And 882,000 Sq Ft Floor Space



An agile and transformative ecosystem at AFRL/RI, connecting global technology leaders to collaborate and solve complex Air Force computing challenges.

Linking researchers from government, industry, and academia, to share the best and brightest people, ideas, and facilities.

Discovery lab outside the fence for high risk, high impact problem solving

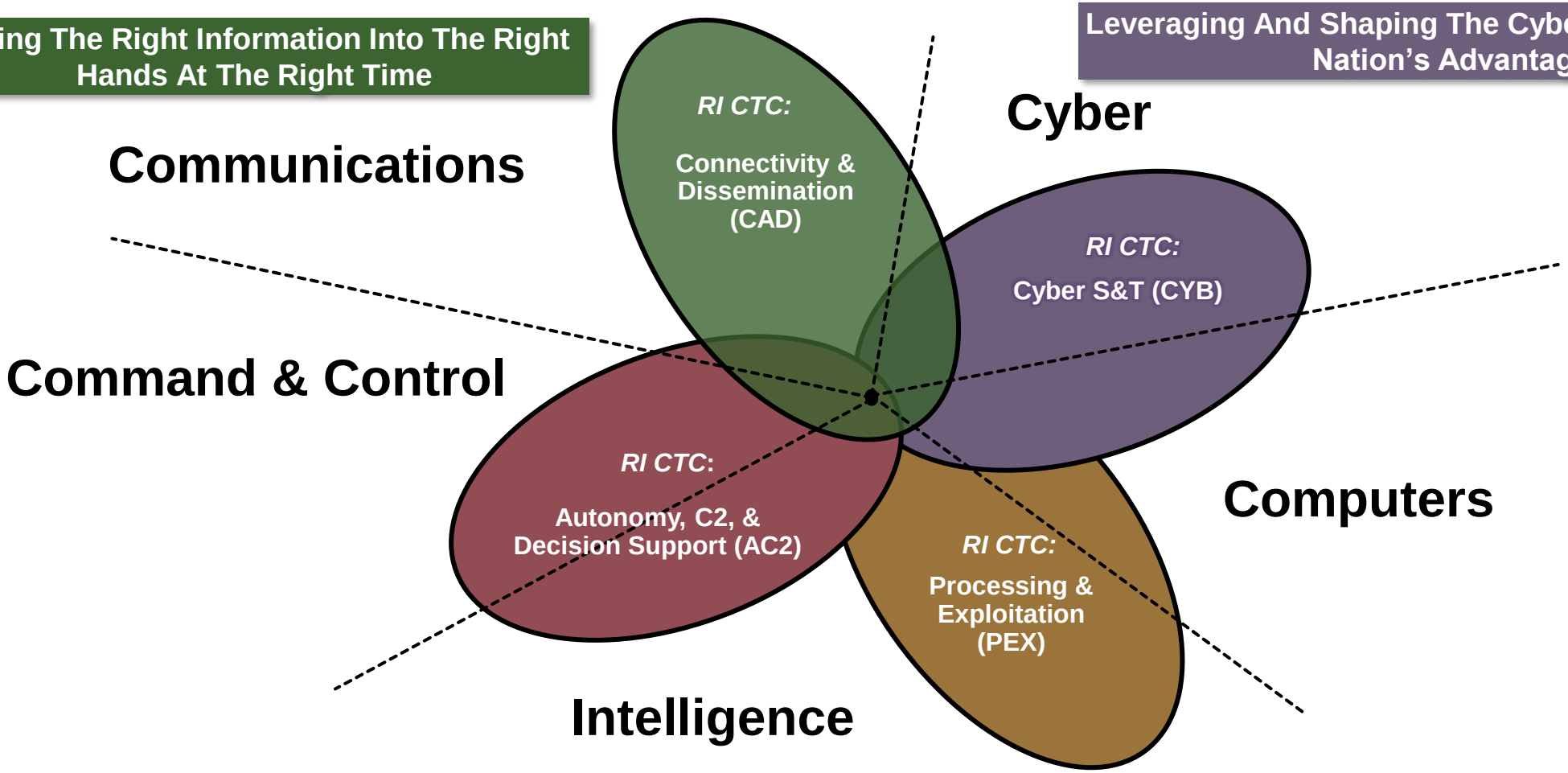
- Open campus facility within walking distance of AFRL campus
- Hard and soft lab space
- Collaboration space
- Event space
- One facility for outreach
- Co-located partners, offices, labs, event center
- Basic research hub for C4I and Cyber

S-UAS Testing | Quantum Facilities | Neuromorphic Computing Facilities | STEM Education | Internships

AFRL/RI Core Technical Competencies (CTCs)

Putting The Right Information Into The Right Hands At The Right Time

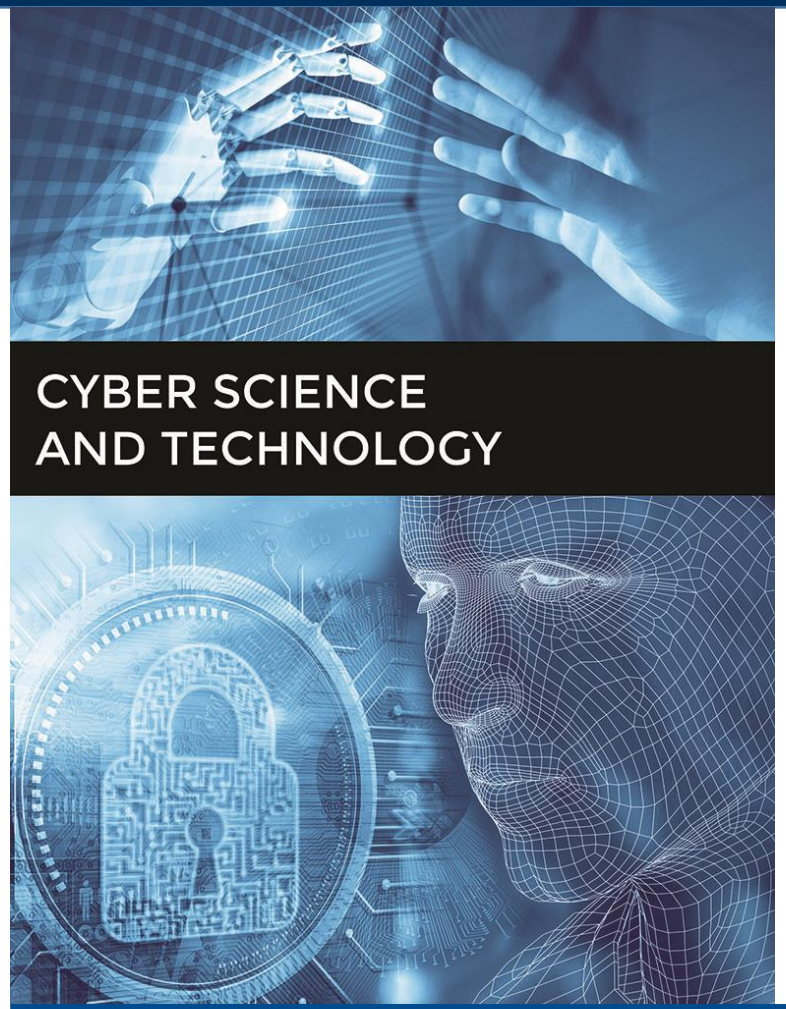
Leveraging And Shaping The Cyber Domain To The Nation's Advantage



Mastering Complexity of Multi-domain Command & Control

Exploiting Computing and Algorithms to Transform Big Data Into Information

Cyber Science and Technology (CYB) CTC



Mission: Deliver the science and technology necessary to ensure cyberspace superiority and support the conduct of full-spectrum, multi-domain, integrated cyberspace operations.

Vision: An Air Force equipped with technologies that enable our freedom to operate in cyberspace while denying the adversary the same.

CORE PRINCIPLES

Context is essential to R&D	[Scope]
Evidence as a first principle of research	[Effectiveness]
Cyber is driven by mission requirements	[Risk]

Mission Assurance as first priority

Leveraging And Shaping The Cyber Domain To The Nation's Advantage

Air Force Strategy

- **Assuring Information as it Traverses Mission Infrastructure, Supporting Operations in All Domains**
- **Projecting Power In, Through and From Cyberspace as a Domain**
  - Cyber Operations, Air Enabled (COAE)
  - Counter Adversary Defense Systems
  - Joint Intelligence Preparation of the Operational Environment
- **Integrate, Synchronize, and Optimize Cyber Operations Across Domains in Order to Compete and Deter**

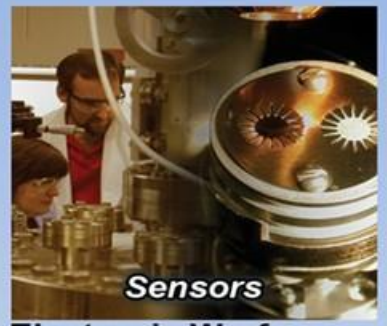
Air Force Operational Imperatives

1. **Defining Resilient Space Order of Battle and Architectures (defensive and offensive).**
2. Achieving Operationally-Optimized Advanced Battle Management System (ABMS) / Air Force Joint All Domain Command and Control (JADC2).
3. Achieving Moving Target Indication and Tracking at Scale (air, sea surface and ground mobile targets).
4. **Defining the Next Generation Air Dominance System of Systems (sensors, communications, command & control, weapons, and uncrewed aerial vehicles).**
5. **Defining Optimized Resilient Basing, Sustainment, and Communications in a Contested Environment.**
6. Defining the B-21 Long Range Strike Family of Systems.
7. **Evaluating Readiness of the DAF to Transition to a Wartime Posture Against a Peer Competitor.**

Space Force Strategy

- **Preserving freedom of action in space is the essence of military space power**
- **CORE COMPETENCIES**
  1. Space Security
  2. Combat Power Projection
  3. Space Mobility & Logistics
  4. Information Mobility
  5. Space Domain Awareness

AFRL Cross-Directorate Cyber Collaborations

RI	711HPW	RY	RV	RW
				
Mission Assurance Command & Control / Visualization Cyber Operations Communications & Networking Processing & Exploitation Signals Intelligence Electronic Protection	Cognitive Task Analyses Operator Selection & Training Adaptive Interfaces / Visualization	Electronic Warfare Avionics Protection	Space System Hardening	Munition Systems Cyber Resiliency

AFRL's Cyberspace Capability Leadership

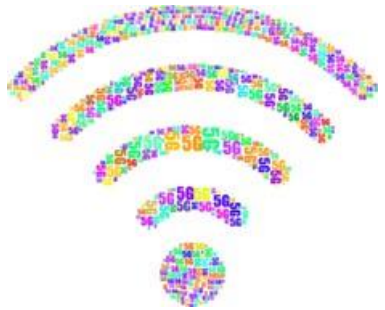
Cyber Trends of Interest

- **Ubiquity of Cyber**
  - 5G and IoT increase pervasiveness of cyber elements
  - Growth in availability of commercial assets
  - Explosion of available publicly available information (PAI)
- **Increasing Complexity**
  - Disadvantage for cyber assurance/defense
  - Advantage for cyber offense
- **Continued Military Reliance on Commercial Assets**
  - Commercial cloud for storage and processing, routing infrastructure, space assets
  - Commercial components in military systems
- **Increased Functionality within and Reliance on the Space Domain**
  - Expanded network access
  - Mesh networks in space for increased resilience
- **Resource Scarcity Driving Increased Worldwide Conflict**
  - Increased environmental risks and survival stakes shift in deny, delay, disrupt, destroy, or manipulate (D4M) effects
  - Potential increase in attacks with greater visibility/effects

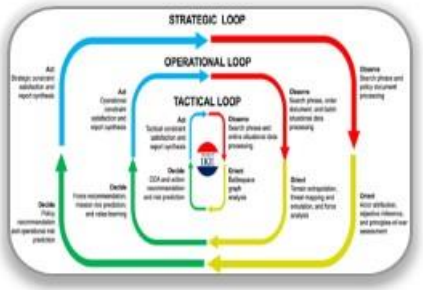
Technological Trends of Interest

- Internet of Things and 5G/6G
- Zero-Trust Architectures
- Agile Development (DevSecOps)
- Autonomy/AI/ML
- Offensive/Defensive Implications of Future Computing Platforms
- Fully Immersive Environments

  (Virtual/Augmented Reality)



Cyber CTC Lines of Effort



Cyber Warfighting

Cyber warfighting technologies that support joint, integrated DCO-OCO-DODIN operations across all domains and levels of conflict. **Vision:** Cyber operations on par and integrated with air and space.

Cyber Assurance

Integrated components and processes that provide measureable and provable guarantees for current and future system architectures. **Vision:** Mission assurance in environments of heterogeneous trust.

EM-Cyber Convergence

Fusion of wired & wireless capabilities with advanced signal processing, enabling future integrated multi-domain ops and emerging missions. **Vision:** Cyber ops agnostic to medium and geography.

Emergent Cyber Challenges

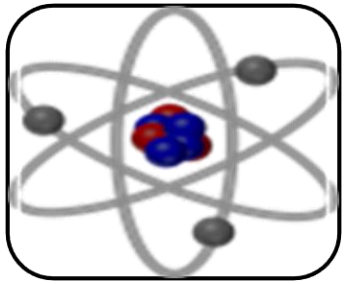
AFRL leads development and employment of future concepts in support of cyber operations and mission assurance concepts

Cyber technologies for emergent environments in FY23 and beyond

- Automated, integrated cyber capabilities
- Security implications of modern systems development practices
- Fundamental concepts for EM-cyber
- Cyber implications to information warfare
- Protocol analysis techniques
- Digital twins of systems for vulnerability analysis

Space-Cyber Applications

Heterogeneous-Trust Concepts



Future Computing Platform Implications

Future UAS Threats

Cyber Workforce Transformation

Recent Cyber Transition Activities

- **Counter-Unmanned Aircraft System Operational Science & Technology Applications (COSTA)**
  - Ninja C-sUAS S&T innovation – Counter small unmanned aerial vehicles (C-sUAS)
  - Transitioning to AFLCMC/HBU with hundreds of Ninja systems fielded to bases around the world
- **Rapid Cyber Prototyping and Transition (RCPAT)**
  - Firestarter rapidly transitions cyber technologies to the warfighter
  - Transitioned dozens of tools to capabilities/organizations such as CVA/H, AFLCMC, 90 COS
  - Threat intelligence, cyber ops SA, automated testing, fuzzing, malware analysis
- **Advanced Course in Engineering Cyber Security Boot Camp (ACE)**
  - 10-week summer program to educate and train the cyber leaders of tomorrow
  - Transitioned OCO/DCO range environment, tabletop cyber exercise, and cryptographic attack infrastructure to support Undergraduate Cyber Warfare Training (UCWT) and impact all AF/SF 17A/B

AFRL/RI Research Opportunities: Information Institute

- The Information Institute consists of universities allied with the US Air Force Research Laboratory Information Directorate in Rome, NY
- Alliances between government and universities called "Education Partnership Agreements" (EPAs) are used extensively
- Visiting Faculty Research Program (VFRP) provides research opportunities for full-time faculty for 8-12 week-tours during the May-September period
- Research topics span the 4 CTCs, examples include:
  - Machine Learning Applications for Geospatial Intelligence Processing
  - Wireless Sensor Networks in Contested Environments
  - 5G Core Security Research
  - Quantum Computing Theory and Simulation
- Also opportunities through the Summer Faculty Fellowship Program (SFFP) sponsored by the Air Force Office of Scientific Research (AFOSR)

INFORMATION INSTITUTE®

More information at: https://www.afrl.af.mil/About-Us/Fact-Sheets/Fact-Sheet-Display/Article/2332471/afrlri-information-institute/

AFRL/RI Internship Program Opportunities: RI Interns

- June 5, 2023 – August 11, 2023
- Paid summer internship opportunity for students currently enrolled in an accredited college or university at the freshman level through PhD level (U.S. CITIZENS ONLY)
- Work on-site with AFRL researchers on a wide variety of research projects
- Examples of research topics available
  - Data Efficient Machine Learning
  - Artificial Intelligence
  - IoT
  - Small Unmanned Aircraft System
  - Neuromorphic Computing
  - Trusted Software
  - Quantum Information Sciences
- Travel and housing assistance for those who live more than 50 miles from Rome, NY

More information:
https://www.griffissinstitute.org/who-we-work-with/afrl/summer-internship

AFRL/RI Internship Program Opportunities: ACE

ADVANCED COURSE IN ENGINEERING
Competence | Commitment | Courage | Compassion

More information: https://www.ace-cyber.com/

- The ACE program forges a cadre of cyber warriors and leaders of consequence
- Immersion in mission centric education, training and research at the tactical and operational level provides the leaders and change agents the nation needs in cyberspace
- 10-week paid internship program – 30 May – 11 Aug 2023
- Run 8 miles each week
- Trip to Gettysburg to walk the battlefields, discuss principles of leadership, and apply lessons learned to the cyber environment
- Eligibility
  - US Citizens eligible for DoD Secret Clearance
  - Rising undergraduate juniors or seniors
  - Majoring in Computer Science, Computer Engineering, Electrical Engineering, Math, or a computer security-related major

"ACE was the most impactful summer of my life"

AFRL/RI Internship Program Opportunities: VICEROY

8-week cyber and electromagnetic spectrum paid internship for VICEROY students (housing, travel, and some meals also covered)

12 June - 4 August 2023 in Rome, NY

Admitted 42 first-year interns, 5 graduate assistants

Incorporates leadership, writing, public speaking, research, capstone, and graduation dinner components

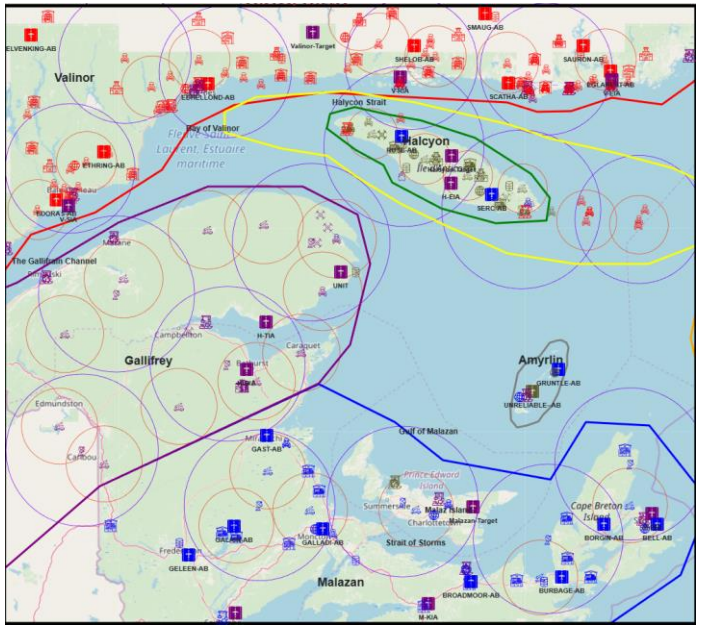
Core Curriculum

- AF/SF mission and electromagnetic spectrum (EMS) emphasis
- Cyber and EMS-focused lectures on UAS, Satellites, Cyber-Enabled Munitions, SCADA, and Military IoT mission systems
- Research projects with AFRL/RI mentors
- Blue Book® cyber vulnerability assessment of a mission system
- IEEE conference-style paper on research projects
- Hands-on cyber and EMS exercises

Application information will be sent out to VICEROY schools in fall 2023

AFRL/RI Internship Program Opportunities: VICEROY

- Partnership with AFRL/RI's *Blue Edge* competition development team
- **Concord Dawn Capstone**: Transmit the coordinates of a High Value Target to a UAV to enable target strike
- **Future**
  - Custom capstone tailored to the new MAVEN curriculum
  - Blue Edge developing additional competitions for all VICEROY students



AFRL/RI Internship Program Opportunities: VICEROY

VICEROY MAVEN

PLAYBOOK

- Yearly Battle Rhythm
- Curriculum
- Schedule
- Templates
- Cross-Service Capstone

U.S.ARMY

UNITED STATES NAVY

Questions?

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