



NATIONAL SECURITY INSTITUTE
VIRGINIA TECH.

National Security Institute

Research and Talent Development Programs

Eric Paterson
Executive Director

18 September 2024

We meet the pressing needs of the defense and intelligence communities by advancing interdisciplinary research, technology, policy, and development of specialized talent.

NSI at a glance

- + **Dual locations** in Arlington and Blacksburg, Virginia
- + **30+% growth** in FY22, FY23, FY24 - research expenditures to over **\$40M**
- + Balanced portfolio at the **intersection of private and public sector innovation.**
- + **Specialized facilities and computing** at both locations
- + Focus on developing **cleared talent pipeline** with robust internships and project-based learning opportunities with partners
- + **70 graduate and 1000 total students (AY24) contribute to our being a top producer of talent** through the Hume Center's National Security Education Program
- + **Personnel (TOTAL: 500+)**
 - + **169** researchers, staff, and GRAs
 - + **300+ UG** researchers (on wages)
 - + **60+** affiliated faculty from 5 colleges

A one-of-a-kind university institute fully dedicated to serving the defense and intelligence communities.

Rising to national prominence through 10-year growth of the Hume Center for National Security & Technology.



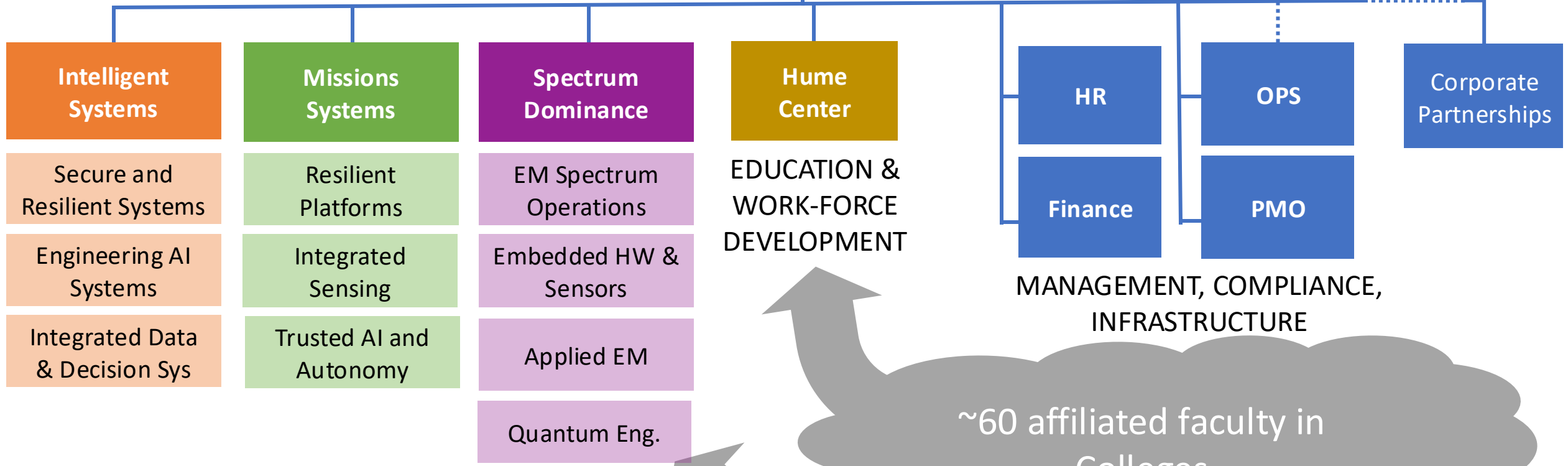
NATIONAL SECURITY INSTITUTE
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Vice-President for Research and Innovation

Office of the Director
Executive Director – Blacksburg
Deputy Director - Arlington

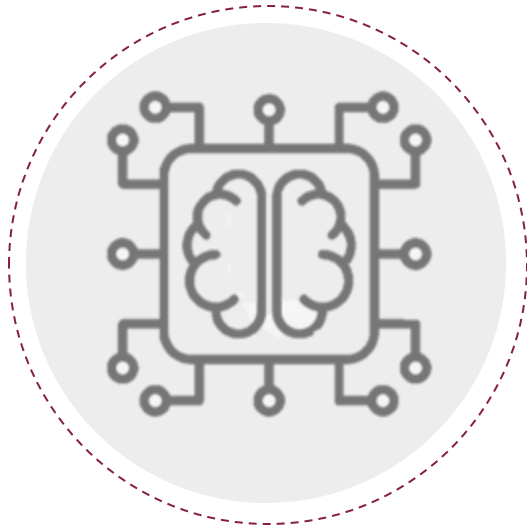
OESRC

Innovation & Partnerships



TECHNICAL DIVISIONS

~60 affiliated faculty in Colleges



INTELLIGENT SYSTEMS

Fundamentally changing how we interact with and learn from data

- Data science, ML, AI
- AI Engineering
- Cyber security & complex systems
- Validation and test & evaluation
- Deep learning for sensor processing
- Data fusion & sensemaking



MISSION SYSTEMS

Intelligent & resilient platforms

- Resilient, autonomous missions
- Remote & in-situ sensing
- Space situational awareness
- Marine autonomy & robotics
- Energetic materials
- Counter UAS technology



SPECTRUM DOMINANCE

Establishing ownership of the RF Spectrum

- Assured & secure communications
- Advanced C4ISR & counter-C4ISR
- Quantum & heterogeneous computing
- RF machine learning
- Open Gen wireless innovation

FACILITIES - Buildings



Blacksburg – RB1311



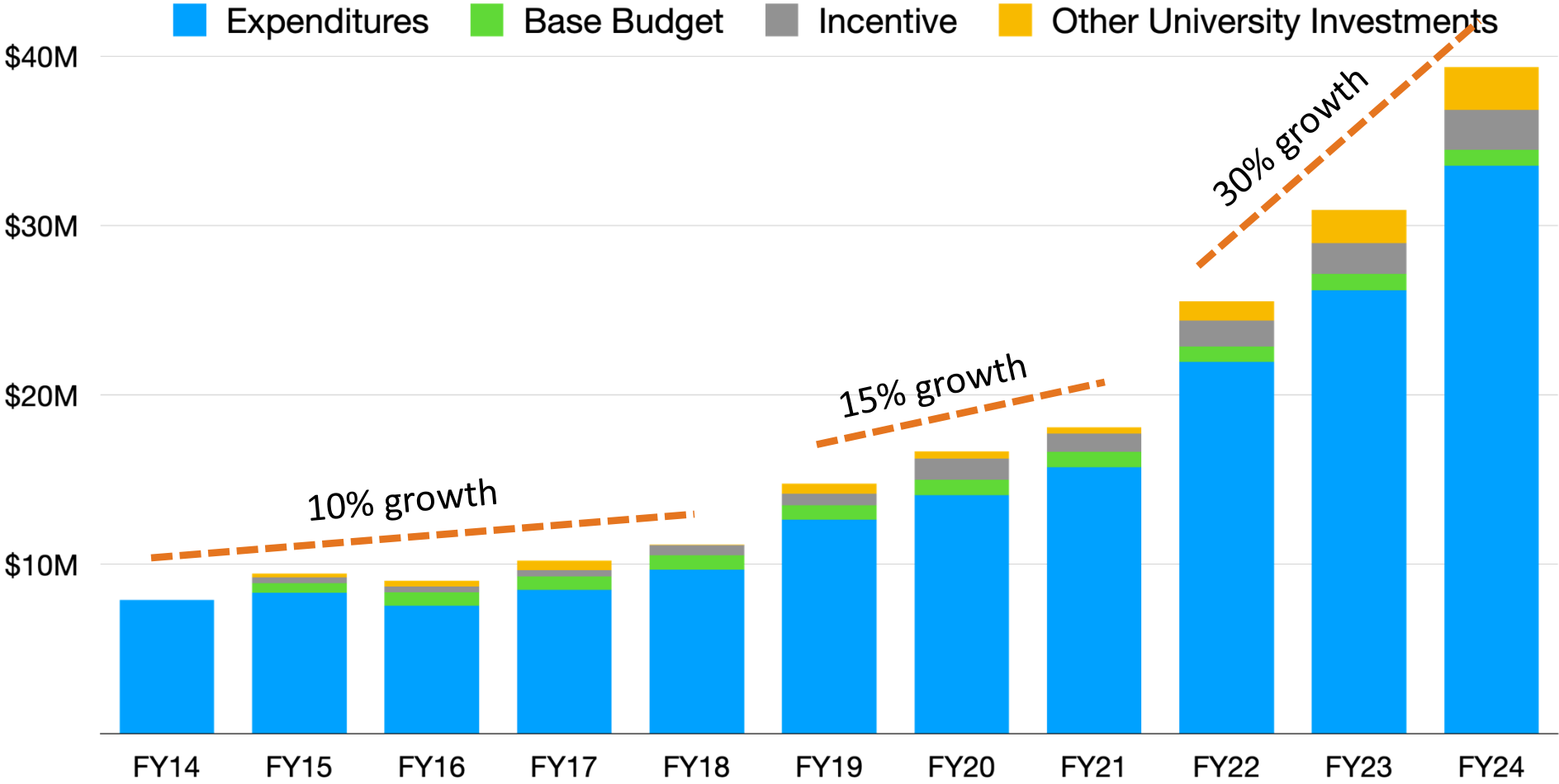
Arlington – VTRC-A



Blacksburg – Knowledge Works II: JULY 1, 2024

NSI
~20,000 sq-ft

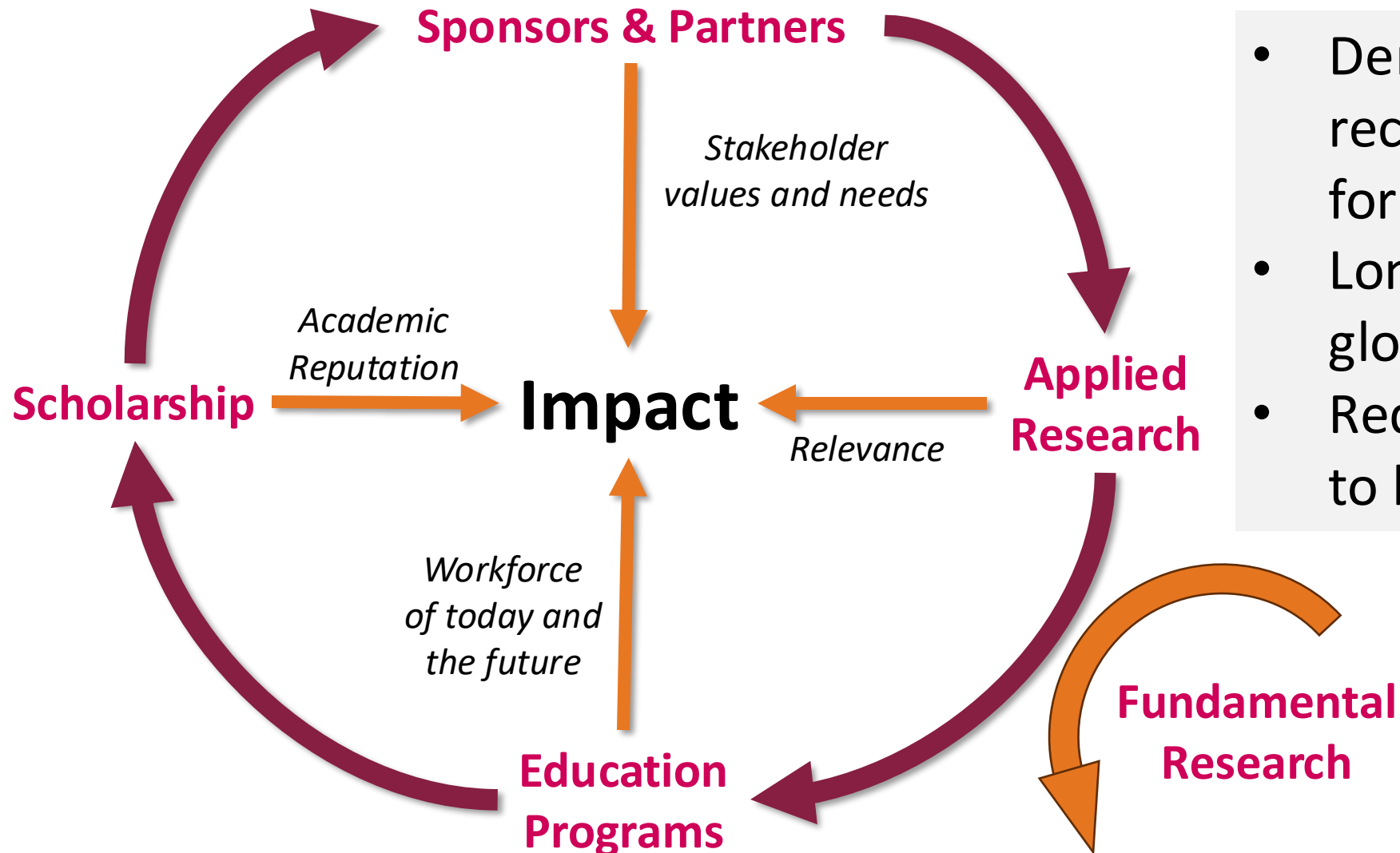
Extramural funding



KPIs

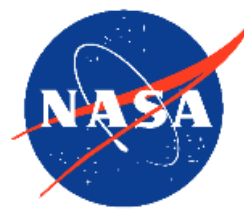
- ~\$40M per year
- 3-year average growth of >30%/year
- **ROI of 6:1**
- Daily total cost to run NSI of \$132K

NSI's operational model is a flywheel for *impact at scale*.



- Demonstrated track record of impact is critical for securing new awards.
- Long-term success leads to global distinction.
- Requires faculty dedicated to broad goals

Commitment to innovation through partnerships



- Partnerships at NSI are multi-dimensional relationships
 - Co-Capture on federal awards (prime/sub-contractor relationship)
 - Investment of corporate IRAD on focused research projects
 - Support of capstone projects, design teams, and academic affiliate programs
 - Philanthropy
 - Participation on advisory boards
 - Hiring students for internships and full-time jobs
 - Initiation of student security clearance during internships
 - Externships for industry and USGov employees at VTNSI
- Management of numerous relationships requires a team approach between multiple NSI and university-level units.

Partner Dashboard

EXAMPLE

Hokies at Lockheed Martin

929

Hokies currently employed at Lockheed Martin

- + 16 Fellow
- + 13 Directors
- + 8 VP's

Hiring Hokies

89 AY 22/23

Legend: College (dark purple), Intern (orange)

Top 3 Majors for FT Hires

- + Aerospace Engineering
- + Computer Science/C Eng
- + Mechanical Engineering

Bus. Area Hires

Legend: Aero (dark purple), EO (orange), MFC (grey), RMC (black), Space (light grey)

AY 22/23

Engagement

4

Hokies on advisory boards

- + 3 Space@VT
- + 1 VTNSI

CRAD/Co-Capture

\$3M Classified Research

- + No current efforts

\$1.5M Unclassified Research

- + IRAD funded project lead to new program (\$9M; over 3 years; LMCO Advanced Technology Lab is the sub)

Master Research Agreement

\$3.3M

Aug. 2016 – Aug. 2026

- 13 task orders (two active)

LMCO CET 2023 University research Call:

- + 30 whitepapers submitted
- + 1 funded

Student Team Projects

- + 6 Projects - VT Ware Lab
- + 2 Projects Advanced Engineering Design Lab
- + Engineering Education Senior Design Program



- Systems Engineering Research Center (SERC) is a consortium UARC competitively awarded by the Assistant Secretary of Defense for Research and Engineering, ASD(R&E)
- \$18.5M over 30 NSI projects
- \$11M in current work

- **DOT&E** funding @~\$3.5M/year has two years and working on contract for 4 more. Existing programs in (1) Digital Engineering approaches to Operational Test and (2) Operational Test for AI-enabled systems
- Recent award for **DOT&E** Test Harness to study new approaches to test of AI-enabled systems
- **Deloitte** PHM test harness: \$500K to establish machine environment for testing AI approaches to prognostics and health management (PHM)
- **NRO** Program to study AI resilience. Focus on critical infrastructure resilience and cyber resilience of AI-enabled systems



Deloitte.



IARPA – Intelligence Advanced Research Projects Activity

SCISRS Securing Compartmented Information with Smart Radio Systems

- Partnership with **Northrop Grumman**. NSI is technical lead on program.
- Recent win of Phase III. NSI share of program greater than \$10M.
- Goal: develop smart radio techniques to automatically detect and characterize RF anomalies that may indicate a compromise of secure data in complex RF environments.
- Leverages world-class expertise in RF Machine Learning and wireless communications



Major thrusts

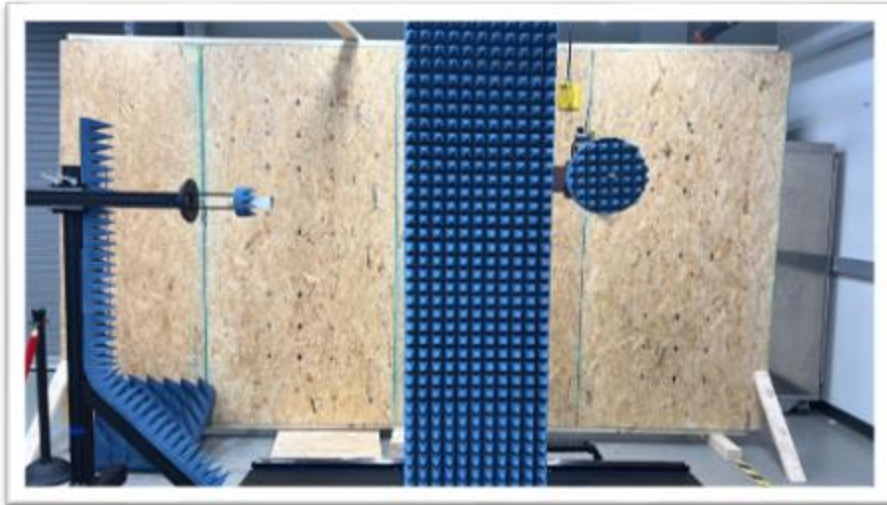
- Persistence
- Unstructured and non-permissive environments
- LPD/I acoustic communication
- Low-cost access to the deep ocean

Demonstration goals

- Change detection
- Ship traffic monitoring, adversarial UUV detection
- Collaborative tracking of actors with anomalous behavior
- Energy-aware transit and surveys



- Partnerships: IUSG – Industry – Academia
- At-sea demonstration
- Economic development



Mission

Create the **premier** Counter-UAS testing and Research Center in the country to ensure security in the context of evolving aerial threats, AI-enabled systems and contested airspace



Counter UAS System Test Lab

- Mixed reality setting
- Anechoic chamber for RF and GPS denied testing
- 3D computer graphics to lab test defeat systems

Counter UAS System Test Site

- Library of COTS UAS w recovery systems
- Test capabilities for evaluation CUAS systems
- Validate lab results

Student Programs

- Growth
- Recruitment
- Work force development programs
- Defense Civilian Training Corps
- Executive & professional education

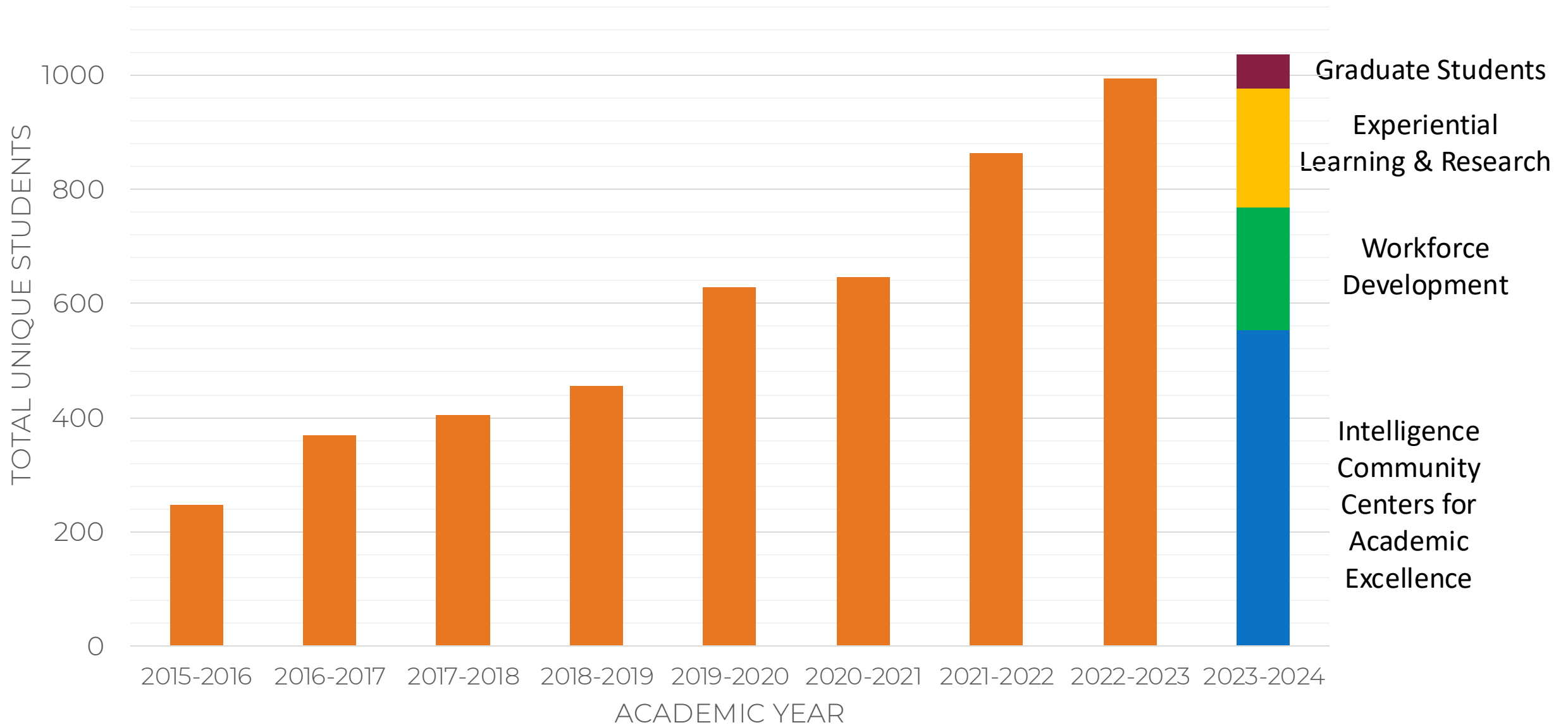


The institute's workforce development initiatives provide opportunities students at all academic levels to gain real-world, hands-on experience with cutting-edge optical systems for space operations.



Students recently assisted the institute's [Mission Systems Division](#) in completing the first phase in a long-term series of improvements to the Space Domain Awareness Telescope.

Student programs - growth



Fall 2024 Undergraduate Research Open House



Example summer student visits



Central Intelligence Agency



Round-table with DNI Avril Haines

The Hume Center Workforce Development Programs

Internships | Security Clearances | Careers

Industry
Active
Students

56

Government
Active
Students

178

Active
Awards

**\$16
Mil**

10+ Programs with a focus on AI/ML, Cybersecurity, RF, DSP, Autonomy, & Advanced Manufacturing

41

GRADUATES (FTEs) IN MAY 2023

“ Being a part of this program has given me a sense of security and confidence that I feel I wouldn't have had at this point in my college experience without the program. I not only know what I want to do, but also how I will be able to achieve my goals. ”



“ I'm definitely more excited about graduating and working. Now that I have some real world experience under my belt and part of my future set in stone, I feel like I am so much more prepared to transition into working full-time. ”



DEFENSE CIVILIAN TRAINING CORPS
OUSD ACQUISITION & SUSTAINMENT

National Security Leaders Today and Beyond

The Defense Civilian Training Corps

(DCTC) was established to develop a modernized, multi-disciplinary civilian talent pipeline for the Department of Defense (DoD). DCTC provides the targeted education, development and experiences required to meet current and future complex demands on the DoD workforce. The goal is to foster a continuous and increasing stream of multi-disciplinary cleared talent directly from the higher education system into the DoD civilian workforce.



Accomplishments

- Successful VTCC and VTNSI collaboration
- 67 Scholars, \$4.3M in scholarships and stipends. Cohort 1 – 29, Cohort 2 – 38
- \$1.5M award for DARCIE: expand CUI research infrastructure development for broad use by universities across nation
- Internships at 17 DOD facilities, working on projects ranging biological threat detection to the optimization of aircraft overhaul and combat feeding of our troops.

- Tuition
- \$25,000/year
- Summer internship
- Security clearance
- Guaranteed job at GS9

DCTC Pilot Universities

Virginia Tech

NC A&T

U. Arizona

Purdue

Deloitte AI Academy™ Builds Tailored Generative AI Curriculum in Collaboration With **Renowned Universities** and Technology Institutions for Deloitte Professionals and Clients

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As part of Deloitte's initiative to train up to 10,000 professionals across the U.S. and India in AI, Deloitte AI Academy expands its curriculum to include Generative AI training that both practitioners and clients can tap into

- Current program with **Deloitte** trained more than 100 employees.
- **DHS** AI training program - selected for full proposal submission.
- **NAVSEA** AI training program - contract negotiations for pilot curriculum at NSWC-DD in Dahlgren, Virginia.
- **DOT&E** has requested a proposal for similar program.



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