The Digital Trident AI Challenge is a mission-driven initiative at the Naval Postgraduate School that increases mission impact by leveraging cutting-edge NVIDIA technologies through a collaborative agreement. With support from industry partners, faculty–student teams develop AI solutions to address national security challenges.

Make Operational Application of AI for Automatic HEL Beam Control

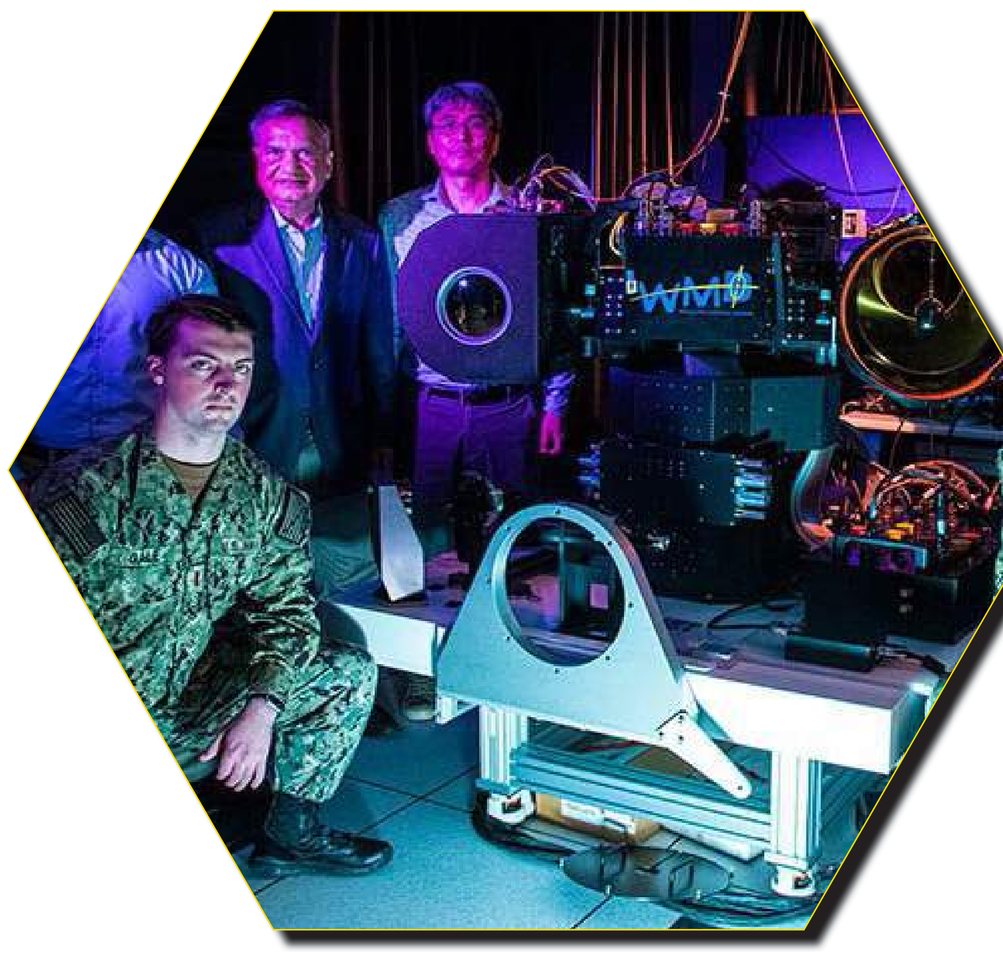
Key Operational Challenge Area: Command & Control (C2)

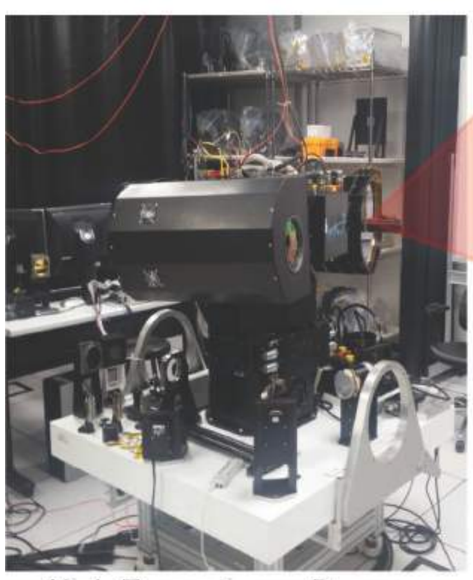
The Challenge

High-energy laser (HEL) systems require faster, more autonomous targeting to respond to emerging threats such as drone swarms. Current systems rely on manual identification and aimpoint selection, which can slow engagement time.

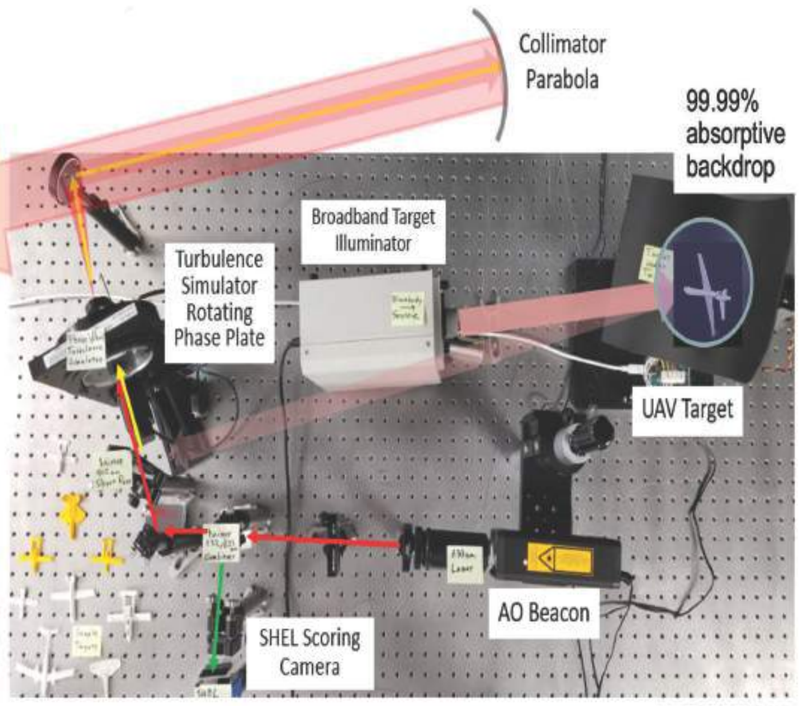
The Project

This project advances AI-enabled target detection, classification, and aimpoint selection to support autonomous HEL beam control. It builds on three years of research at NPS developing and testing AI models using the High Energy Beam Control Testbed. This phase aims to improve synthetic training data, compare performance on real versus synthetic inputs, and explore the use of unlabeled data for model training. AI models will be tested through simulation and hardware evaluation using NSWC Dahlgren datasets.





High Energy Laser Beam Control Research Testbed (HBCRT)



The Team

Distinguished Professor Brij Agrawal, MAE/SSAG (PI)
Dr. Leonardo Herrera, Faculty Associate, MAE
Jessica Herman, Professor of Practice, MAE
Gary Chern, Research Engineer, LMC
Eric Montag, Research Engineer, NSWC, Dahlgren
NPS Students: Space Engineering, Mechanical Engineering, Computer Science
NVIDIA

DELIVERING IMPACT

This effort supports the development of AI-enhanced targeting systems that increase responsiveness and accuracy of laser weapon platforms. With potential application to drone swarm defense and other fast-emerging threats, the project contributes to future integration of autonomous targeting into Navy HEL platforms.

Towards Ultra Long Endurance Flight Around the World

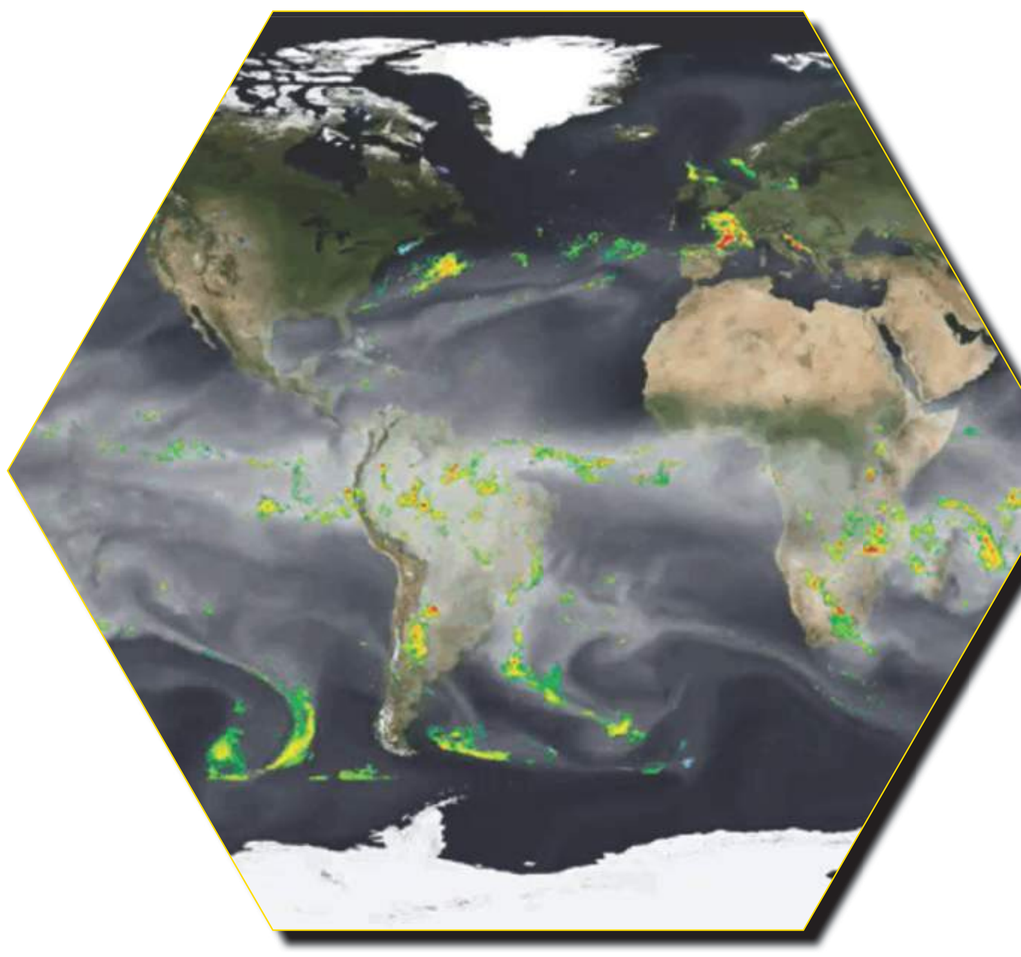
Key Operational Challenge Area: Robotic Autonomous Systems

The Challenge

Current UAV platforms face endurance limitations due to fuel constraints and limited onboard decision-making intelligence, hindering long-duration missions such as Arctic surveillance, ISR, and communications relay across vast or denied regions.

The Project

This effort enhances UAV range and autonomy through intelligent, energy-aware path planning. The team integrates high-fidelity digital twins with weather-aware optimal control using AI-driven methods. By leveraging NVIDIA platforms—including CorrDiff for generative weather downscaling, Omniverse for mission visualization, and Jetson for onboard inference—the project enables real-time fuel-optimal routing and adaptive guidance. Flight testing will utilize existing infrastructure and partners, including the Vanilla UAV and Vigilant Spirit GCS.



The Team

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Wenschel Lan, SSAG
U.S. Naval Research Laboratory
Platform Aerospace
Ideal Aerosmith
TrustPoint GPS
NVIDIA

DELIVERING IMPACT

The NVIDIA-accelerated digital twin and control framework is designed to improve endurance, adaptability and autonomy of UAVs operating in remote or denied environments. Validated through flight testing, this approach supports mission planning and platform development for future long-range operations.

Operationalizing AI with Microgrid Digital Twins for Energy Security

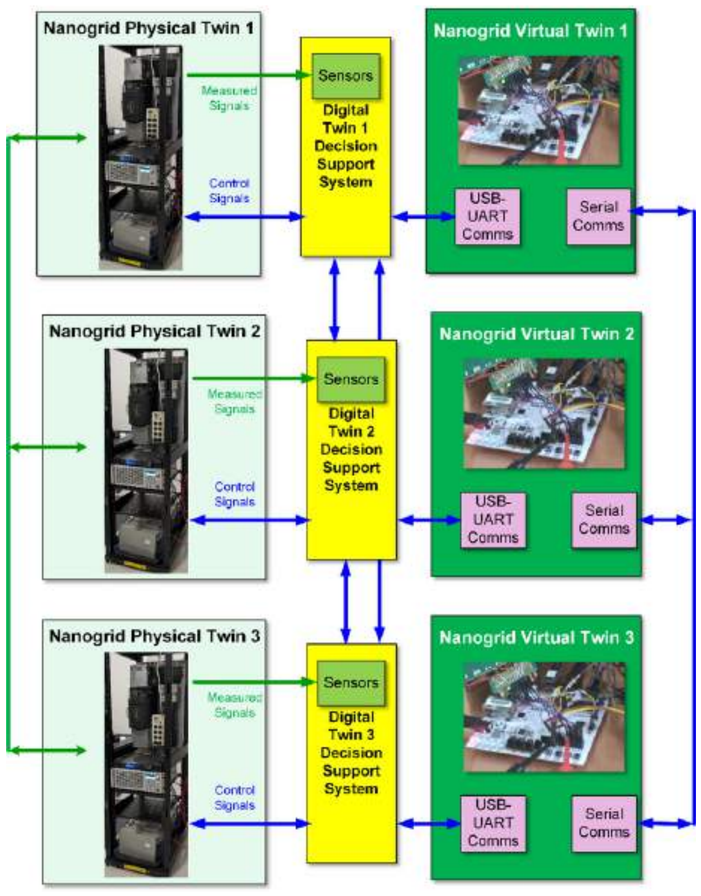
Key Operational Challenge Area: Contested Logistics

The Challenge

Military installations need resilient, autonomous power systems that can adapt in real time to emerging threats, particularly in contested environments.

The Project

This project will use an AI agent developed in the NVIDIA Omniverse environment and deployed on NVIDIA hardware to operate military microgrids. The system will anticipate threats and adjusts operations dynamically to maintain energy security. It builds on existing work from the Microgrid Innovations Research Center, including digital twins, hardware testbeds and non-intrusive load monitoring. After demonstration on the NPS microgrid testbeds, results will support transition of validated solutions to operational DOD sites.



The Team

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Co-PI: Dr. Giovanna Oriti, Electrical and Computer Engineering
Co-PI: Dr. Daniel Reich, Operations Research
Co-PI: Dr. Preetha Thulasiraman, Electrical and Computer Engineering
Co-PI: Dr. Ron Giachetti, Systems Engineering
Co-PI: Mr. Michael Davis, Energy Academic Group

Mr. Richard Alves, Electrical and Computer Engineering
Mr. Brandon Naylor, Energy Academic Group
Dr. Bill Anderson, Microgrid and Energy Resilience Senior Subject Matter Expert, NAVFAC EXWC

Students from Electrical & Computer Engineering, Systems Engineering, Operations Research and other departments

DELIVERING IMPACT

The AI-enhanced microgrid system increases operational resilience and mission assurance across naval infrastructure. With scalable applications at global installations, the project supports DOD energy security goals across INDOPACOM and other contested regions.

AI-Driven Seeker Autonomy and Omniverse-Integrated Digital Twin for Low-Cost Missile Development

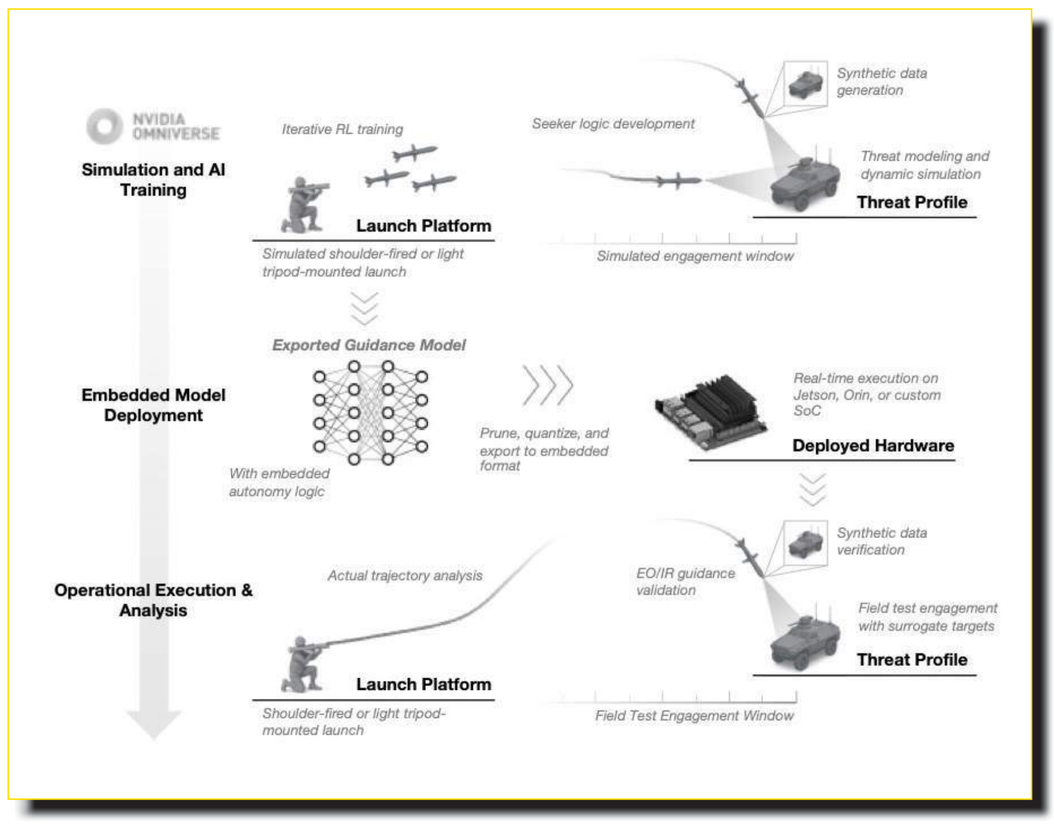
Key Operational Challenge Area: Low-Cost Attritable Platforms

The Challenge

The Marine Corps and Joint Force require autonomous, low-cost precision-guided munitions capable of operating in GPS- and communications denied environments.

The Project

This project develops an AI-enabled seeker system and digital twin environment to support autonomous missile operations in GPS- and communications-denied environments. Using NVIDIA Omniverse and Jetson-class hardware, it aims to create a complete autonomy pipeline—from synthetic data generation and reinforcement learning to embedded inference and field validation. The project builds on a flight-tested missile prototype developed at NPS and is transitioning toward operational use through a CRADA with Anduril Industries.



The Team

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1stLt Kyle Hicks, Computer Science Department
Mr. Alex Savattone, Faculty Associate Research, SSAG
Ms. Denise Jungling, Management and Program Analyst, SSAG
Anduril Industries
NVIDIA
Office of Naval Research
USMC Combat Development & Integration

DELIVERING IMPACT

The project aims to accelerate development of autonomous weapons systems and contribute to the design of affordable, scalable missile architectures that align with emerging operational requirements.

Small Scale AI for Aviation Maintenance

Key Operational Challenge Area:
Contested Logistics

The Challenge

Maintenance teams deployed in disconnected environments need diagnostic tools that do not rely on network access or cloud infrastructure.

The Project

This project develops a stand-alone, AI-powered maintenance assistant using NVIDIA Orin single-board computers. Using aircraft maintenance data from NAVAIR, the system will train embedded models to detect faults and suggest repairs in real time without relying on external connectivity or cloud infrastructure.

Collaborators

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LCDR William Norman, Student, DDM
LCDR Kate Hussey, Student, DDM
LCDR Patrick Glynn, Student, DDM
NAVAIR
NVIDIA

DELIVERING IMPACT

The project supports the development of AI-powered maintenance tools that function independently of cloud or network infrastructure. By enabling fault detection and repair recommendations in real time, it aims to increase mission readiness and resilience in forward-deployed and austere aviation environments.

Terahertz Imaging Camera for Upper Atmosphere Surveillance

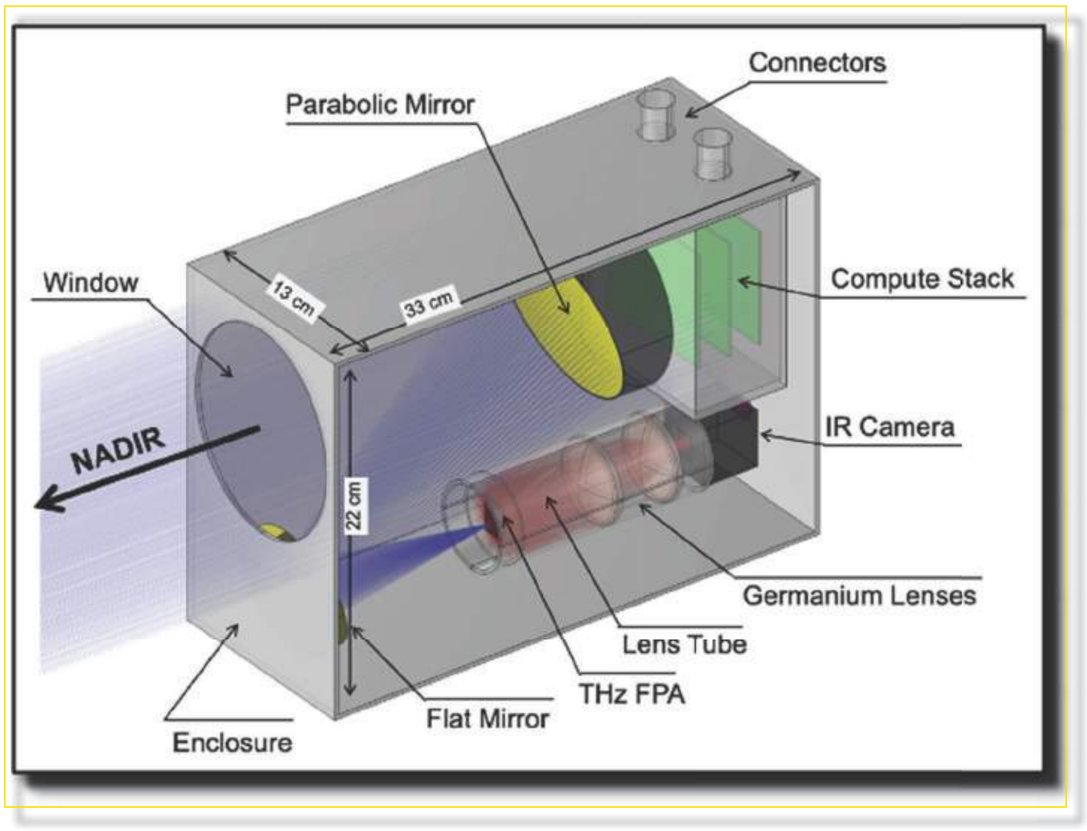
Key Operational Challenge Area: Space

The Challenge

Space-based instrumentation to perform atmospheric OI concentration measurements are scarce, extremely complex, and expensive (multimillion dollar efforts) and do not provide real-time global coverage These constraints can limit the efficiency of communications, long range radar detection, hypersonic activity awareness and consequently the decision-making speed.

The Project

This project supports development of a compact terahertz imaging camera (TIC) scheduled to fly aboard the International Space Station in 2027 as part of the DoD STP-H12 mission. In Phase 1, the team will develop the terahertz sensor and accessory electronics, test compatibility between the payload and the ISS and establish an initial concept of operations for commanding the camera and collecting image data. Later phases will test AI-based image processing and assess edge-based processing for space-based sensing missions.



The Team

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ENS Andrew Oleson, USN, MS Student, Space Operations
Zachary Robbins, Model Maker, Space Systems Academic Group
Daniel Moreno, Model Maker, Physics
James Horning, Faculty Associate Research, Space Systems Academic Group
Ronald Phelps, Faculty Associate Research, Space Systems Academic Group
DoD Space Experiment Review Board
Aegis Aerospace and The Aerospace Corporation via DoD Space Test Program

DELIVERING IMPACT

This effort will validate core system functionality and establish a concept of operations for deploying compact THz imaging sensors on orbit. Phase 1 results will inform feasibility of future onboard AI processing and help define pathways for integrating edge-enabled sensing into space-based ISR (Intelligence, Surveillance and Reconnaissance) missions.