Domain Awareness and On-Orbit Processing

RIVERSIDE RESEARCH

Deployment of massless payloads to partner satellites allows for rapid capability development and adaptability

Ground-based architectures are limited by throughput speed and capacity. Warfighters need information delivered at speed with agility to match mission imperatives and facilitate decisions.

This IRAD demonstrates our ability to work with partner satellite operators to deploy software and processing capabilities to on-orbit assets. On-board processing allows for immediate analysis of imagery with requisite follow-on activities to deliver information to warfighters within tactical timelines.
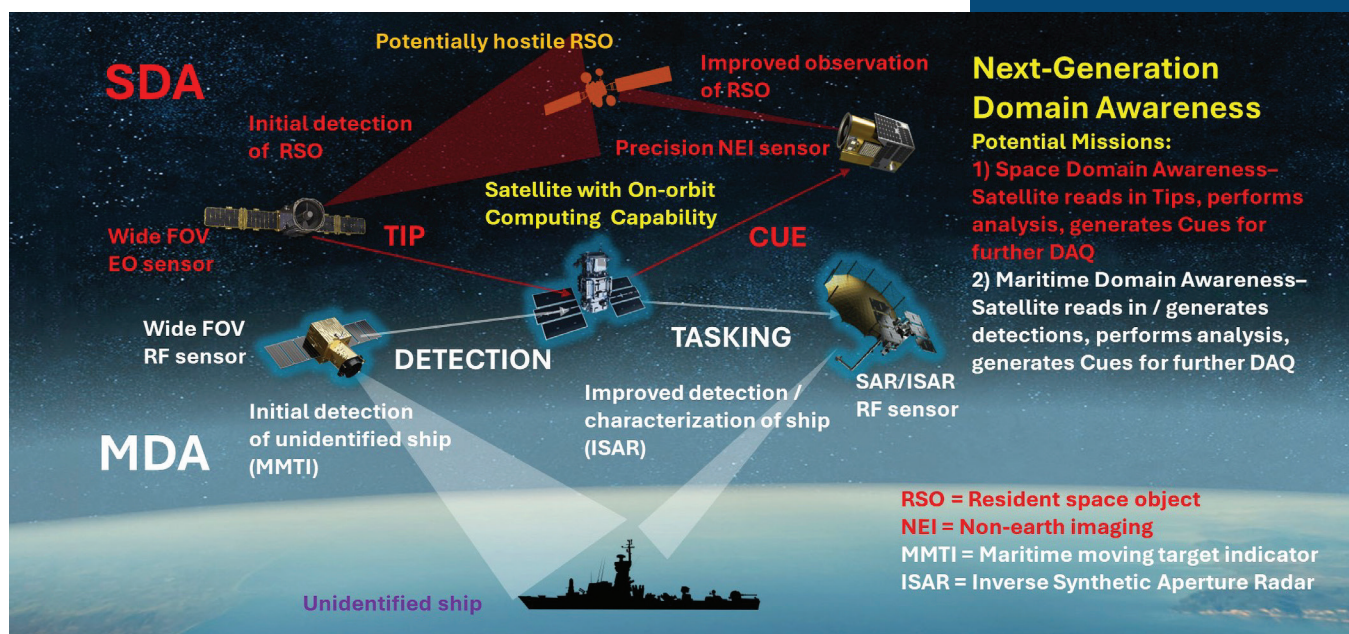
Observations

- Applications re-factored for on-board environments
- NVIDIA Jetson test server used for simulated environment and test deployments
- Integration with partner deployment pipelines to demonstrate delivery of massless payloads

Key Features

- Delivers containerized massless payloads, including analytics and algorithms

- Reduces latency by bypassing ground communications

- Eases deployment by using in-house system (NVIDIA Jetson) to match partner pipeline requirements

- Capable of Domain Awareness applications in both Space and Maritime environments

SDA

Potentially hostile RSO

Initial detection of RSO

Improved observation of RSO

Precision NEI sensor

Satellite with On-orbit Computing Capability

Wide FOV EO sensor

TIP

CUE

Wide FOV RF sensor

DETECTION

TASKING

Initial detection of unidentified ship (MMTI)

Improved detection / characterization of ship (ISAR)

SAR/ISAR RF sensor

MDA

Unidentified ship

Next-Generation Domain Awareness

Potential Missions:
1) Space Domain Awareness– Satellite reads in Tips, performs analysis, generates Cues for further DAQ
2) Maritime Domain Awareness– Satellite reads in / generates detections, performs analysis, generates Cues for further DAQ

RSO = Resident space object
NEI = Non-earth imaging
MMTI = Maritime moving target indicator
ISAR = Inverse Synthetic Aperture Radar

Domain Awareness and On-Orbit Processing

Riverside is exploring partnership opportunities with multiple satellite providers to take advantage of varying sensor suites, on-board processing systems, orbital regimes, and communications architectures to develop a comprehensive and extensible edge compute offering capable of operating in multiple domains.

Containerization is a key driver of success, as applications and algorithms must be purpose-built for resource constrained environments. Successful procurement of an NVIDIA Jetson developer kit allows for effective simulation of partner on-board compute environments.
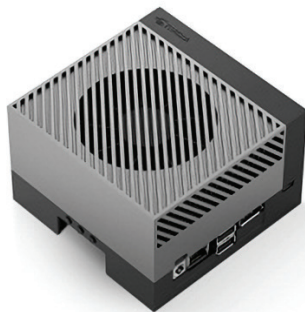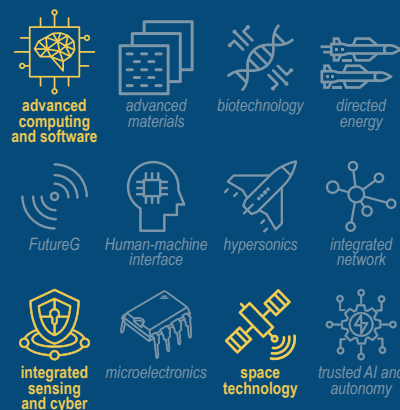

NVIDIA Jetson is deployed on partner satellites
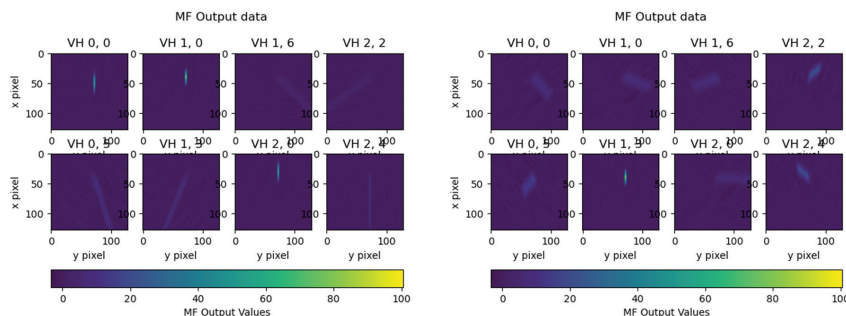
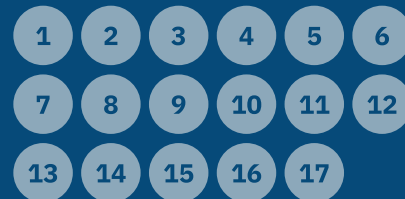**Processing example:** Matched-filter outputs for MDA target detection

Next Steps

This research is expected to continue through 2025 and 2026 to inform hybrid architecture solutions for integrating commercial data and derived insights into the Proliferated Warfighter Space Architecture for dissemination to tactical users at speed and scale.

RIVERSIDE RESEARCH

Critical Tech Areas

advanced computing and software

advanced materials

biotechnology

directed energy

FutureG

Human-machine interface

hypersonics

integrated network

integrated sensing and cyber

microelectronics

space technology

trusted AI and autonomy

DoD Priorities

1 2 3 4 5 6

7 8 9 10 11 12

13 14 15 16 17

1. Southwest Border Activities
2. Combating Transnational Criminal Organizations in the Western Hemisphere
3. Audit
4. Nuclear Modernization (including NC3)
5. Collaborative Combat Aircraft (CCAs)
6. Virginia-class Submarines
7. Executable Surface Ships
8. Homeland Missile Defense
9. One-Way Attack/Autonomous Systems
10. Counter-small UAS Initiatives
11. Priority Critical Cybersecurity
12. Munitions
13. Core Readiness, including full DRT funding
14. Munitions and Energetics Organic Industrial Bases
15. Executable INDOPACOM MILCON
16. Combatant Command support agency funding for INDOPACOM, NORTHCOM, SPACECOM, STRATCOM, CYBERCOM, and TRANSCOM
17. Medical Private-Sector Care