



U.S. Geological Survey – UAS for Research & Applied Science

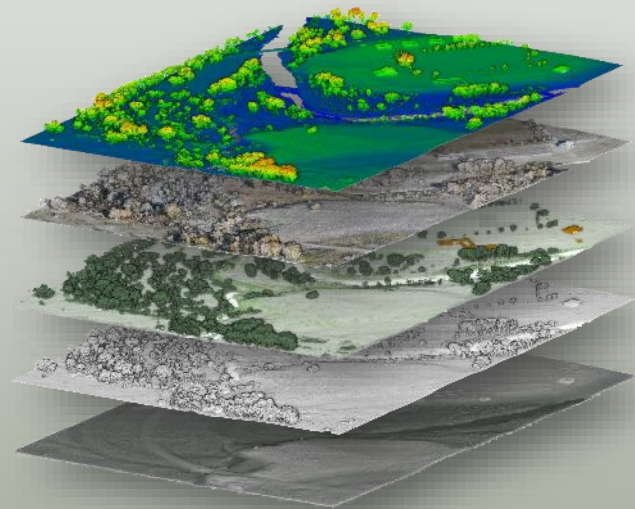
Matthew A. Burgess, Ph.D.

National Uncrewed Systems Office
U.S. Geological Survey
U.S. Department of the Interior

uas.usgs.gov

USGS_UAS  

November 2023



U.S. Department of the Interior



- Bureau of Indian Affairs (BIA)
- Bureau of Indian Education (BIE)
- Bureau of Land Management (BLM)
- Bureau of Ocean Energy Management (BOEM)
- Bureau of Reclamation (BOR)
- Bureau of Safety and Environmental Enforcement (BSEE)
- National Park Service (NPS)
- Office of Surface Mining Reclamation and Enforcement (OSMRE)
- U.S. Fish and Wildlife Service (USFWS)
- U.S. Geological Survey (USGS)



USGS National Uncrewed Systems Office - UxS Strategy

Mission Statement: *The USGS National Uncrewed Systems Office will lead the safe, efficient, cost-effective and leading-edge investigation of the potential uses for UxS technology in scientific research activities for the USGS and the Department of the Interior.*



Goal: *Implement UxS as a common tool for scientific research and operational activities.*

Objectives:

- ✓ UxS Operator Training and Qualifications
- ✓ Develop Data Processing Techniques & Best Practices
- ✓ Sensor Integration, Testing, and Approval
- ✓ Perform Proof-of-Concept Missions
- ✓ Sensor Calibration and Data Accuracy Assessments
- ✓ Data Archive Framework



U.S. Geological Survey – Current UAS Platforms



3DR Solo



Parrot ANAFI



BirdsEyeView
FireFLY 6 Pro



DJI Matrice
M600 Pro



DJI Mavic Pro

USGS UAS Inventory (Sept. 2023)

| | |
|----------------------------------|-----|
| DJI Matrice M600 Pro | 23 |
| BirdsEyeView FireFLY 6 Pro | 8 |
| 3DR Solo | 114 |
| DJI Mavic Pro | 27 |
| Parrot ANAFI..... | 23 |

Total UAS @ USGS 195



Moving Towards 'Blue' & NDAA-Compliant Platforms



Skydio X2D



Parrot ANAFI USA



Teal 2



Vantage
Robotics
Vesper



Wingtra WingtraOne GEN II



WISPR SkyScout



Watts
Innovations
Prism Sky

USGS UAS Inventory (Sept. 2023)

| | |
|----------------------------------|----|
| Skydio X2D..... | 2 |
| Parrot ANAFI USA..... | 1 |
| Teal 2..... | 1* |
| Vantage Robotics Vesper..... | 1* |
| Wingtra WingtraOne GEN II..... | 8 |
| WISPR SkyScout..... | 0* |
| Watts Innovations Prism Sky..... | 0* |



USGS UAS Sensor Integration – Lidar



YellowScan Surveyor



YellowScan Vx20-100



YellowScan Mapper



YellowScan Voyager



YellowScan Mapper +

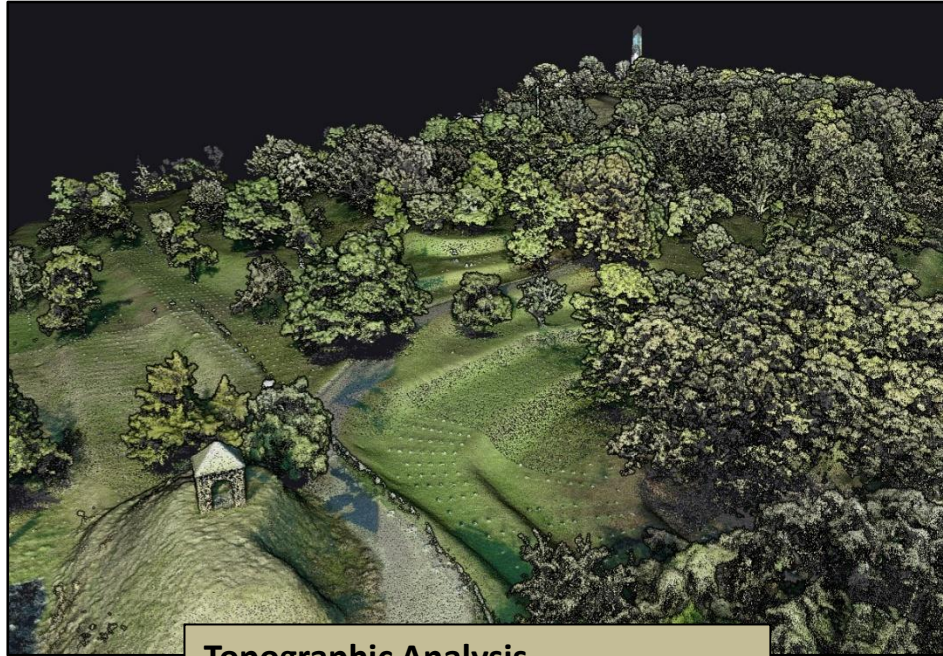
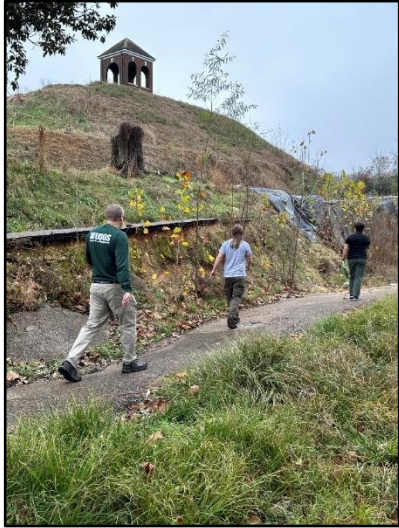


Lidar data is experimental test data for information purposes only

Imagery data is archived and publicly available

USGS – NPS Vicksburg Military Park

USGS/NPS – Vicksburg, Mississippi



Topographic Analysis

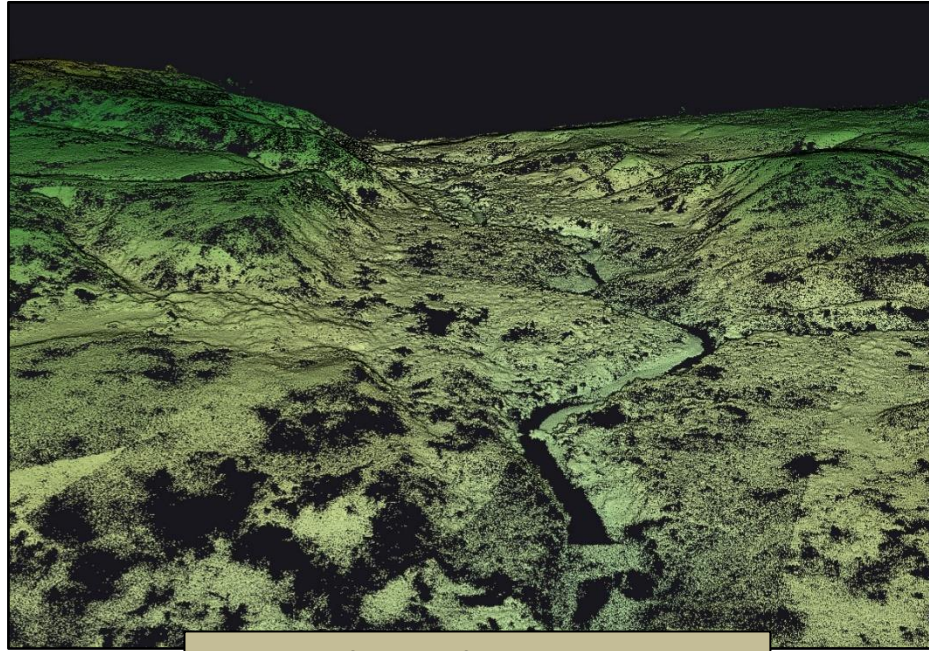
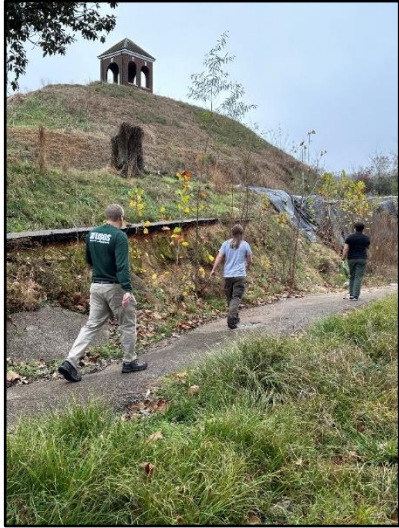
- Soil stability concerns following rain events in 2020
- YellowScan Mapper Lidar

Experimental test data for information purposes only



USGS – NPS Vicksburg Military Park

USGS/NPS – Vicksburg, Mississippi



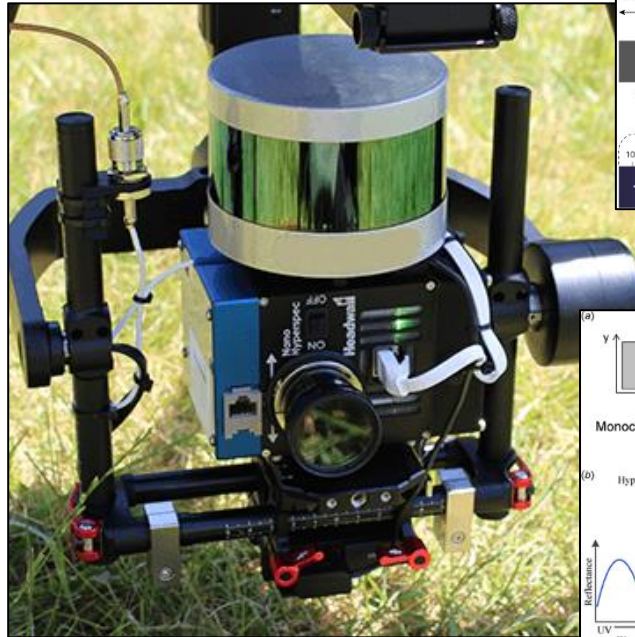
Topographic Analysis

- Soil stability concerns following rain events in 2020
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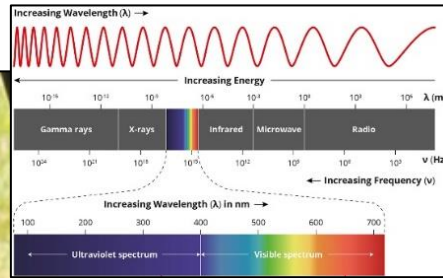
Experimental test data for information purposes only



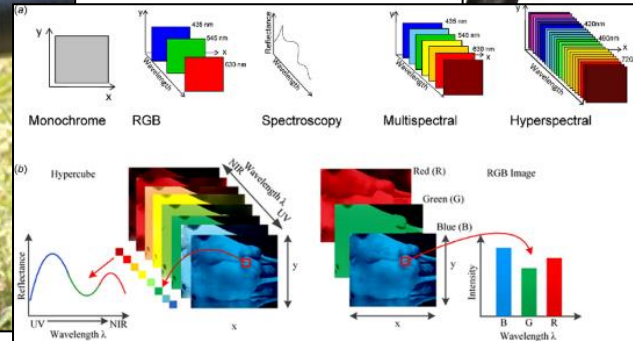
USGS UAS Sensor Integration – Hyperspectral



Headwall Nano Hyperspectral



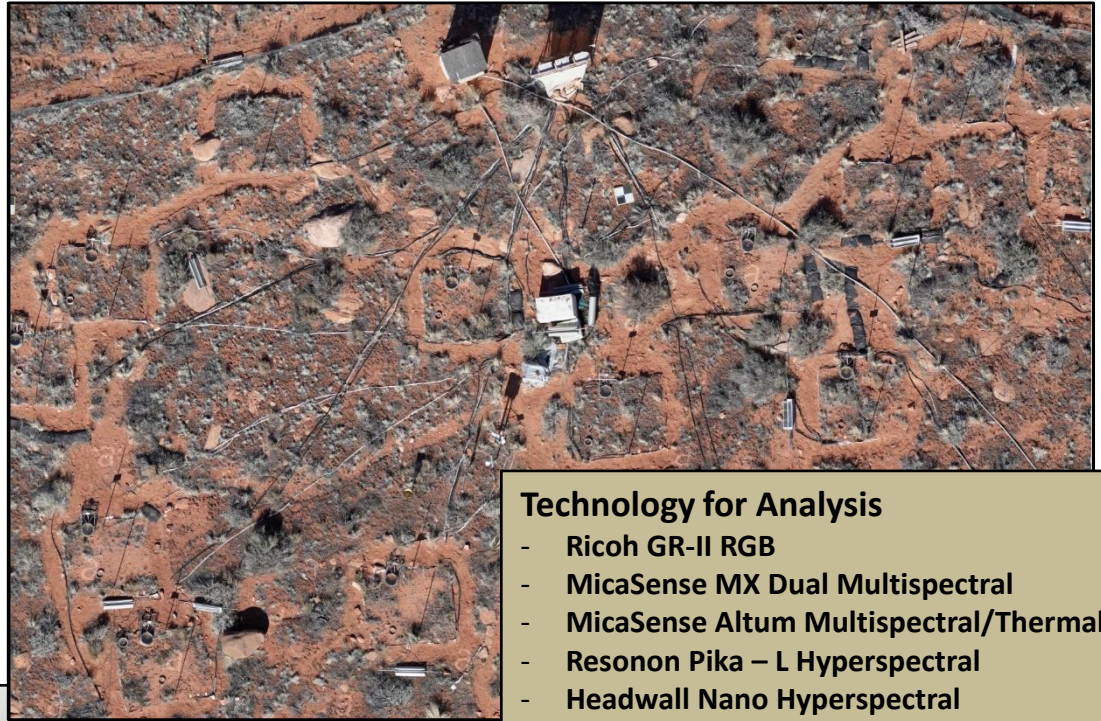
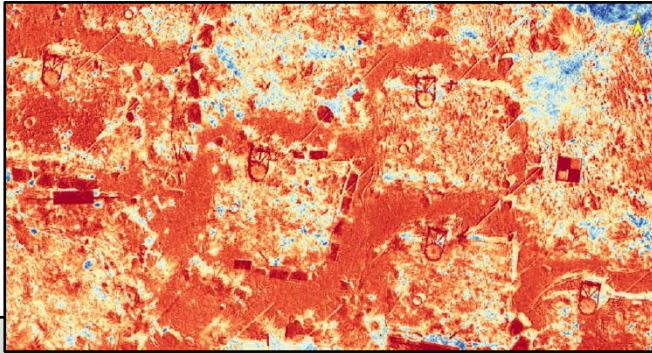
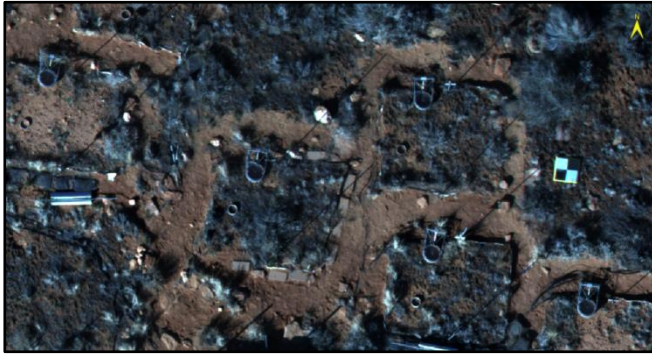
Resonon Pika-L Hyperspectral



Sensor integrations are presently still in development

U.S. Geological Survey – Moab Biocrust

USGS/University of Arizona – Moab, Utah



Technology for Analysis

- Ricoh GR-II RGB
- MicaSense MX Dual Multispectral
- MicaSense Altum Multispectral/Thermal
- Resonon Pika – L Hyperspectral
- Headwall Nano Hyperspectral
- Zenmuse XT2 RGB/Thermal

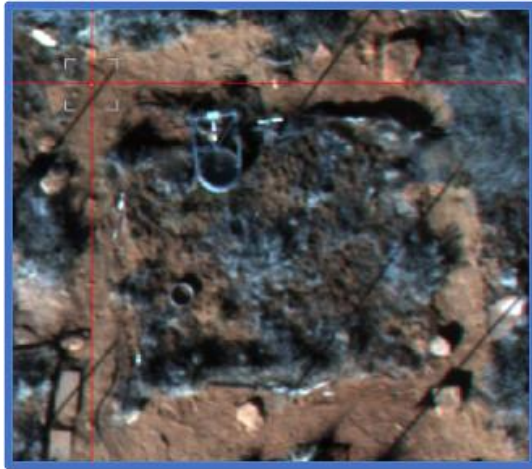
Experimental test data for information purposes only



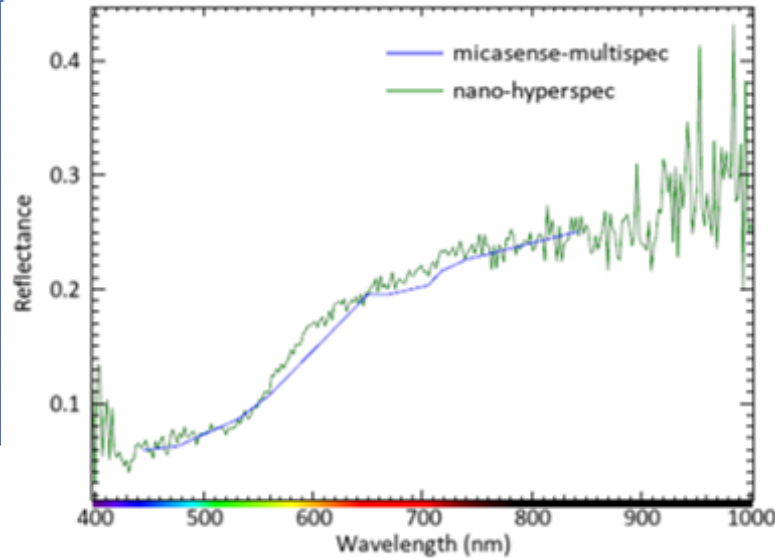
USGS
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U.S. Geological Survey – Moab Biocrust

USGS/University of Arizona – Moab, Utah



10-band MicaSense MX-Dual
Multispectral Image



274-band Headwall Nano
Hyperspectral Image

Comparing **multispectral** and **hyperspectral** reflectance profiles



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USGS – Gamma Ray Spectroscopy

USGS/DOE – Grand Junction, CO



Background

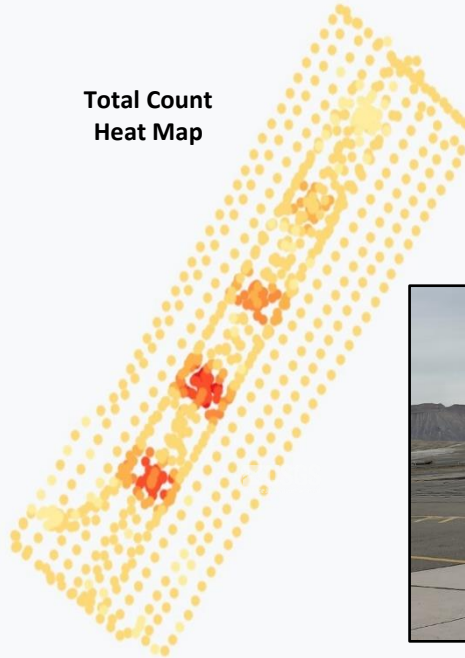
Potassium (K_{40})

Thorium (Th_{232})

Uranium (U_{238})

Mix ($K_{40}, Th_{232}, U_{238}$)

Total Count
Heat Map



Calibration Testing

- DOE Environmental Radiation Calibration Facility
- Medusa MS-350 (Potassium, Thorium, Uranium)
- ~2X Background Gamma Ray Exposure

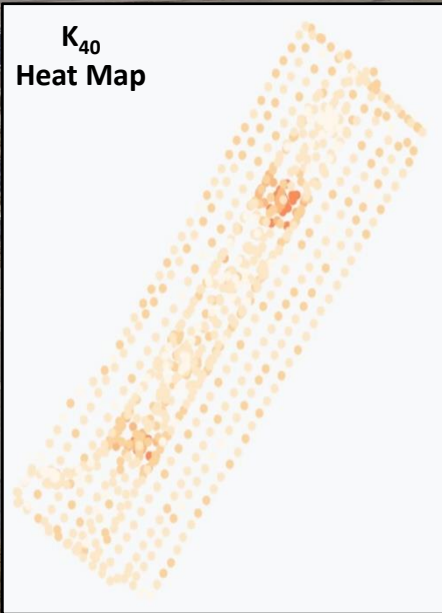
Experimental test data for information purposes only



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USGS – Gamma Ray Spectroscopy

USGS/DOE – Grand Junction, CO



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Experimental test data for information purposes only

USGS National Uncrewed Systems Office



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