Remote Sensing Systems for Finger Lakes Research

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RIT Airborne Remote Sensing Systems

- Rochester Institute of Technology (RIT)
- Digital Imaging and Remote Sensing Lab (DIRS)
- Laboratory for Imaging Algorithms and Systems (LIAS)
- Modular Imaging Spectrometer Instrument (MISI)
- Wildfire Airborne Sensor Program (WASP)
Colors of Light

- Humans can see in the **visible** region
  - These are mostly reflected photons from the Sun, Moon or lights.
- Some animals can see in the **near infrared (NIR)** region
  - This gives them improved contrast of prey against vegetation.
- Some sensors can “see” in the **long-wave infrared (LWIR)** region
  - This allows them to measure temperatures without touching it.
ASD FieldSpec

![Graph showing spectral reflectance of Grass, Brick, and asphalt roofing.](image)
Characteristics of Spectral data

solids
liquids
gasses
Imaging Spectrometer

- Oscillating scan mirror
- Telescope
- Aperture
- Diffraction grating
- Linear array
- Scan Track
- Ground track

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Modular Imaging Spectrometer Instrument

HSI Concept

MISI image spectral cube of Irondequoit Bay

Illustration of the HSI concept. Each material type may be identified by spectroscopic analysis.
Wildfire Airborne Sensor Program

**WASP Operational Methodology**

WASP captures a sequence of frames which form a mosaic in each of 3 IR bands and RGB.

- **RGB**
- **SWIR**
- **MWIR**
- **LWIR**

Imagery from each camera is spatially registered for multiband fire detection algorithms.

**Single Axis Gimbal**

Provides Wide Field of Regard.

**Gimbal Pivots About Line of Flight**

**Line of Flight**

- 1 mile @ nadir
- 4 mile swath @ 10kft

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4 Co-aligned Frame Cameras

Sensor Assembly

Cameras Mounted to Aircraft

- Vis
- SWIR
- LWIR
- MWIR

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First Flight

WASP Flight 1
14 July 2003
Greater Rochester Intl Airport
3,500 ft

Visible
0.18m Resolution
3,500 ft alt

Running engine

MWIR
1.1m Resolution
3,500 ft alt

Thermal “shadow”
Demonstrated Large Area Mapping
(Hi Res RGB) – Rochester NY

- RGB Band
- 2 flight lines, gimbal operating using 4 positions
- 10,000 ft AGL
- 120 Knots - area covered in about 20 minutes of flying
- 100 frames in the mosaic
- No ground control points used in assembling mosaic
- Mosaic assembly time: about 1 hour
- 0.5m GSD (at nadir)
Active Forest Fire in 4 Bands

LWIR

SWIR

MWIR

RGB
WASP Real-time Geo-spatial Information Products

Example of Data That Will be Available from WASP RT processor

Prescribed burn at Vinton Furnace Experimental Forest in Ohio
17 April 2004

Hot Fire
Burned Ground (Warm)
Conesus Lake
Confluence of Hudson and Indian Rivers (thermal imagery)

Pre-release

Post-release
Collaboration

- Test flights occur beginning of flight season
- Coincident Ground Truth and Field collections
- Understanding of subsurface phenomena
- Data Exchange
- Resource for Finger Lakes Research

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Conesus Lake
MISI and WASP Imagery