Marine & Environmental Optics Lab & Remote Sensing Center

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FIT Project Beginning July 2003 (Just Begun): 3 years Project

NASA Stennis Space Center Funded Project Total: $ 880,000

Principals:

-**Florida Tech** Component: Dr.. Bostater - **$440,000**
-**Kennedy Space Center** Component: $440,000.00
-**St. Johns Water Management District:**
NASA Stennis Grant Recipient
Pass Trough Grant to FIT & KSC

NASA Stennis Space Center - Sponsored Research Title:

Hyperspectral Remote Sensing Protocol Development-

Detection & Mapping of Submerged Land Features: Submerged Aquatic Vegetation

Project Objective: Demonstrate Operational Techniques for Active (Laser) & Passive (Satellite & Aircraft) Remote Sensing of Shallow Coastal Waters.

Goals:
- Demonstrate a Hyperspectral Remote Sensing Protocol for Use by State & Federal Agencies for Submerged Vegetation Detection.
- Apply the Demonstration to Aircraft Based Remote Sensing & Satellite Data.
- Transfer the Protocol to Florida Agencies & Kennedy Space Center Environmental Monitoring Programs.

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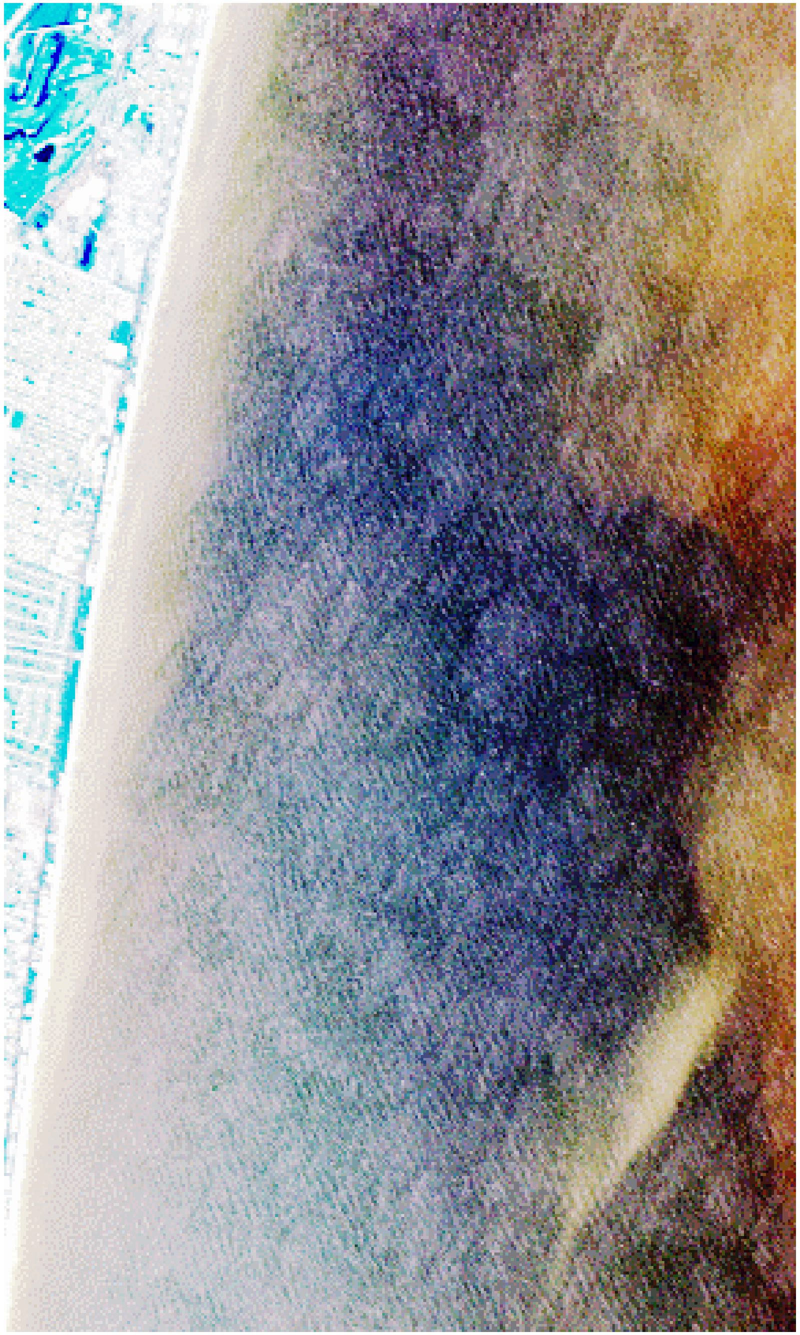
Previous Work: Example AVIRIS Airborne Hyperspectral U2 image of coastal water region near *Satellite Beach*, Florida. Remote sensing **derivative spectroscopy** algorithm applied to selected channels to enhance coastal water fronts (Right Image - Note Color Bands In Image from image area below.



Hyerspectral Sensor(s) - Aircraft Or Satellite Overflights & Subsequent Atmospheric Correction for Sensor Based ***Airborne Reflectance*** of Submerged Targets.
Note: Correct Imagery for Differences between Ground and Airborne Reflectance Signatures due to Sky , Bottom Type, Water Type, Depth.

-Coincident & Antecedent Ground Based Measurements & Radiaitve Transfer Modeling:
-***Reflectance Measurements*: *Bottom & Submerged Targets.***

- Synthetic Image Generation(s) of Bo***ttom Reflectance***,
- Synthetic Image Generation of Climatological Water Type & Depth .

Difference between Ground based Reflectance of targets and Airborne Measurements:

- Improve Atmospheric Corrections.
- Utilize Calibrated Reflectance Targets For Both Ground & Airborne Flights.

Goal : Eliminate ground & airborne reflectance differences for Application of Algorithms.

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Developing Scientifically Based Hyperspectral Remote Sensing Algorithms

APROACH:

Analytically Based Reflectance Modeling & Simulation Of Reflectance Signatures.

Goal: To Predict & Understand Ground Based Reflectance Signatures using:

- **Water constituents/chemistry**,
- Water **absorption signatures**,
- **Submerged Canopy Closure** ,
- **Bottom Reflectance signatures**.
- **Water Depth Imagery (DEM)**

APROACH

Spectroscopy of Reflectance Signatures of Derivative ground based canopy level reflectance signatures.

Goal: *Automated-Objective Selection of the Optimal Channels or Bands to utilize for –*

- *identification of targets,*
- *target chemical characteristic determinations,*
- *target dysfunctional detection. (e.g. plant stress detection).*

Apply Resulting Derivative Spectroscopy Algorithms to Hyperspectral Imagery:

- Software Based (With & Without Noise Effects),
- Hardware or Firmware Based (Silicon Strategies)

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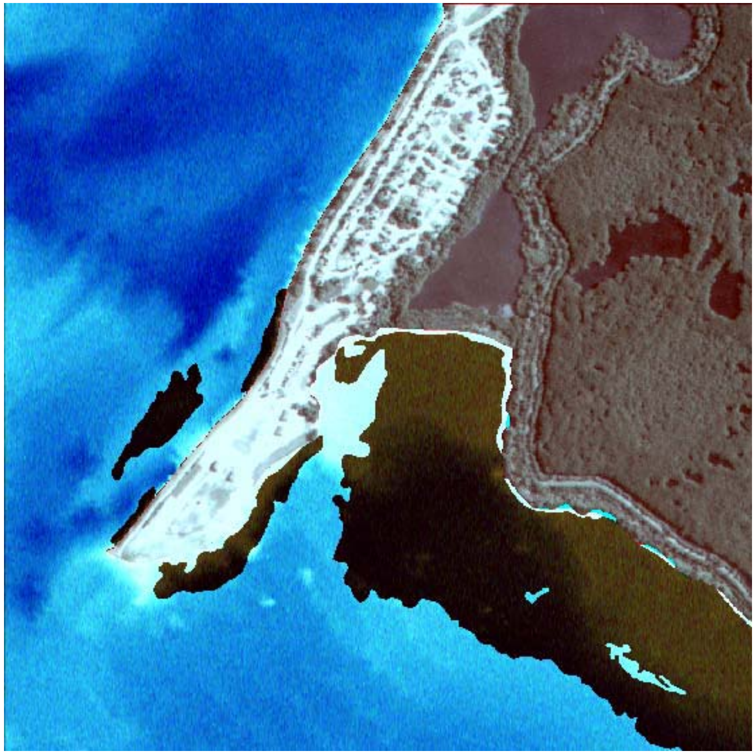
Synthetic Image of Optically Shallow Water Generated On the Beowulf Cluster at Florida Tech.

Applications: Environmental Monitoring & Detection by State & Federal Agencies,
Testing of Remote Sensing Surveillance Techniques, Algorithms & Remote Sensing Systems.
(Active & Passive (laser) systems).

The computer generated image using a *Hyperspectral Monte Carlo Radiative Transfer Model* (lower right) shows (detects) submerged targets: Target Type=Submerged Aquatic Vegetation, observed at 3 Wavelengths:RGB= 650nm,520nm,480nm.

Actual 1 meter pixel resolution aerial image from Sebastian Inlet area. Variable water depth and submerged grasses are observed.

Synthetic (Computer Generated) Image of the same area for testing remote sensing algorithms. This image is based upon Dr.. Bostater's Monte-Carlo Radiative Transfer Modeling Techniques. ≅40 hr Bluemarlin simulation time with ≅ 48 processors.



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