Today’s Talk:

- Provide a conceptual framework for G-LiHT
- Describe how the multi-sensor system evolved over time
- Identify projects important to TE program goals
- Discuss open-access data products and distribution
G-LiHT: Goddard’s Lidar, Hyperspectral, and Thermal airborne imager

G-LiHT is a portable, multi-sensor airborne imaging system that simultaneously maps the composition, structure, and function of terrestrial ecosystems using:

- **lidar** to provide 3D information about the spatial distribution of canopy elements;
- **VNIR and SWIR Imaging spectroscopy** to discern species composition and variations in biophysical variables (e.g., photosynthetic pigments);
- **thermal measurements** to delineate wetlands and detect heat and moisture stress in vegetation; and
- **stereo RGB photographs** to identify fine-scale (~3 cm) canopy features and provide context for coarser data.

**Co-registered, fine-scale** (<1 m) observations covering large areas and environmental gradients are used to understand tree-scale ecosystem interactions with atmosphere, hydrosphere and climate.

**Multi-temporal acquisitions** with high radiometric and geographic accuracy are key to scaling between ground-satellite observations, and understanding ecosystem responses to disturbances and global environmental change.

[https://gliht.gsfc.nasa.gov/](https://gliht.gsfc.nasa.gov/)

Loblolly pine plantation in lower coastal plan near Plymouth, NC
G-LiHT Instrument System has Evolved Since 2011

- Improved **spectral** range & resolution; radiometric accuracy
- Improved **spatial** accuracy & resolution
- Improved **instrument stability, design-life and redundancy**

<table>
<thead>
<tr>
<th>G-LiHT Version</th>
<th>v1.0</th>
<th>v1.5</th>
<th>v2.0</th>
<th>v2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years</td>
<td>2011-13</td>
<td>2014-16</td>
<td>2017-18</td>
<td>2019-Present</td>
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<tr>
<td>Platform(s)</td>
<td>Cessna 206 (wing pod) King Air UC-12B</td>
<td>Piper Cherokee Cessna 206 (interior port)</td>
<td>King Air A90 Cessna 206 (interior port)</td>
<td>King Air A90</td>
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<tr>
<td>GPS-INS</td>
<td>Oxford RT-4041</td>
<td>Applanix POS AV v6</td>
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<tr>
<td>Lidar(s)</td>
<td>Riegl VQ-480</td>
<td>2 @ Riegl VQ-480i</td>
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<tr>
<td>Headwall imaging spectrometer(s)</td>
<td>Hyperspec VNIR (A Series)</td>
<td>Micro-Hyperspec VNIR (E Series)</td>
<td>FIREFLY (red-edge for SIF)</td>
<td>SWIR</td>
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<tr>
<td>Solar irradiance spectrometer(s)</td>
<td>Ocean Optics USB-4000 VNIR</td>
<td>Ocean Optics FLAME VNIR</td>
<td>Ocean Optics QE-Pro red-edge</td>
<td>Spectral Evolution VSWIR</td>
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<td>Thermal camera</td>
<td>Xenics Gobi-384</td>
<td>Xenics Gobi-640-GigE</td>
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<td>Fine-res RGB camera</td>
<td>None</td>
<td>Nikon D7100</td>
<td>Phase One IXU-R 1000</td>
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<td>Calibration</td>
<td>NASA GLAMR (tunable laser) Pseudo-invariant cal sites &amp; tarps</td>
<td>NASA GLAMR (tunable laser) Labsphere HELIOS D-Series</td>
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</tbody>
</table>
G-LiHT TE Projects & Funding Partnerships

1) Regional forest carbon stocks in CONUS & Mexico (NASA CCS; ICESat)
2) Inventory of forest carbon stocks & ecosystem dynamics in interior Alaska (USFS FIA; NASA CMS, ABoVE)
3) Earlier detection of forest insect & disease outbreaks (USFS FHP; NASA FLARE)
4) Nutrient & land-use interactions in tropical forests (US-DOE NGEE-Tropics)
5) Coastal ecosystem dynamics and biogeochemistry (NASA NIP, NASA-USDA CCS)
6) Post-hurricane damage and recovery assessments in Puerto Rico and South FL (NASA TE, USDA NIFA, DOI, FEMA)
7) Cross-calibration of NASA Earth Observing Satellites (NASA-USGS; Landsat, EOS)
8) Modeling of LiDAR and Solar-Induced Fluorescence (SIF) signals from space (NASA FLARE; ICESat-2, ESA FLEX)
G-LiHT Data Products & Distribution

https://gliht.gsfc.nasa.gov
G-LiHT Open Access Data Server

L1 through L3 data products shared with the science community in **user friendly formats** that are accessible by **anonymous FTP** through G-LiHT’s **map-based interface**.

https://gliht.gsfc.nasa.gov
G-LiHT Fine-Res Stereo Images

1) View and download photographs as sequence of individually

https://glihtdata.gsfc.nasa.gov/puertorico/index.html
G-LiHT Fine-Res Stereo Images

2) View and download mosaicked images in ArcGIS

- Index and boundaries for all acquisitions
- Mosaic of all images

https://maps.nccs.nasa.gov/image02/rest/services/gliht/201703_PuertoRico_test/MapServer
For more information:

http://gliht.gsfc.nasa.gov

Poster Session I, Monday (9/23), 4-5 pm, Poster #25


Lawrence Corp, Bruce Cook, Douglas Morton, Temilola Fatoyinbo, Hank Margolis