Airborne Lidar and Remote Sensing Research
at the
Near Surface Observatory
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Program Overview

The airborne lidar and remote sensing component of the Near Surface Observatory (NSO) integrates airborne and near-surface geospatial technologies to support research across diverse environmental, geological, coastal, and hydrological applications. NSO researchers apply modern lidar, imaging, and remote sensing methods to characterize dynamic Earth surface processes, coastal change, geomorphic evolution, geohazards, and water-related phenomena.

Core Functions and Research Applications

NSO's airborne lidar and imaging work supports internal and external research communities, state and federal agencies, and interdisciplinary scientific teams. Key program capabilities include:

- High-resolution topographic and bathymetric mapping for coastal, fluvial, terrestrial, and cryospheric landscapes.
- Geologic hazard assessment (e.g., sinkholes, subsidence, faulting).
- Coastal change analysis related to storms, hurricanes, shoreline, dune and beach evolution and volumetric calculation.
- Environmental characterization – vegetation structure, wetlands status, shallow water morphology.
- Sea ice assessment and validation of satellite elevation products (e.g., NASA's ICESat-2).

NSO operates advanced airborne survey platforms that collect research-grade topographic and bathymetric data, coupled with multi-band aerial imagery for 3-D mapping and analysis. Current systems owned and operated by the group include the following:

- **Leica Chiroptera 5** – newest airborne lidar system, purchased in 2023. Chiroptera simultaneously records three-dimensional surface information with two laser wavelengths (515 nm and 1064 nm). The high-resolution onboard camera supplements the lidar datasets with 4-band imaging capability. Typical applications indlude the following:
  - Topographic and bathymetric applications
  - Environmental habitat monitoring
  - Flood risk and disaster management
  - Renewable energy and resource planning.

- **Drone Boat (USV)** – Unmanned Surface Vehicle. The USV can determine water depths from about 60 cm to 50 m using a dual-beam echosounder. Common applications include the following:
  - Hydrographic mapping of shallow water bodies (e.g., rivers, lakes, and sinkholes)
  - Verification and calibration of conventional and remote sensing depth measurements.

- **Aurelia X4 (UAV)**– Unmanned Aerial Vehicle (drone) system. This drone carries loads up to 3.3 lb with 30 to 40-minute flight times in winds up to 18 knots. Advanced digital photogrammetry enables generation of accurate terrain models in smaller survey locations that can't be practically flown with airborne lidar. The Aurelia drone can be equipped with a FLIR (thermal) or a high-resolution natural color camera.
  - More information is available here.