I. Problem Statement

The DoD relies on strategic coastal sites for training and testing. To sustain these activities, they must comply with environmental regulations requiring monitoring and mitigation impacts on these sensitive ecosystems. Traditional, boots-on-the-ground methods of assessing environmental impacts are limited in scope and cost.

II. Objectives

Objective: To use integrated aerial remote sensing technologies to meet the DoD’s monitoring and management challenges over broad areas, at high resolutions, and with reasonable costs.

This work will:
• Develop high-resolution land-to-sea digital elevation maps (DEMs) and shallow water benthic habitat maps for two sites using aerial LiDAR and hyperspectral data
• Illustrate use of these products to assess military training impacts (or lack thereof) in coastal areas.

III. Technology / Methodology

Primary technologies to be demonstrated:
1) The SIO Modular Aerial Remote Sensing System (MASS), which includes hyperspectral and bathymetric/topographic LiDAR imaging systems.
2) The Coastal Waters Spectral Toolkit (CWST), a hyperspectral data processing methodology for benthic habitat classification in development at NRL.

IV. Field Data Collection: San Clemente Island

Aerial Data Collection


Underwater Ground Reference Data Collection


V. Field Data Collection: Marine Corps Base Hawaii

Aerial Remote Sensing and Underwater Ground Reference Data Collection

April 2018.

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VI. Results

Digital Elevation Model (DEM)

Figure 9. Lidar data are used to make a digital elevation model (DEM) of each demonstration site. Image shows a land-to-sea DEM of NOTS Pier area at San Clement Island.

Benthic Habitat Map

Benthic habitat maps are made using NRL’s Coastal Water Spectral Toolkit (CWST). The CWST:
• Generates a database of all probable combinations of bottom reflectance spectra (determined by benthic cover, water depth, and water column optical properties) using a radiative transfer model.
• Matches remotely-sensed pixel spectra with a library of in-situ habitat spectra to make its classification.

VII. Data uses for DoD environmental managers

• Primary need of DoD environmental managers: “knowing what is there”
• Direct training away from protected habitats/species
• Identify appropriate sites for compensatory environmental mitigation (e.g. MCBH is growing corals as compensatory mitigation, and also using their 500yd buffer zone to help re-establish native oysters in Kaneho Bay).• Monitor shoreline erosion (related to training, recreation, sea level rise)
• Monitor impacts of amphibious vehicles on shoreline...