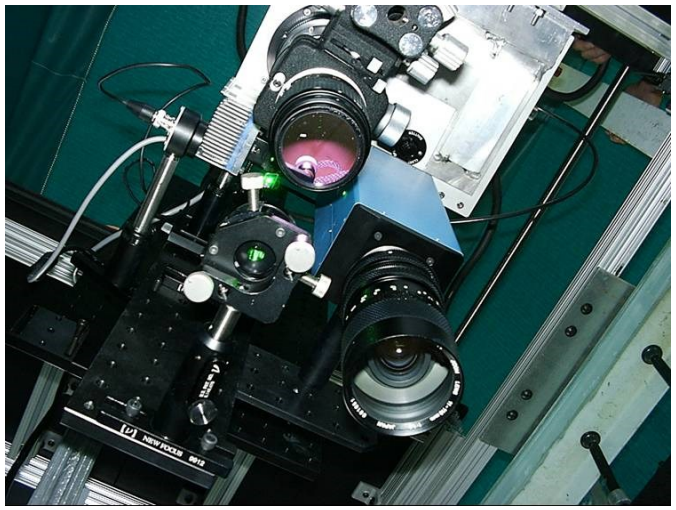
Florida Institute of Technology

Towards Airborne and *In-Situ* Pulsed Laser Imaging - LIDAR

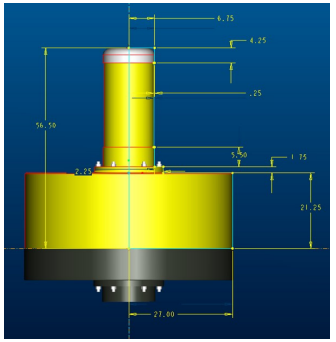
The Ocean Engineering outdoor wave tank with a push-broom sensor motion system. Sides and bottom of the tank are covered with diffuse reflectance panels. The instrument motion carts translate on the top of the wave channel.

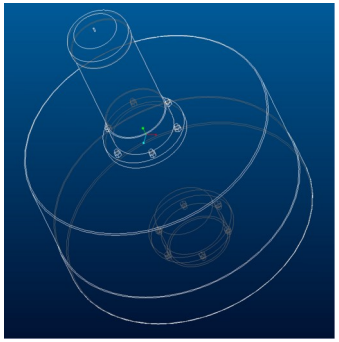
The two images on the right show a line target in contrast with the same target submerged in 1.5m clear natural sweater in the Abaco Sea, Bahamas. Note the distortion of the waves under the influence of small capillary and gravity waves, demonstrating the motivation to study the capability to conduct short pulse laser fan-beam laser imaging (LIDAR) to image shallow water targets.



The above shows a pulse laser, ultra-high speed, low light level, high QE digital CCD camera and a streak tube imaging camera used on the camera motion control system, shown below.

Shallow Water Hyperspectral Optical Buoy for Real Time Observations of Water Quality Constituents



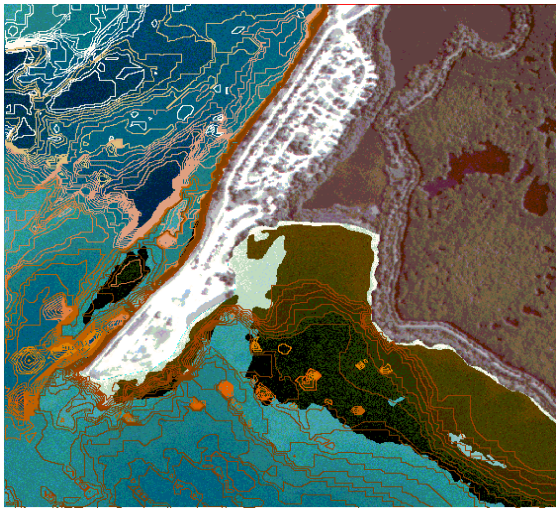


This coastal shallow water observation system utilizes a patented scalable “non-contact” backscatter probe to measure the backscattered optical signal. This signal is related to chemicals suspended in the water column. The optical system can utilize passive or active remote sensing technology, such as solid state spectrographs, pulse laser systems and Raman optical spectrographs. Data is sent to a laboratory via wireless internet connections and post-processed utilizing higher order derivative spectroscopy algorithms.

Florida Institute of Technology

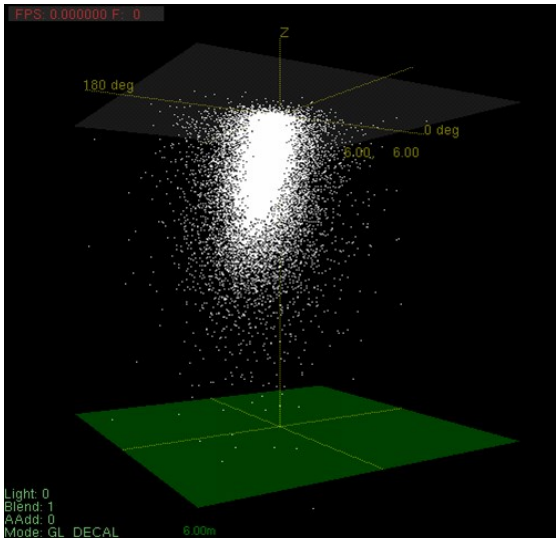
Environmental Optics Laboratory and Remote Sensing Center

The first laboratory was established in the fall of 1992 at ***Florida Institute of Technology,*** College of Engineering. We began with the support of the Office of Sponsored Research, when we renovated the Environmental Sciences Lab to develop this new research, education and industrial/commercial focus. Today we have several laboratories on the campus as well as off campus locations to support our research, education and industrial/commercial partnerships. To date we have consulted and provided services to defense contractors, NASA Centers, and NASA contractors, Department of Energy (DOE) and subcontractors, the State of Florida water management agencies, the Department of State and foreign institutions and organizations.



The Remote Sensing Center also began in 1992 when we began our research in hyperspectral data collection and the analysis of AVHRR, Landsat TM and SPOT imagery of the Indian River Lagoon and The Space Coast Region of Central Florida. Our mission statement or purpose of the center has been to educate as well as conduct research and applications of remote sensing in water and land in the subtropical waters of Florida.

More recently we have extended our activities into airborne hyper spectral data collection and analysis as well as data collection protocol analysis. We have also conducted research and instrument design and applications in laser imaging of the water surface and shallow water bottom types. These activities within the center and the lab have resulted in the development of computer models based upon analytical solutions to sets of differential equations and iterative solutions to radiative transfer of light in homogeneous and layer environmental media (water, vegetation, and atmosphere). We have also developed state of the art analytical and Monte Carlo (MC) models of the radiative transfer processes or "hydrologic optics" for passive and active "***synthetic image generation of the water surface***" based upon the scientifically based image chain approach (see image of the MC model photon output below). In essence we simulate the images of the water surface as affected by water quality, different bottom types as well as by water surface waves (see image on the left).



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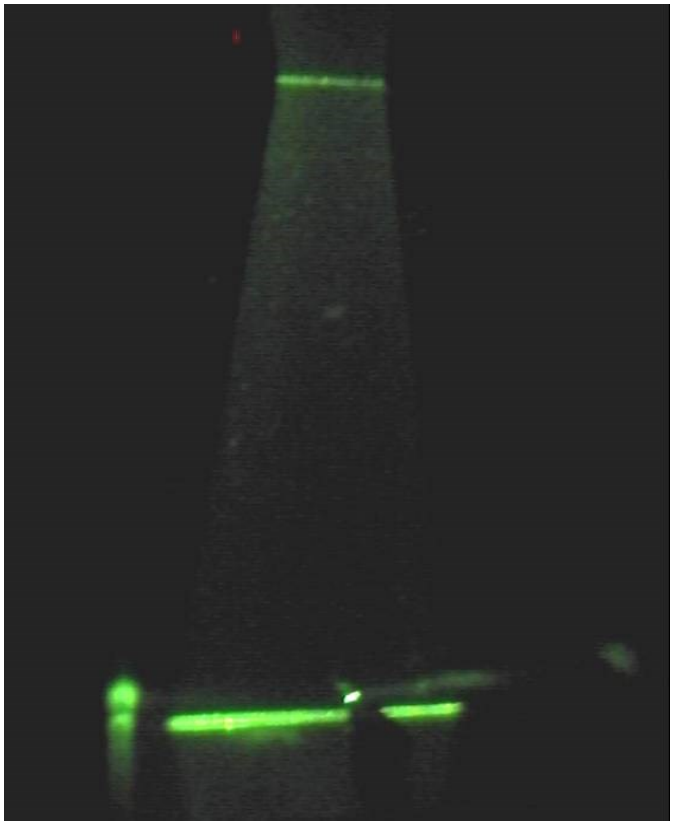
Developing & Testing a Push broom Camera Motion Control System: Using a LIDAR Based Streak Tube Camera for Measuring the Influence of Water Waves on Underwater Light Structure and Detection



An image from an ultra-fast low light level CCD camera of a pulsed laser fan beam entering the water column at the water surface and falling on the bottom. There is an object that interferes with the fan beam at bottom.