MinOOE (Mini-Optical Ocean Experiment)

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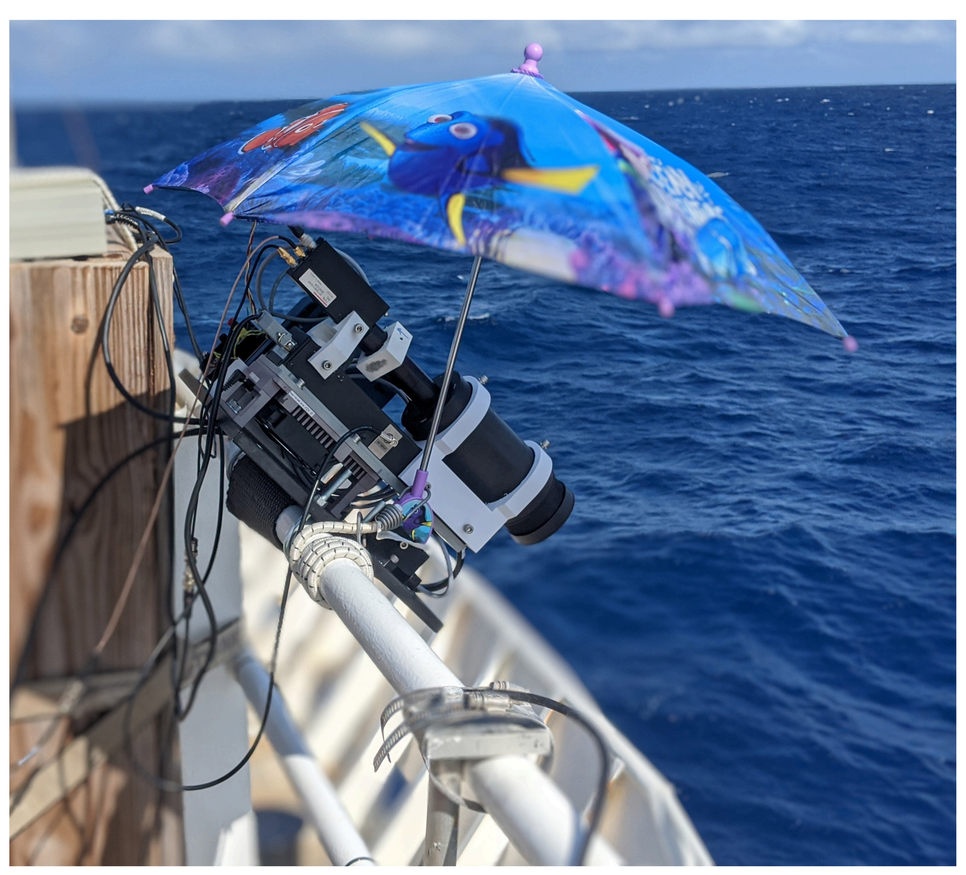
Introduction

Polarized backscatter LiDAR has been used extensively in ocean research for profiling turbidity, plankton layers, algae blooms, fish schools, and even garbage. Using polarization sensitive detection is useful to distinguish spherical scatters such as particulates from depolarizing scatters such as crystalline planktons

NOAA's FLOE (Fish Lidar Oceanic Experiment) is a 75 kg green polarized LiDAR that has been deployed extensively on various aircraft since 1999. It has the advantage of covering large areas of ocean for a low cost using small aircraft.

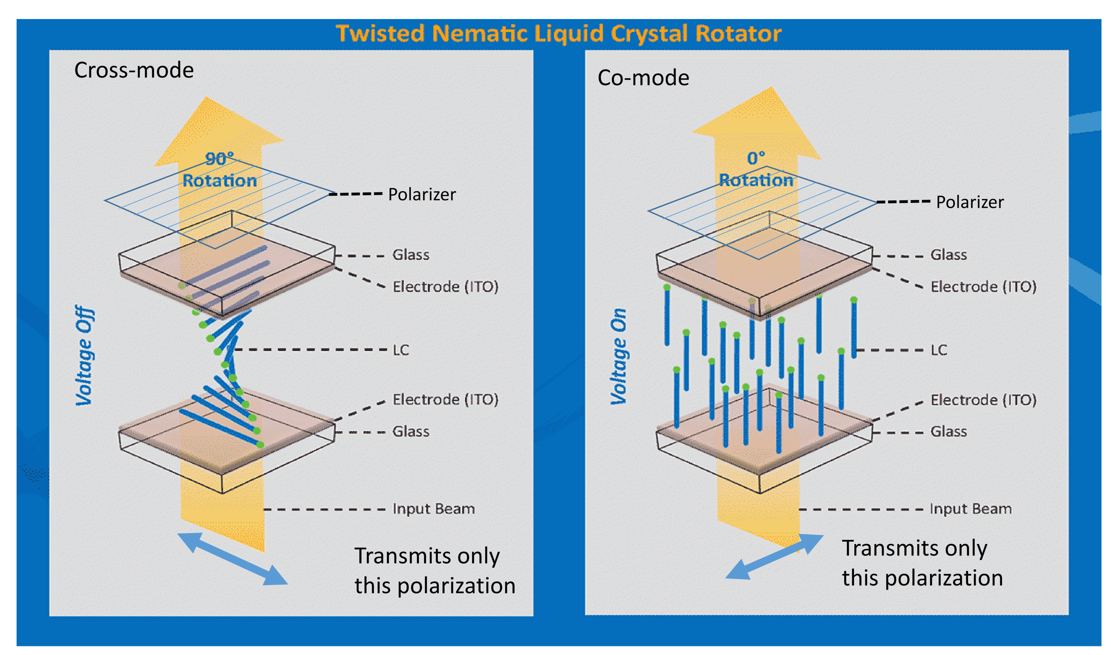
Here we present a small demonstration version for ship-based deployment using a low-energy high rep-rate laser and a small single telescope. Many of mounting and assembly parts are 3D printed, which allows for light weight and rapid development.



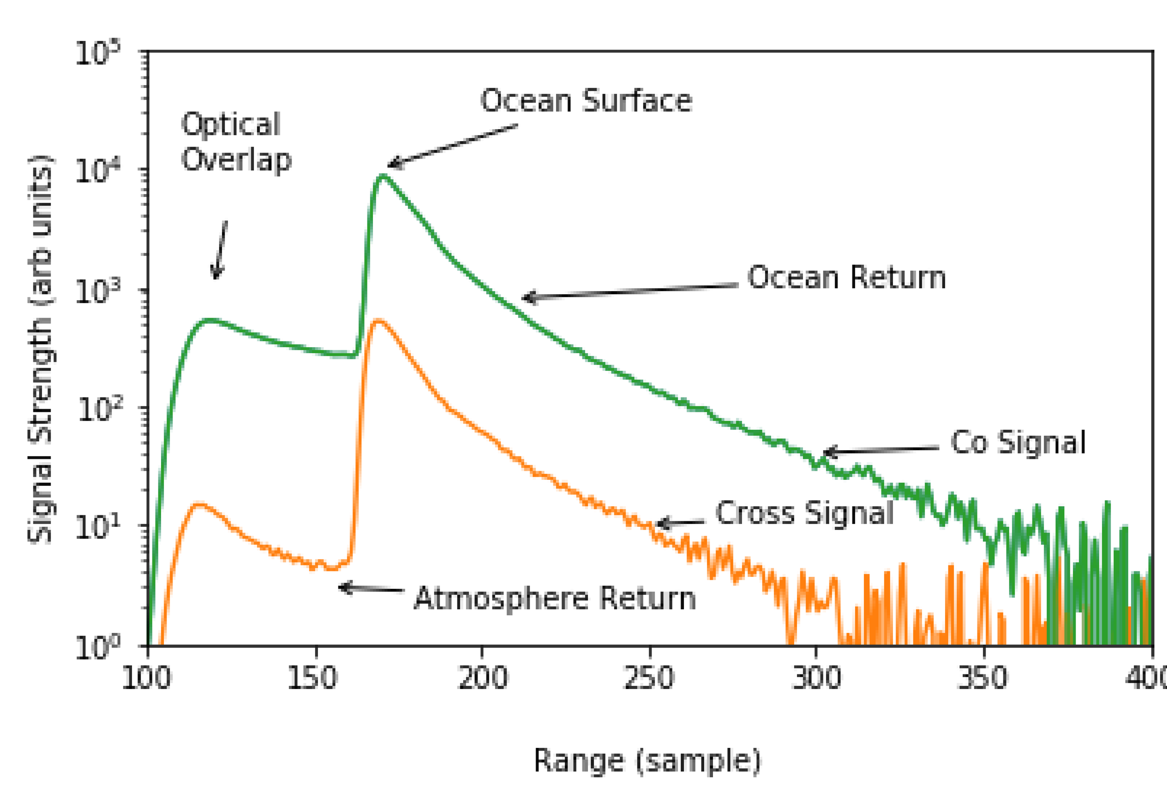
Lidar parameter	Specification
Wavelength (nm)	532
Average power (mW)	11.4
Pulse Energy (μJ)	22.8
Pulse Length (ns)	10
Range resolution (m) Air/water	.15/.11
Pulse repetition rate (Hz)	500
Maximum Range (m) Air/water	1500/50
Bit Depth	14
Sampling Rate (MHz)	1000
Telescope diameter (mm)	75
Mass (kg)	17

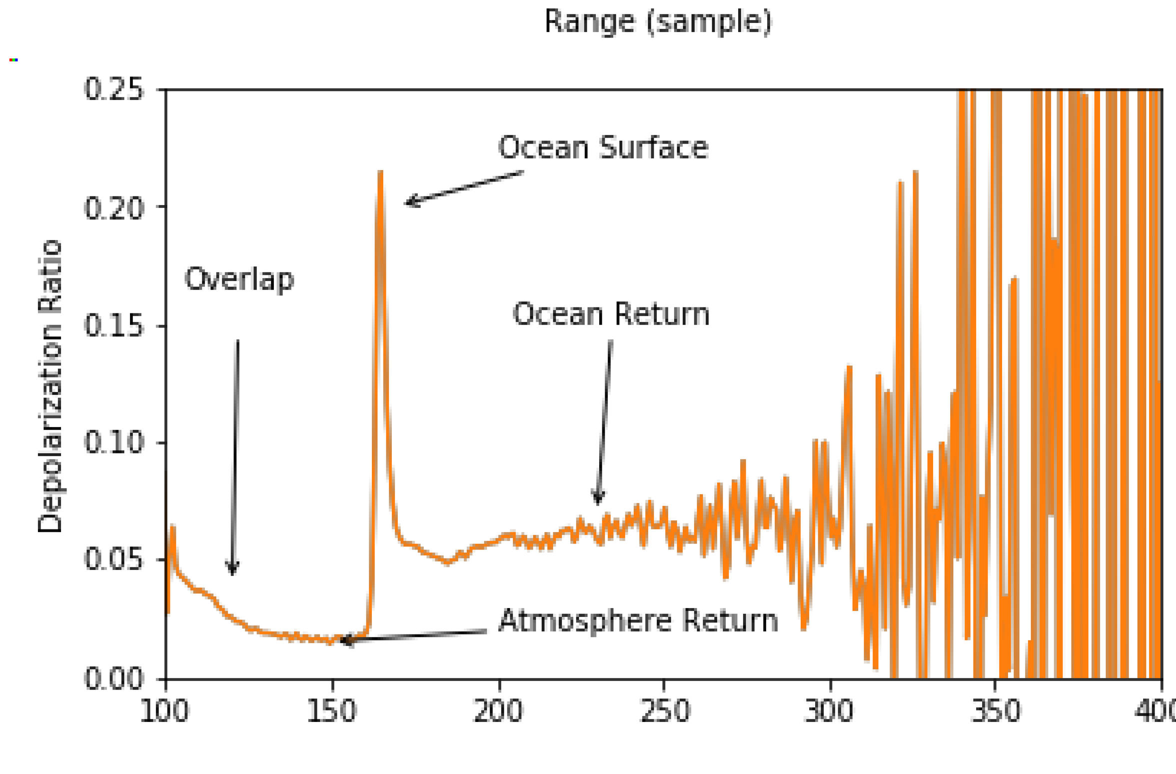
Single-Channel Dual-Polarization

Using a twisted nematic liquid crystal (LC) and a single polarizer, polarized laser light is transmitted by the laser. Scattered light that is depolarized into the orthogonal polarization of the laser will be aligned to the polarizer when the LC is energized (Cross-mode). When the LC is not energized, the light scattered that maintained the original polarization is aligned with polarizer and detected (Co-mode).

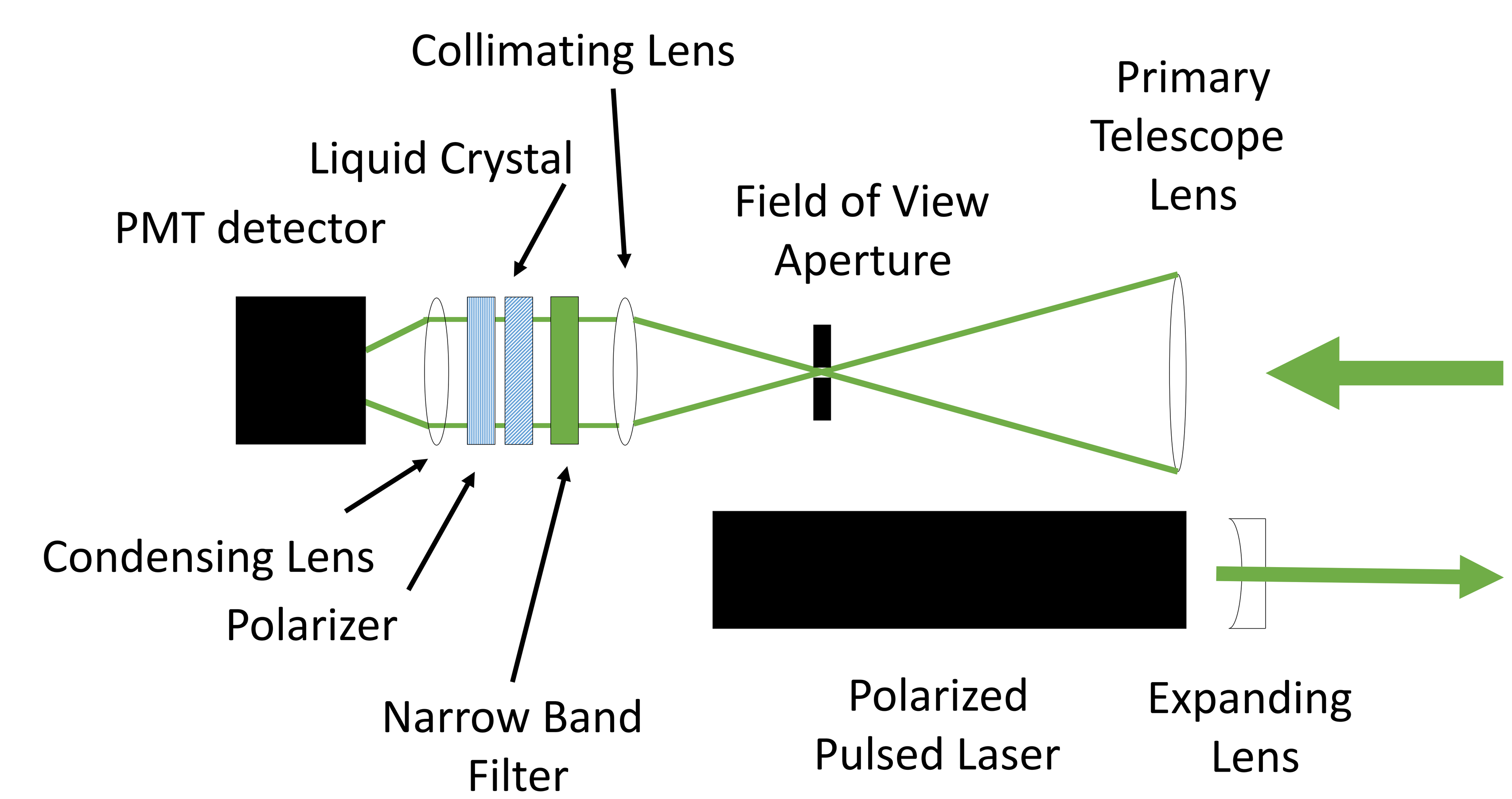


Return Signals (500 shot avg)





Lidar Transceiver Schematic



What's Next?

- **Calibrate LiDAR using a calibrated hard target .**
- **Use ship attitude data to extract ocean wave spectra and compare to wave buoys.**
- **Look at overlap corrected atmospheric return, using ship motion as a way to create height profiles.**
- **Compare 8 bit digitizer to 14 bit digitizer in Performance.**

References

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