Drone-based Oceanographic Instrument

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Emperor
disCoverTheDepths

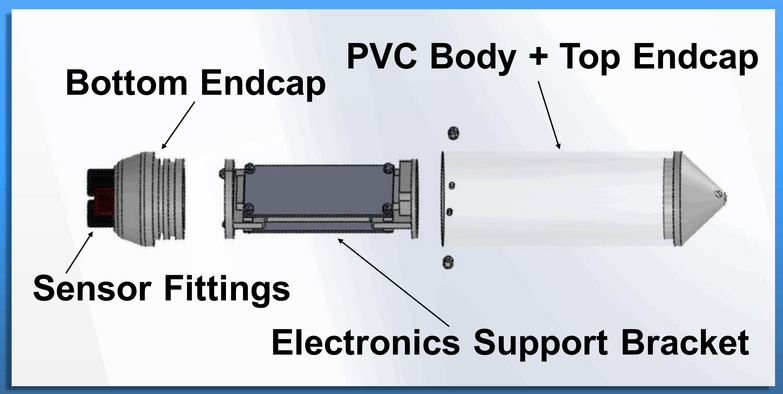
Background

Emperor is a drone-based oceanographic instrument used to measure conductivity, temperature, and depth in the upper regions of the coastal ocean. These three measurements are crucial in oceanographic research, where the instrument measuring these properties is called a CTD. The problem with a conventional CTD is that the equipment is very costly and needs to be deployed from a boat, making it very time-consuming. Emperor aims to solve these problems. Emperor is a miniature oceanographic instrument that can take measurements comparable to conventional CTDs, at a fraction of the cost, and is attachable to drones.

Overview

Emperor is self-contained such that all transducers, battery, electronics, and other components are encased in a small, seawater-proof housing. Sensor fittings expose sensing elements to the environment while keeping signal processing circuitry safe inside the housing. This instrument costs $200 to manufacture, which is significantly more affordable than any conventional CTD. Emperor proves that drone-based oceanographic instruments can be effective and functional.

Exploded View



Final Design

- First CTD attachable to drones
- Low deployment time [15 minutes (down from hours)]
- Low fabrication cost [$200 (down from thousands)]

- Profiles down water column 30 meters deep
- Real-time data logging
- Water-proof and corrosion-resistant housing
- Future upgrades available

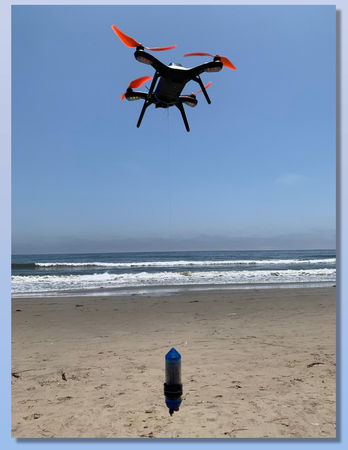
Key Components

Enclosure
- Seawater-proof to at least 40 meters
- SLA 3d-printed custom parts
- Aerodynamically designed

Electronics
- Data storage to a 8Gb micro sd card
- Magnetic on-off switch
- 2.5 hours battery life
- 10 Hz sampling rate

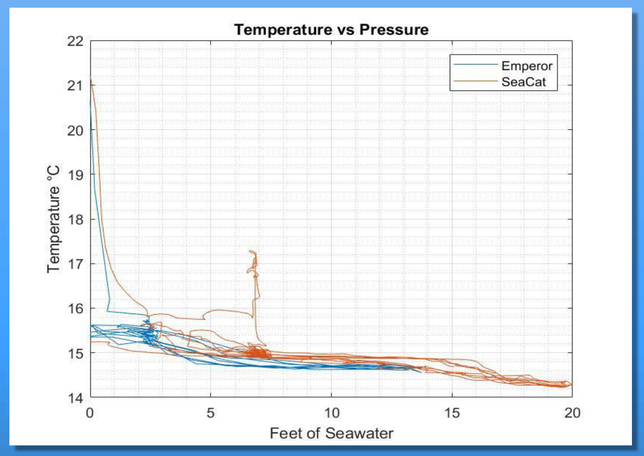
Sensors
- NTC thermistor reads temperatures accurately between 8 °C and 40 °C
- Piezoresistive pressure transducer accurately measures pressure between 0 and 30 meters of depth

Sample Collecting



- Flight testing Emperor with a drone (left)
- Ocean profiling with Emperor alongside a $20,000 CTD, the SBE 19plus V1 SeaCat (right)

Key Result: Comparison with Commercial CTD



- Emperor and SeaCat profile comparison reflecting a process in which both CTD's were repeatedly lowered and raised down Goleta pier

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