The SeaBee: a drone-based system for biopsy sampling marine mammals



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MOTIVATION

- Tissue samples can provide information on individual genetics, population dynamics, foraging ecology, physiology, and health
- Collecting tissue samples using conventional methods is often logistically challenging, can pose risks to researchers, and can introduce stress to both injured and healthy marine mammals during close vessel approaches
- A drone-based biopsy system could improve sampling efficiency while reducing disturbance and risk

GOAL

Develop a drone-based biopsy system and test on marine mammal carcasses

SYSTEM DESCRIPTION

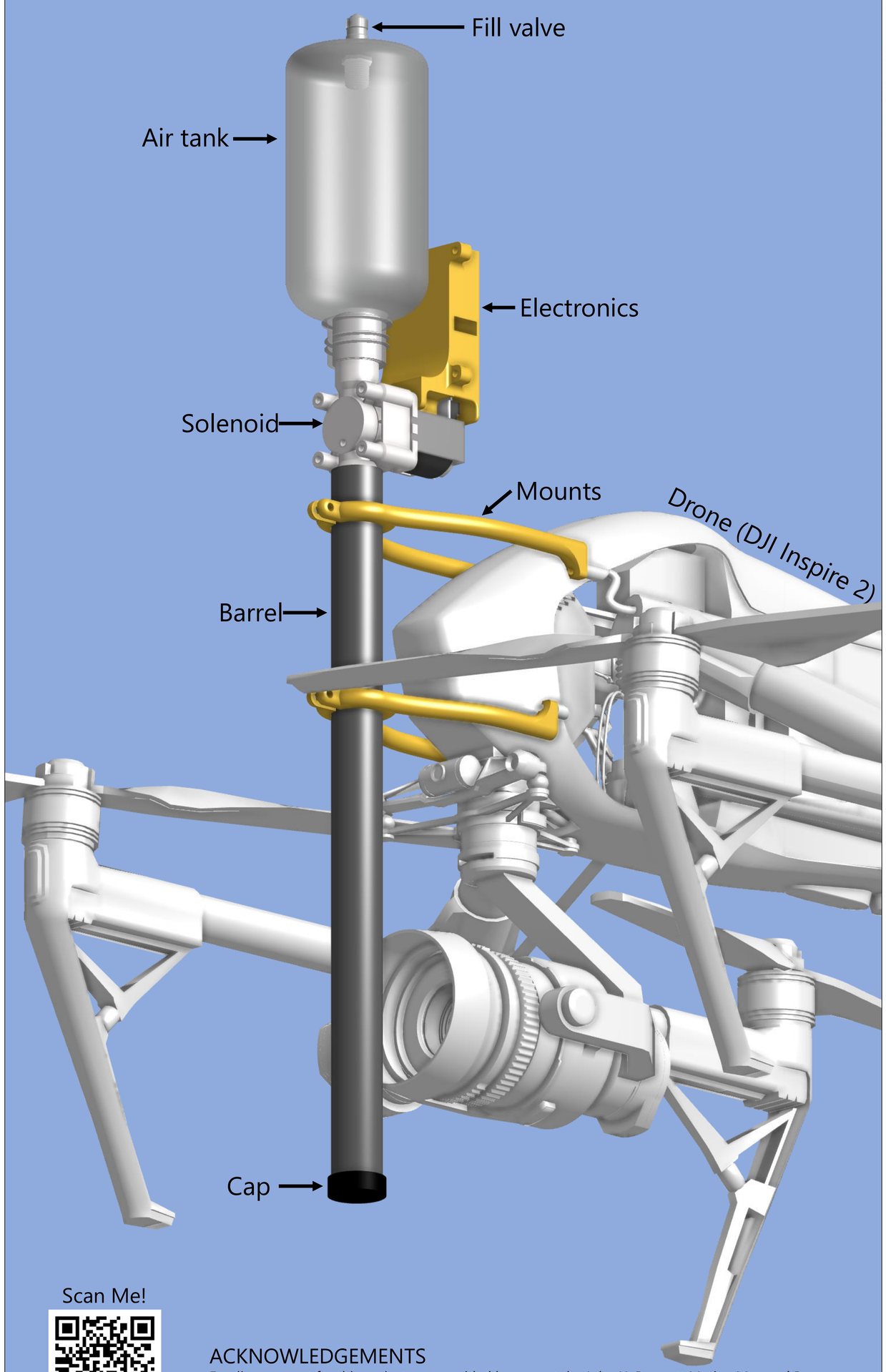
- Pneumatic (air powered) system
- Comprised of an air bottle, electric solenoid valve, and barrel fixed in a downward-facing orientation. A small electronics package houses a receiver, relay, power board and battery
- Deploys free or tethered PAXARMS darts
- Weighs about 250g depending on configuration
- Costs <$250 USD (excluding darts)
- Drone agnostic; tested on DJI Inspire 2

OPERATION

- Load sterilized dart into barrel and cover with cap
- Pressurize to 30-50 psi depending on desired dart velocity/energy
- Turn on SeaBee electronics
- Position drone over target
- Use relay to trigger dart release
- Recover the dart and land drone

TESTING

1. Bench tests to characterize system performance
2. Carcass testing on several species:
   1. Common dolphin
   2. Grey seal
   3. Minke whale



Scan Me!

ACKNOWLEDGEMENTS

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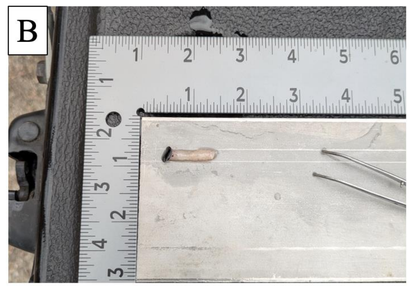
New England Aquarium
Protecting the blue planet

Anderson Cabot Center for Ocean Life
at the New England Aquarium

ifaw

SETUP





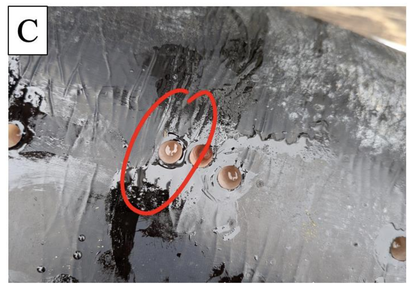


Figure 1. A) Setup used for testing, where the SeaBee was positioned at a fixed height of ~2 m above the target and a chronograph was used to measure dart velocity. B) Example biopsy sample from a Common dolphin carcass, and C) biopsy sample site on the carcass.

RESULTS

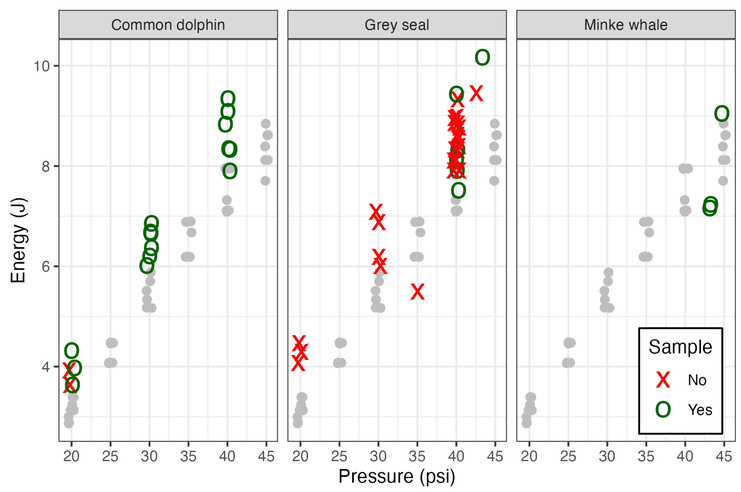


Figure 2. Results of lab tests (no carcass) shown in grey in all panels, and carcass results shown in each panel with successful and unsuccessful sample collection indicated by red X and green O, respectively. At maximum pressure (~45 psi), sample success rates were 100% for dolphin (6/6) and minke (3/3) and 26% for seal carcasses (6/23).

CONCLUSIONS & NEXT STEPS

- Highly effective at sampling common dolphin and minke whale, but not seals (due to fur/skin)
- Develop and test mounts for other drones
- Conduct in-flight testing on moving targets
- Seek permission and funding to test on (non-endangered) large whales