Collecting Water Samples with Aerial Robots

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UAV Water Sampling
Interacting with Environment

• Goals
  – Collect water samples with UAV
  – Partial Autonomy

• Research Challenges
  – Staying safe and dry
  – Integrating ultrasound, altimeter, and water sensor data
  – Easy and robust user interface

Students: John-Paul Ore, J Higgins
Collaborator: S. Elbaum, A. Burgin, M. Hamilton, S. Thompson
How is it Done Now?
Autonomous Water Sampling

youtu.be/7mPbyXZpBws
Challenges

- Altitude over water while sampling
- Acquire and transport water
- Avoid cross-contamination
- Flying in wind
- Ensuring safety
- Autonomy
Micropump (10 grams)
Chassis, Servo, Flushing, Vials
Ultrasonic Sensors
Conductivity Sensors
Experimental Validation

- Sample collection success rate
- Comparison to manual methods
- Operation in wind
Operation in Wind

Total of 225 samples, at least 4 per data point
Methods Comparison: Temperature Transects

- Adjustable length 4m tube with temp sensor
- Static array vs. UAV
- UC Berkeley Blue Oak Ranch Reserve
Offutt Air force Base Lake, Nebraska
Zebra Mussel Veliger Sampling

youtu.be/gL-MahPaeCo
Aerial Water Sampling

• Findings
  – Successfully captured 100s of samples indoors
  – 100+ outdoors
  – Stable in 10-15mph winds
  – Samples compare to grab samples
  – Temperature mapping

• Uses
  – Sampling of hard to access locations
  – Invasive species (eDNA?)
  – Add conductivity, Temp, DO, etc.
  – Chemical spills
  – Others?
NIMBUS Lab

- Nebraska Intelligent MoBile Unmanned Systems Lab
  - Computer Science and Engineering Department
  - Co-directed with Dr. Sebastian Elbaum, Dr. Brittany Duncan, and Dr. Justin Bradley
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This work is supported in part by grants from NSF, USDA, Water for Food Institute, and ORED-UNL.

We would like to thank our collaborators: