

UAS Survey to Support EPA Region 7 HAB Monitoring

USACE Harmful Algal Bloom Research & Development Initiative

Delivering scalable freshwater HAB prevention, detection and management technologies through collaboration, partnership and cutting-edge science

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Problem HAB monitoring continues to be a challenge for many agencies and it is unclear how new technology, such as Unmanned Aircraft Systems (UAS), can assist with monitoring and better understanding of harmful algal blooms (HABs) in relation to toxin production.

Objective Assist EPA Region 7 with their on-going HAB research and development by evaluating new UAS technology including hyperspectral imagery for identifying spectral signatures of cyanobacteria genera and species.

Approach Conduct a two-part experiment to evaluate hyperspectral imagery by: 1) conducting laboratory hyperspectral imaging analysis to better understand and identify relevant spectral bands specific to the cyanobacteria genera and species present in both laboratory monocultures

(cyanobacteria and eukaryotic algae) and field samples from Milford Lake, KS, and 2) conducting a coordinated field survey with simultaneous collection of in-situ samples (physical water samples and sonde measurements) and UAS hyperspectral imagery over a small target area in Milford Lake, KS.

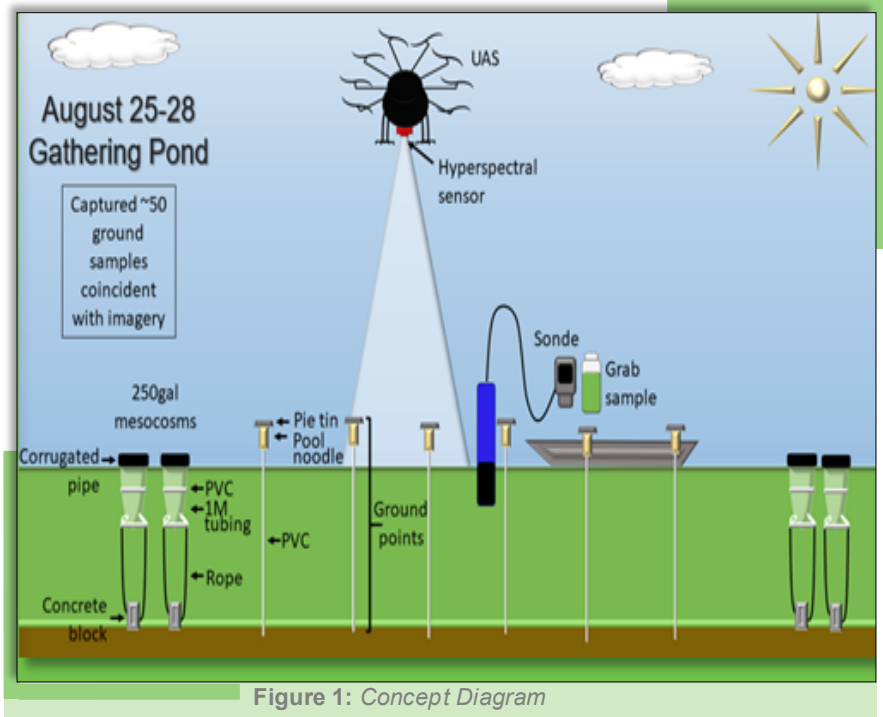


Figure 1: Concept Diagram

Major Milestones

Date	Milestone
FY21 Q1-2	Signed interagency agreement with EPA; EPA funds rec'd; holding pattern until ANSRP funding status is known
FY21 Q3-4	Grow lab cultures of known species; receive strains from UF and samples from NWK; prepare samples and conduct lab imaging
FY21 Q3-4	Monthly/weekly PDT meetings with agencies and teams (EPA, NOAA, ERDC UAS etc) to discuss project and field survey planning and coordination
FY21 Q3-4	Monthly meetings with NOAA/ERDC to discuss lab imaging and spectral analysis approach
FY21 Q4	Begin evaluation of lab imagery spectral signatures
FY21 Q4	Develop field sampling plan and overall data collection/coordination plan for Milford Lake KS with EPA, NOAA and ERDC
FY21 Q4	Conduct coordinated UAS/field survey at Milford Lake KS (Aug/Sept)

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Major Milestones (Cont.)

Date	Milestone
FY22 Q1	Begin sample processing/analysis (UF microID and cell enumeration) & prepare all field sample data for analysis
FY22 Q1	Pre-process UAS hyperspectral imagery (radiometric and geometric corrections)
FY22 Q2-4	Develop a spectral library of field/lab samples and UAS image samples of common species (cross reference with microID and cell enumeration data)
FY22 Q2-3	Conduct image analysis using spectral software tools to compare/integrate spectra from both previous lab and field samples as well as field-based in-situ measurements and attempt species identification and classification
FY22 Q4-FY23 Q1	Multi-agency report of results
Costs	FY21:\$90K FY22:\$105K TOTAL:\$195K


Partnership/Leveraging Opportunities This work will leverage support from EPA Region 7 including funding (\$50K provided in FY21) and field sampling, field sampling support and assistance with spectral analysis from NOAA, boat support from NWK, and sample processing/analysis from University of Florida.

Value to USACE Mission The Environmental Lab has a variety of current and on-going research and development efforts to evaluate the efficacy of UAS and other remote sensing technologies for improved monitoring of HABs. Specifically, this work leverages multiple agency resources to evaluate UAS technology. It will provide a critical step in examining the technology for species identification and potentially to better understand the relationship between toxin production and species-specific spectral characteristics that can be used for monitoring. As such, coordination with other agencies is likewise ongoing to advance the state of the science for maximizing benefits to improve HAB response.



Figure 2: Researchers collecting data during site visit

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