



Overview of UAVs for Ozone Monitoring



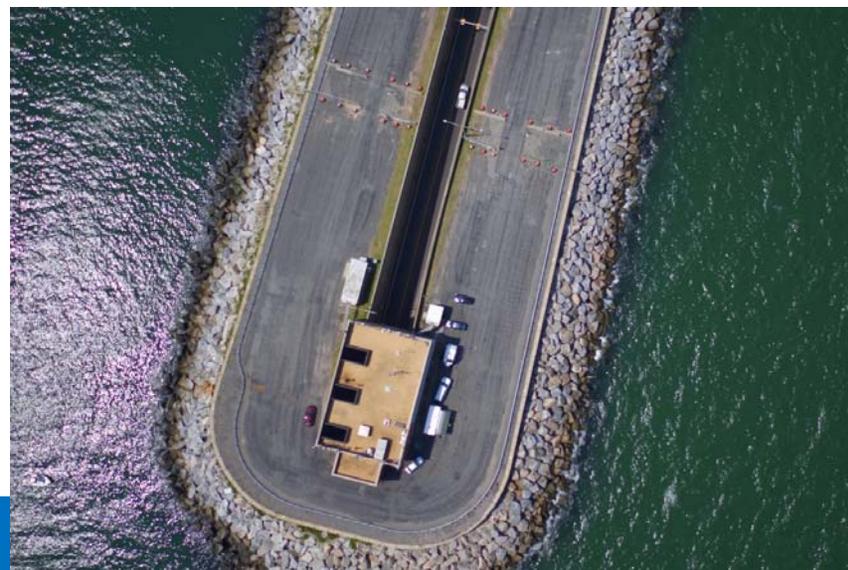
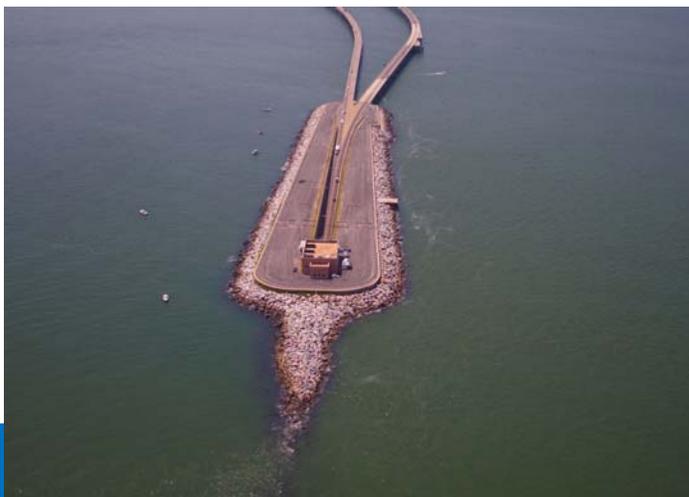
OWLETS Science Team and Planning Meeting 10/18/2017



Objectives of Presentation



- To describe the integration of small sensor systems with sUAS vehicles that will better quantify emissions from hard-to-sample area sources.
- To introduce current capabilities.
- To highlight recent OWLETS missions.
- To open discussion for future campaigns.





Platform Development Goals



- Complement current measurement techniques (LiDAR, Manned Aircraft, Sonde...)
- Provide a stable, high precision X-Y-Z platform, for sample collection.
- Provide adequate flight times for time dependent data collection missions with quick turn-around.
- Provide real-time data logging and quick data retrieval.
- Develop autonomous methods for sample collection.





Sensor Integration Strategies for sUAS Vehicles



PROBLEM

Multiple heterogeneous sensor package payloads are becoming more ubiquitous on autonomous small Unmanned Aerial System (sUAS) vehicles, presenting challenges in integrating the payloads to minimize size, weight, power, and interference.

OBJECTIVE

Develop strategies for packaging and integrating sensor payloads on a variety of sUAS vehicles such that on-board power and communication subsystems can be utilized without interference to the command and control of the vehicle or to other sensors. Demonstrate concepts during test flights under controlled conditions.

APPROACH

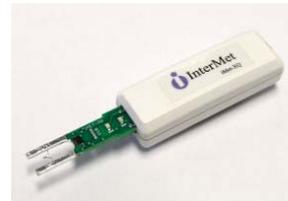
Test sensor payloads for robustness, weight, power consumption, telemetry, etc. Demonstrate ability to successfully package and utilize sensor payloads integrated with vehicle systems for one or more major demonstrations of technology on sUAS vehicles.

Progress (August 2017)

- Developed solutions for multi-sensor payloads for lower tropospheric weather profiling and environmental monitoring using COTS sensors integrated with vehicle subsystems.
- Completed flight missions over land and water with multiple measurement payloads (shown right) that supported successful science data collection.
- Developed solutions for recovery of vehicle in the event of a water landing, developed a mockup model of the sUAS and tested in the Langley hydro basin.



Test flight of OWLETS sUAS vehicle
Inset – ozone sensor payload



iMET Atmospheric Sensor



CICADA microUAS



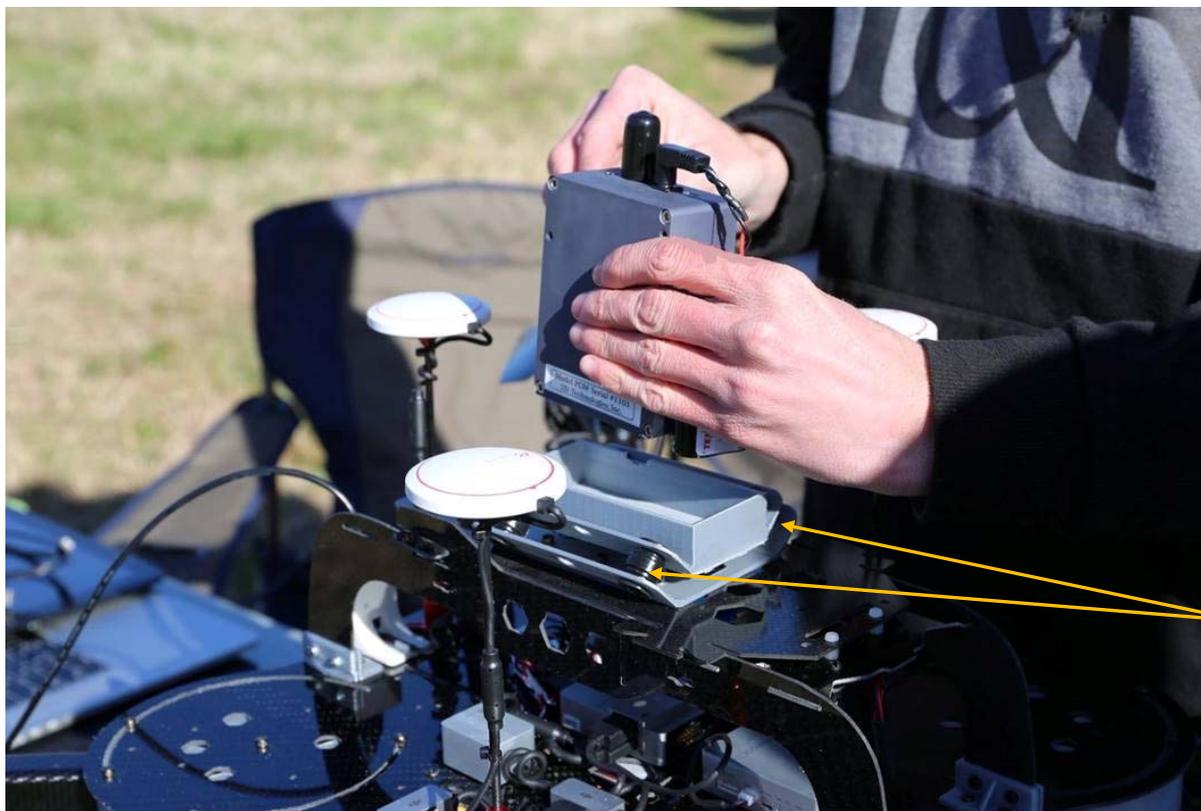
Cairclip O3/NO2



Vehicle recovery raft



Mounting Primary Science Payload



Shock mounts

1.3 Selected Aircraft



DJI Lightbridge

Transmission Distance (Outdoor And Unobstructed)	1.7km
EIRP	100mW
Receiver Sensitivity (1%PER)	-101dBm ±2dBm
Working Frequency	2.4GHz ISM

Unreal Worx Hive X8

Langley sUAS Category	1
sUAS Type	Multi-Rotor, 8 Engine, Brushless Motor
Diagonal Length	64 in
Flight Weight	24 lbs.
Battery	2 x 4S 22000 mAh 25C LiPo
Speed	0 – 30 kts
Endurance	<30 mins
Operating Frequency	100 mW @ 2.4 GHz Command and Control
Radio Range	3.1 miles
Command and Control	Remote Control Transmitter/Ground Station Tablet
Crew Requirements	Pilot, Spotter, Ground Station Operator

Thrust @ 75% Power= 73.5lbs



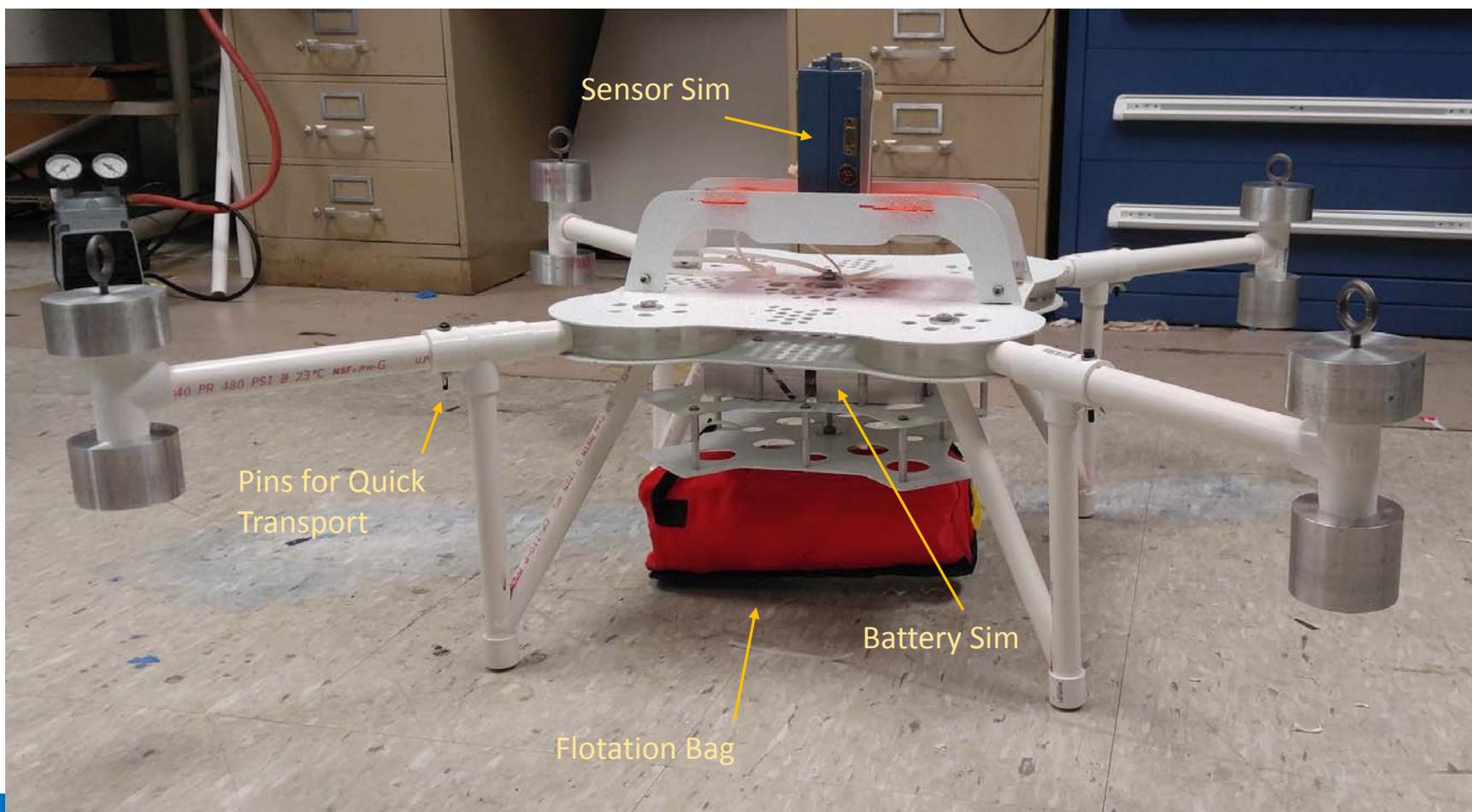


HIVE fully loaded with CBBT payload configuration



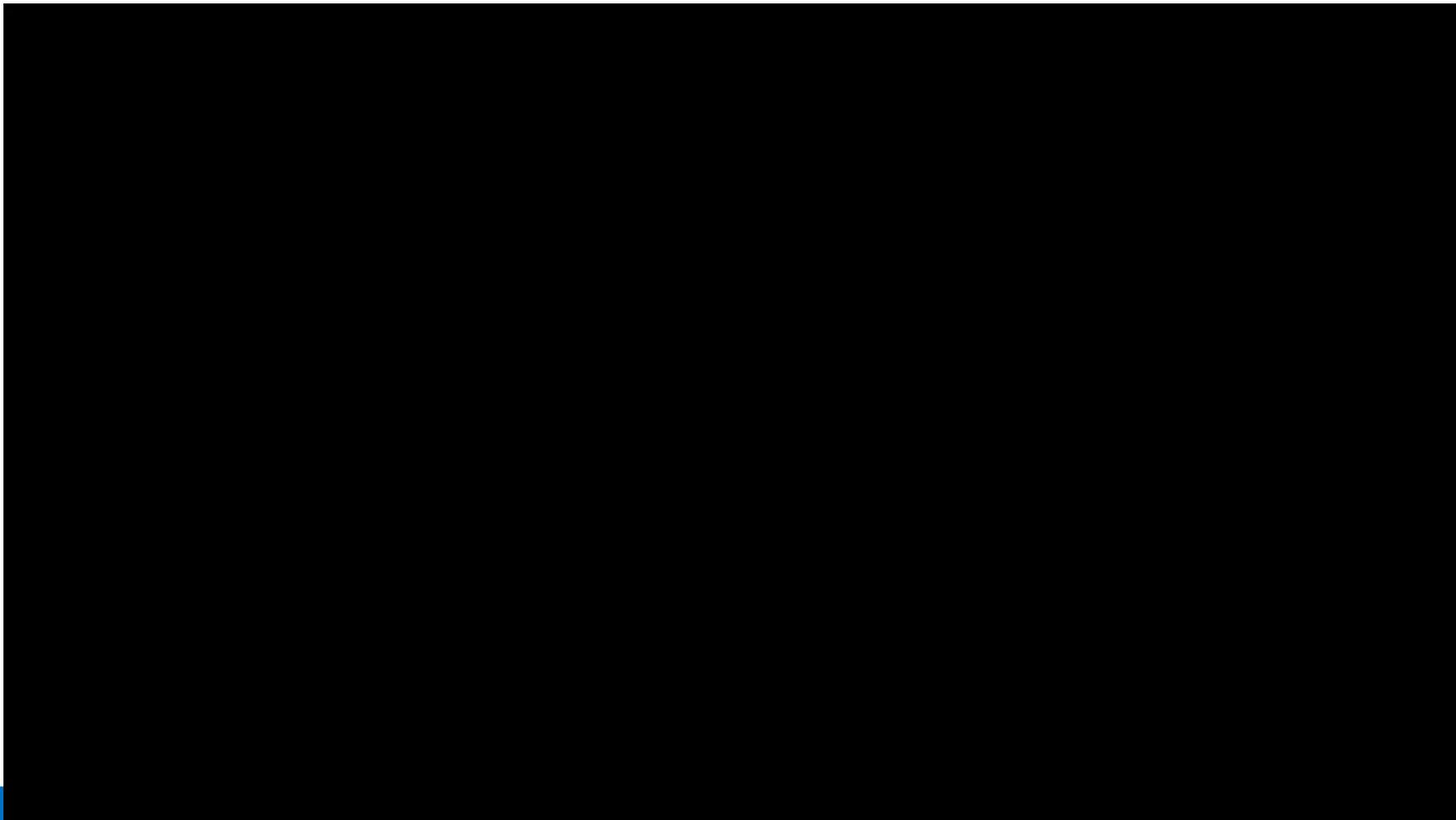


Water Recovery Model *with Matched Buoyancy*





Splash Test





First Flight at CBBT

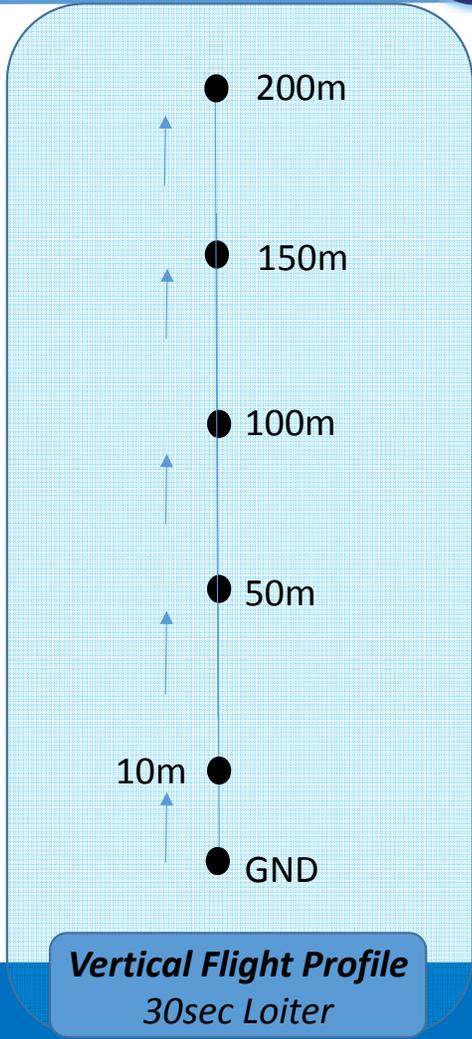
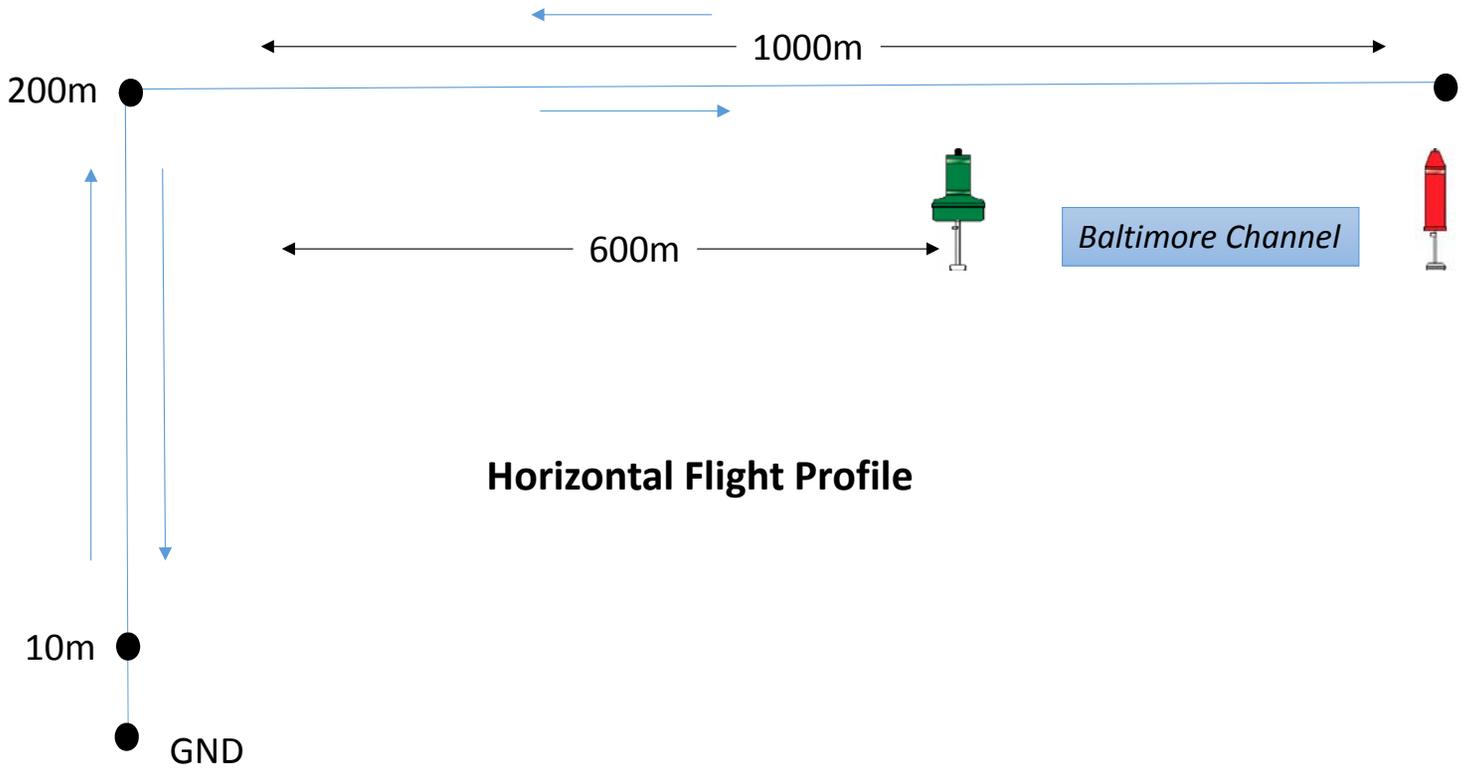


- Vertical flight close to LiDAR to 200m/ FAA limit
- Horizontal flights as requested to 1000m
- Both manual and autonomous control
- Quick turnaround with spare batteries and data download routines



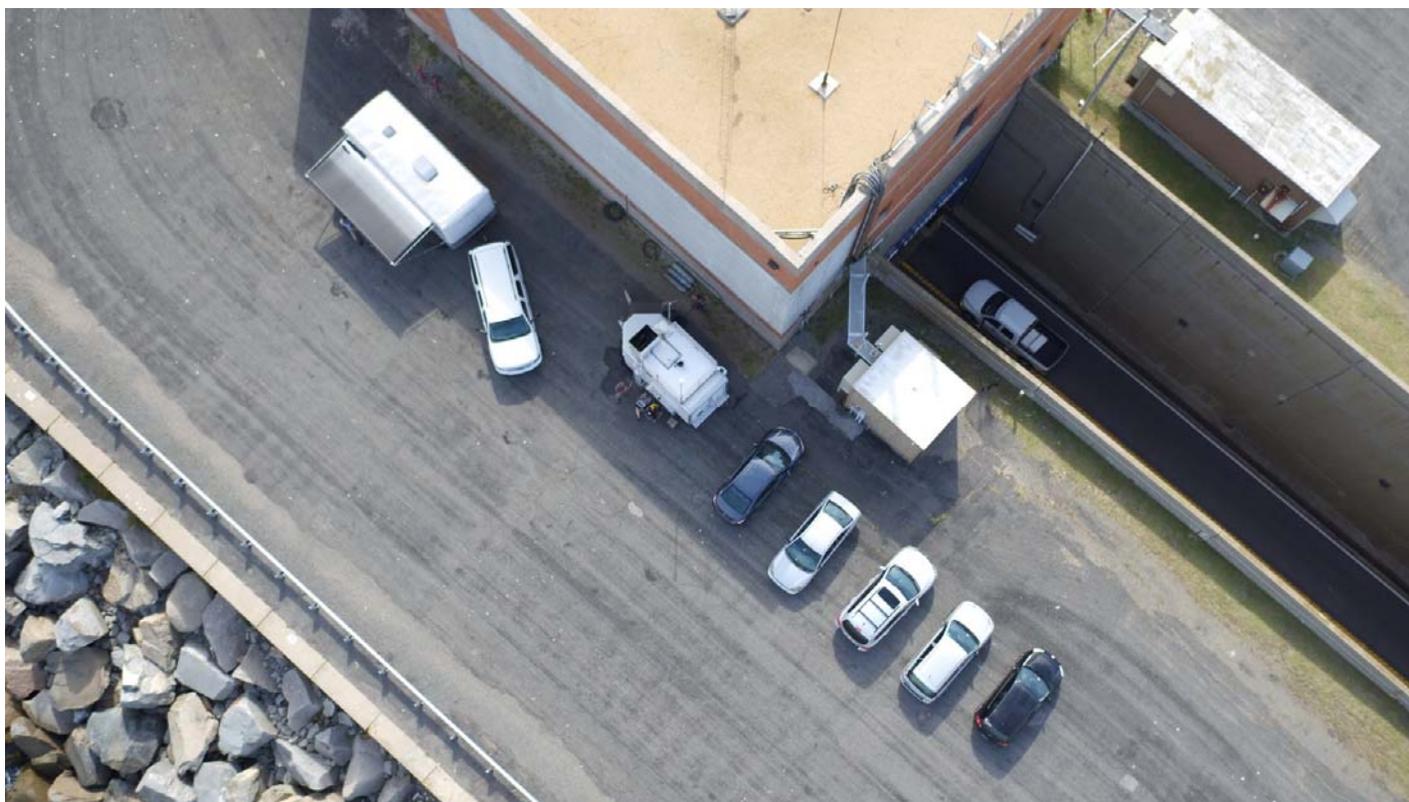


Autonomous Waypoints



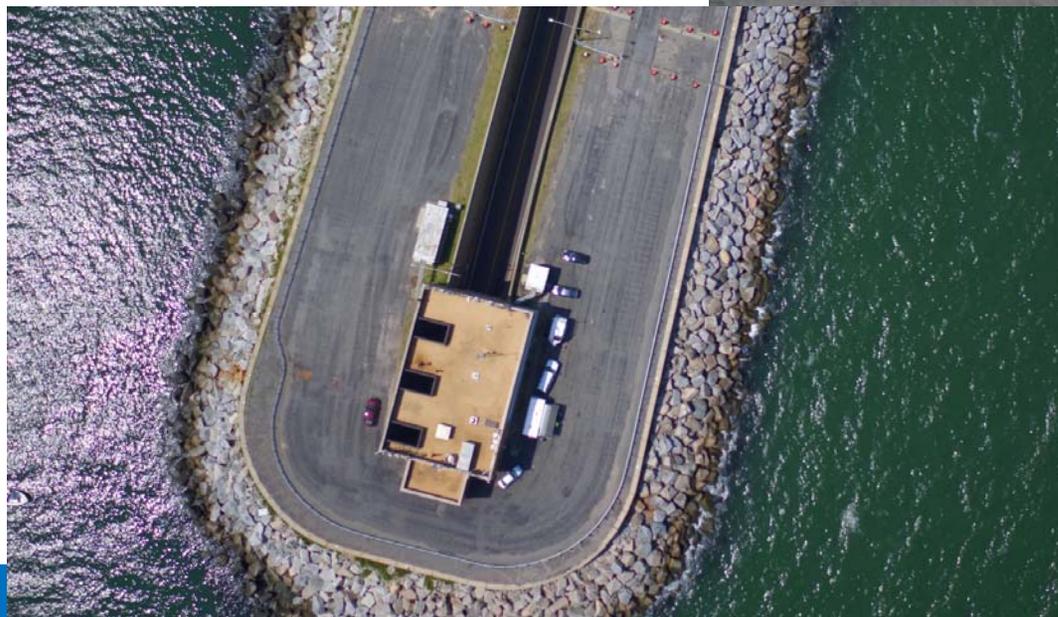
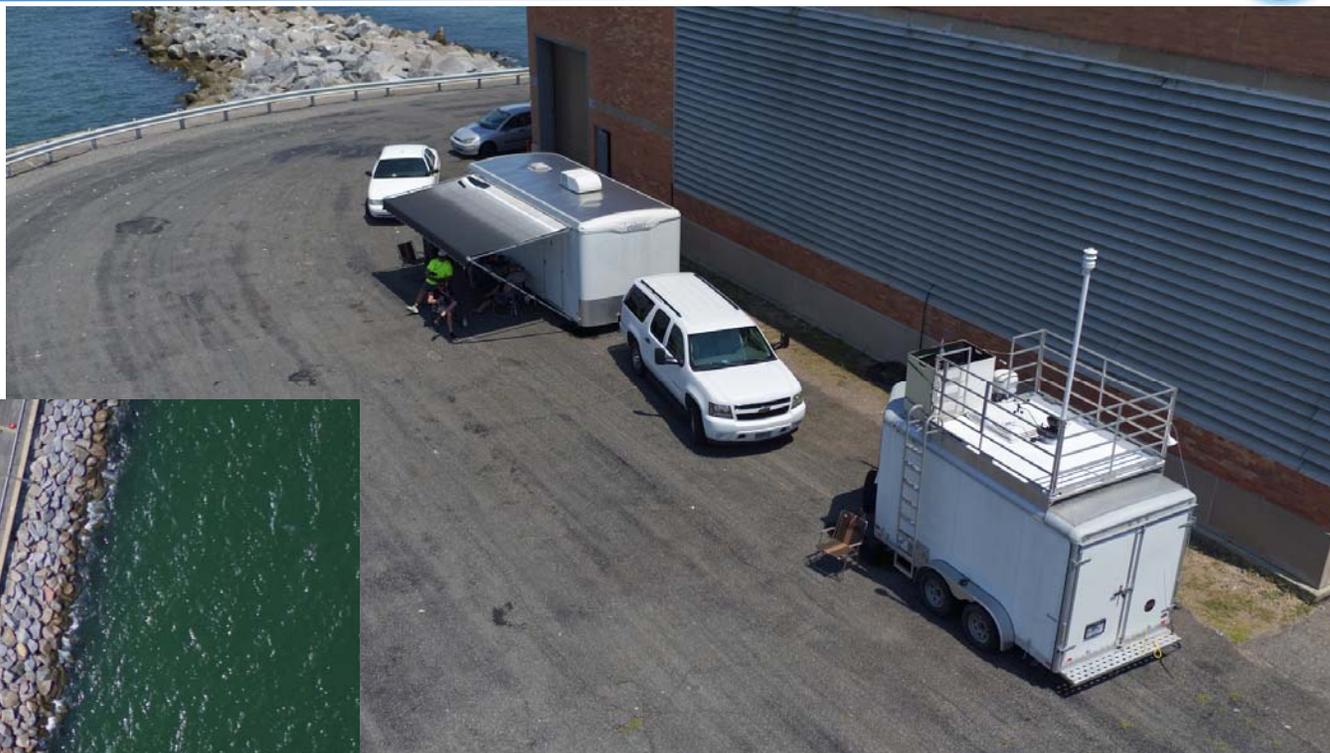


Aerial View of CBBT Test Site



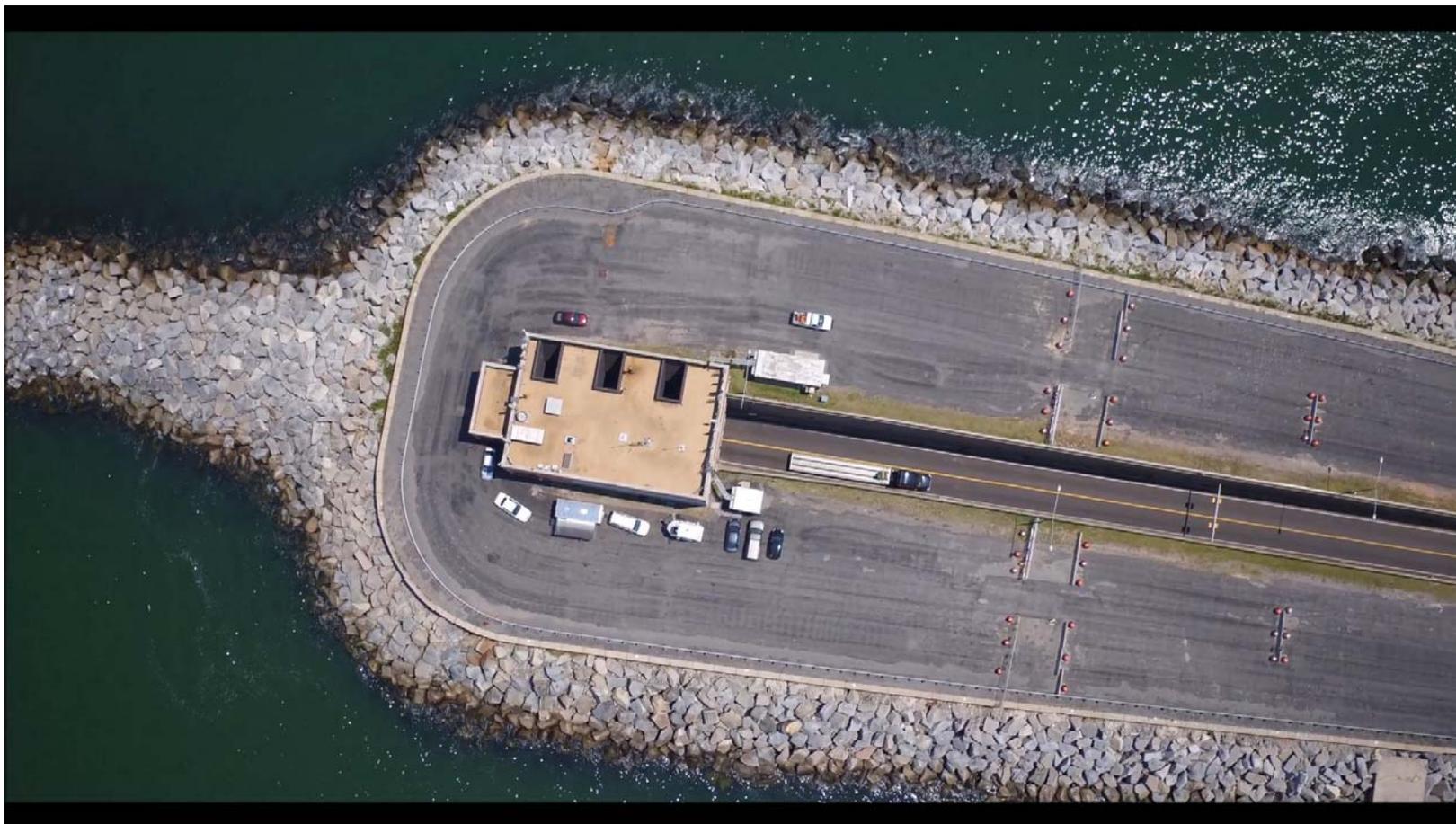


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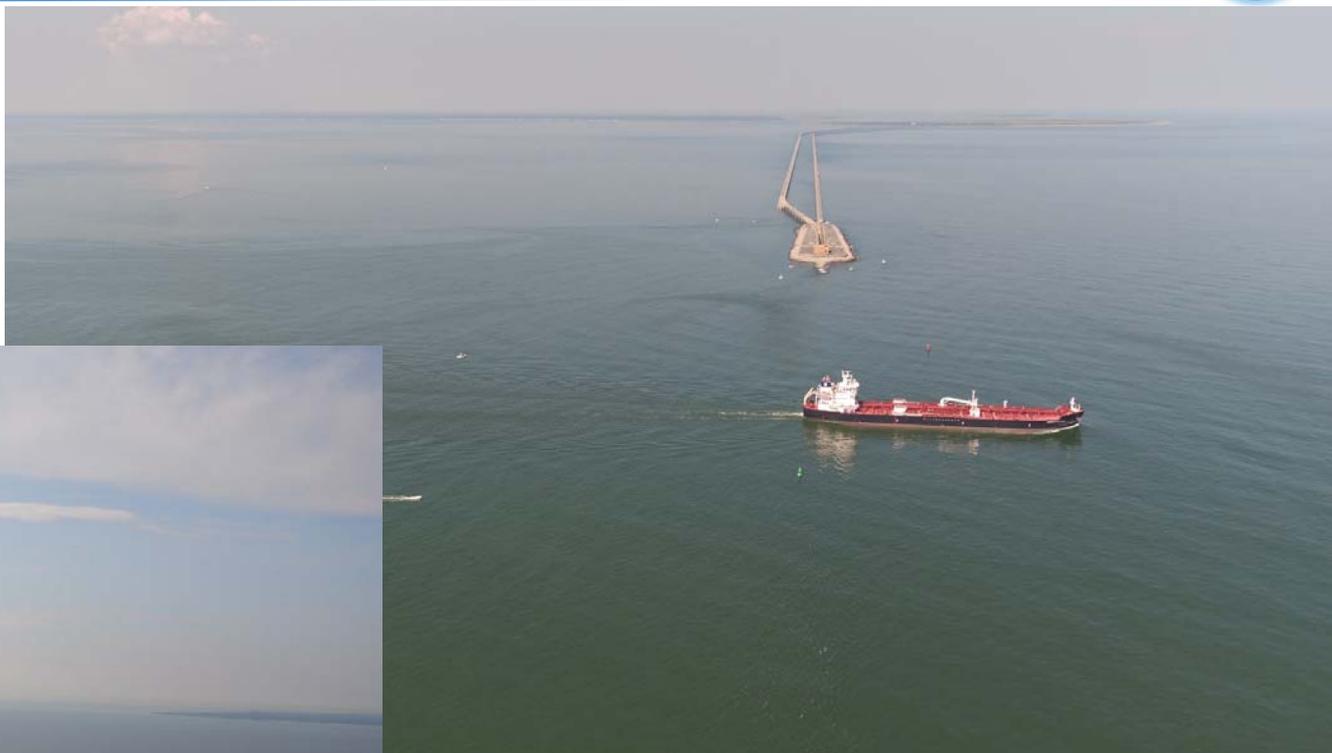


3rd Island CBBT



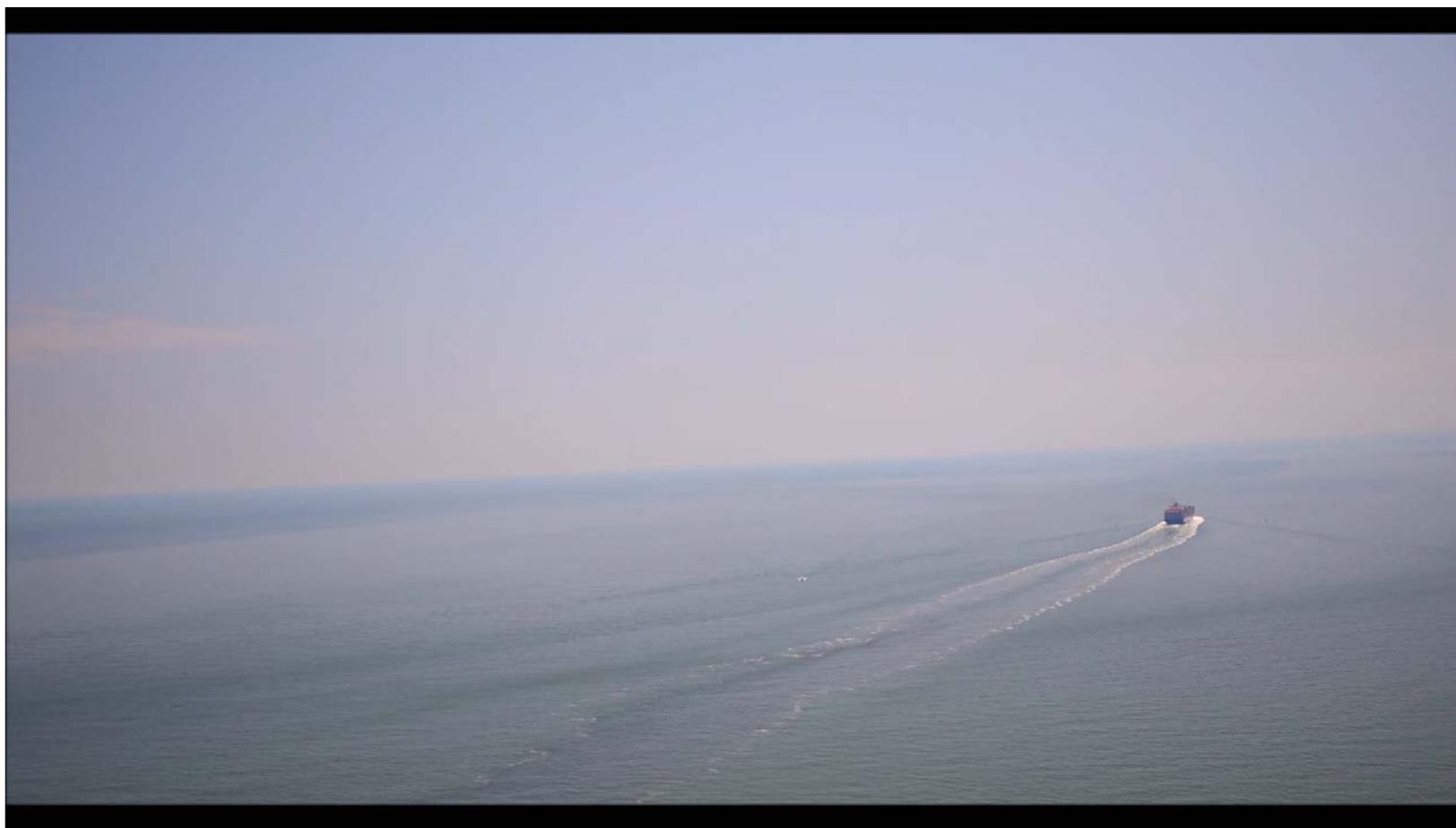


Baltimore Channel Fly-Overs





Visible Smog Cloud





Coordinated Flights



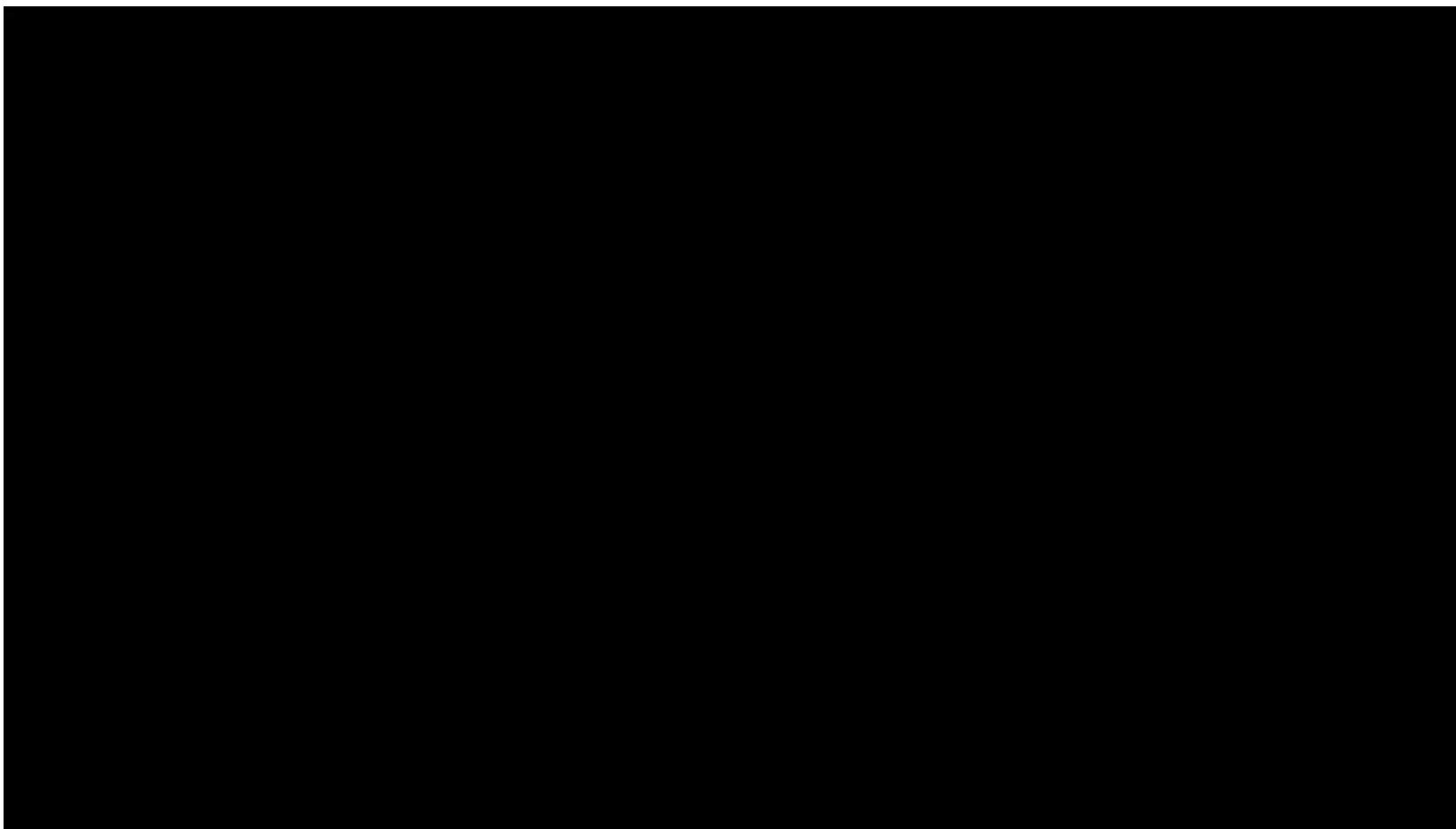
sUAS with Sonde



sUAS with Sherpa



Sherpa Fly-Over





Advantages of using sUAS for Measurements



- Portable, lightweight and foldable design.
- Rapid setup and deployment.
- Safety, in event of control failure, automated return-to-home.
- Several pounds of payload capacity.
- Precision GPS positioning for X-Y-Z along with waypoint navigation.
- Mounting platform can accommodate multiple measurements.
- All electric to minimize emissions and vibration.
- Up to 30 minutes of flight time.
- Capability of real time HD video and data telemetry.





What's Next ?



Hart-Miller Island





Thank You

Questions/Comments?

