



Perception Testbed Fog Chamber Data Documentation

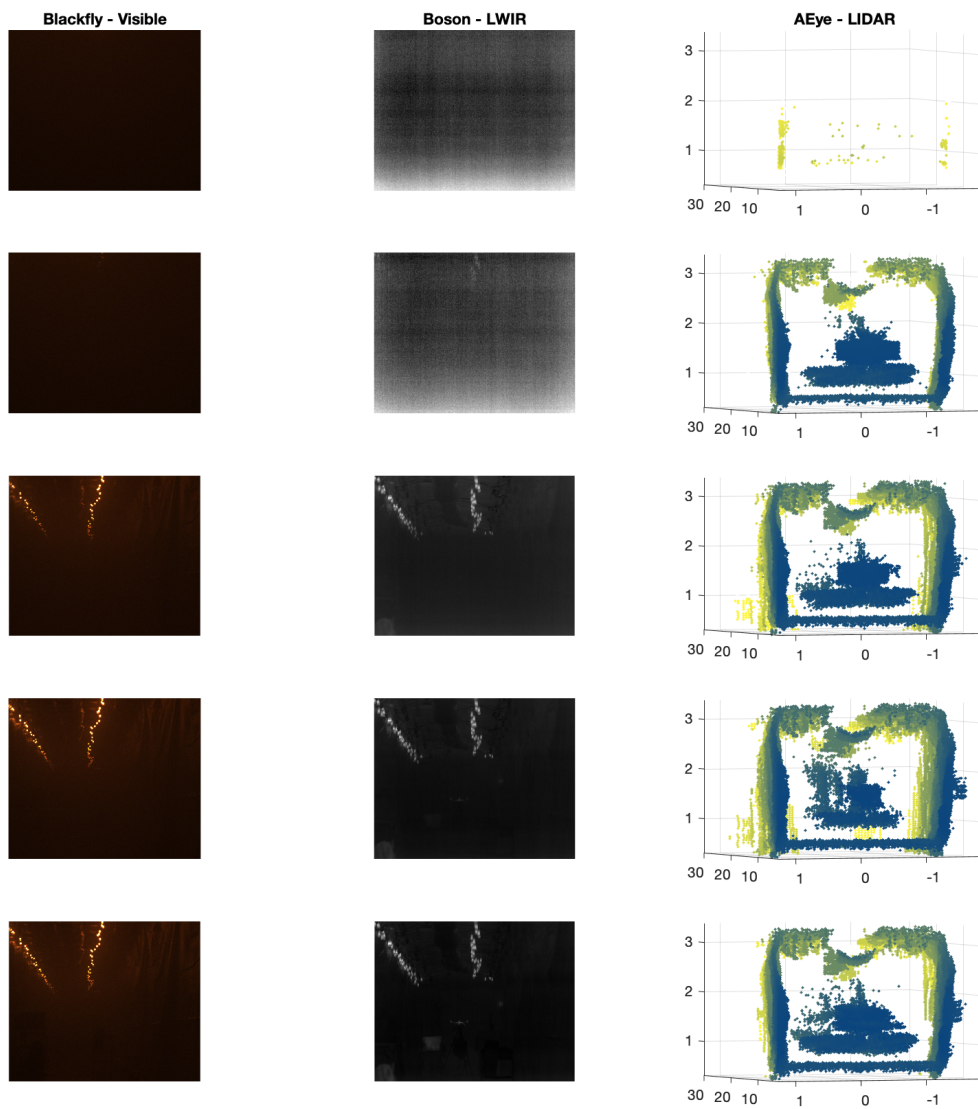
November 1, 2021

Experiment Name: fog22
Start Time: 14-May-2021 13:25:03.432
Duration: 00:31:05.889
Target: UAV-Hover
Target Distance: 45.6692 meters
Target Temperature: N/A
Environment Notes: None.

File Information:
Visible Spectrum: 16943 Images
Longwave Infrared: 18660 Images
LIDAR: 5548 Data & Images

1 Data Snapshot: fog22

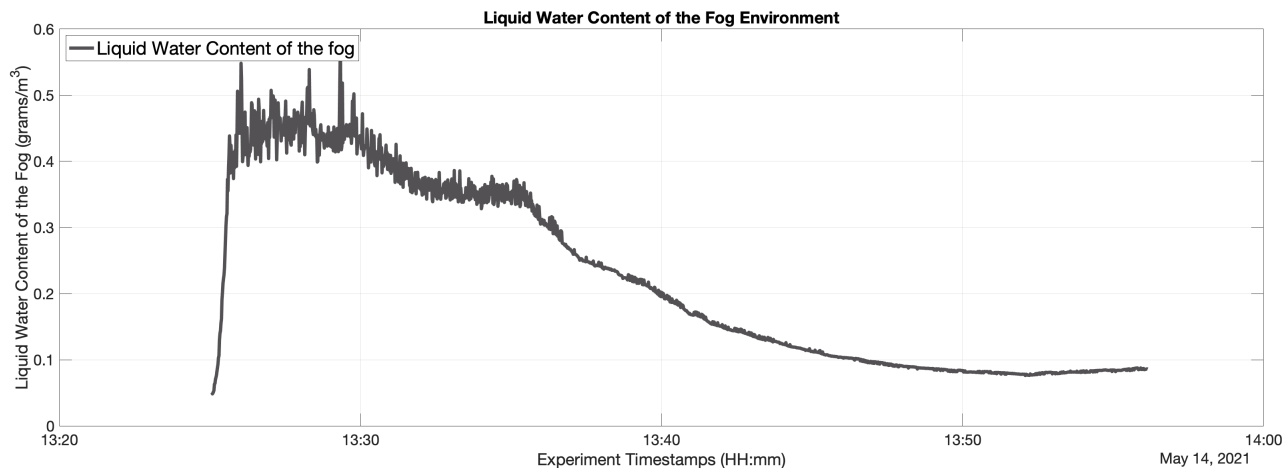
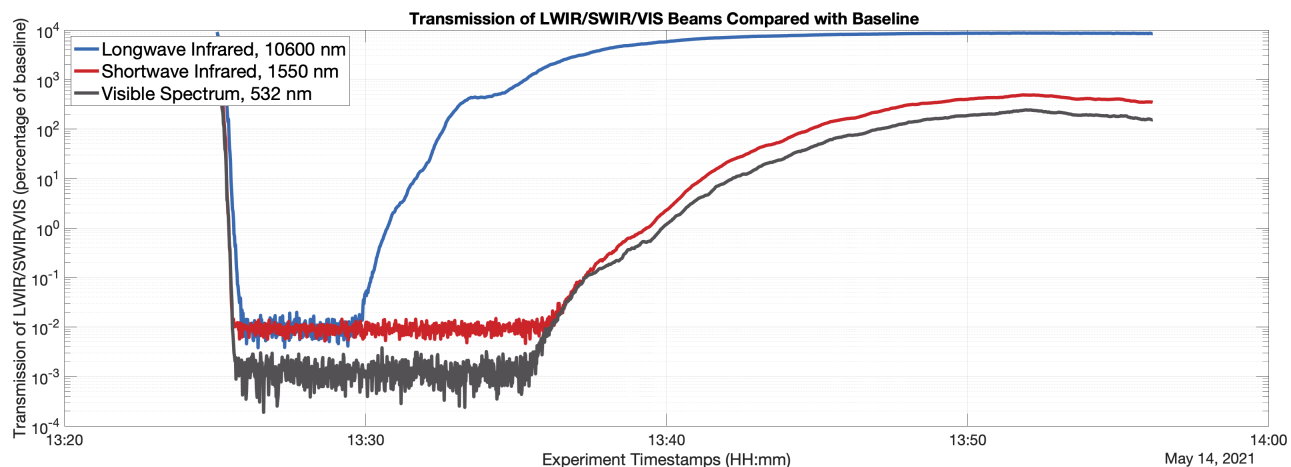
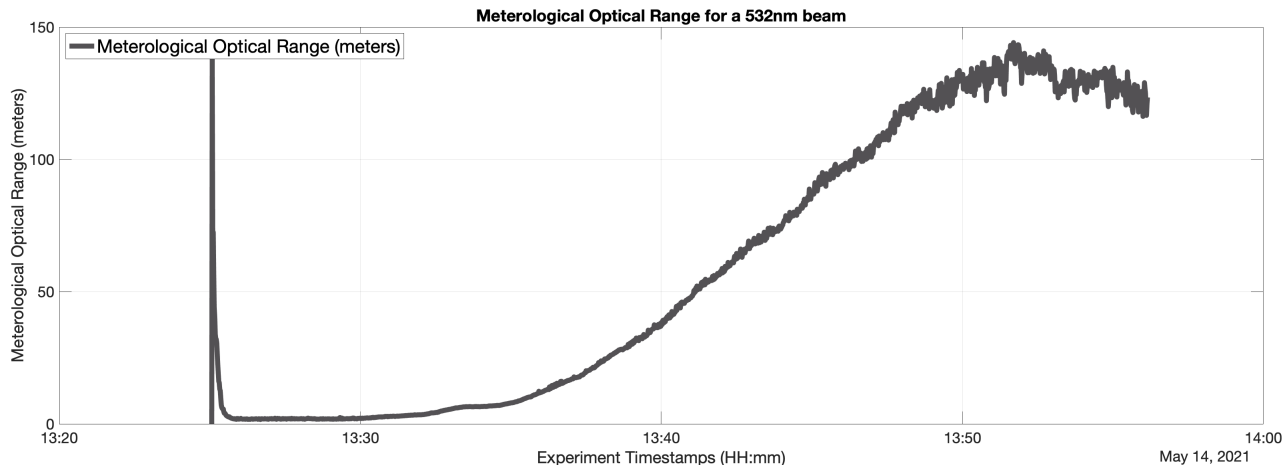
The following images describe the variation in data during the experiment.





2 Experiment Environment: fog22

The following graphs show the variation in the environment during the experiment.





3 Experiment Setup and Equipment Specifications

3.1 Perception Testbed Hardware

A novel testbed, featuring a visible spectrum camera, a longwave infrared camera, and a lidar was built and transported to the Fog Chamber at Sandia National Laboratories for fog chamber testing. The perception testbed features the following equipment:

- FLIR BlackFly - Visible Range Camera
- FLIR Boson – Long wave infrared thermal camera
- AEye Intelligent LIDAR

3.2 Environment Monitoring Equipment

During fog experiments, the following equipment was used for characterization of the fog and light scattering resulting from the fog:

- Malvern Spraytec instrument with inhalation cell accessory - produces a measurement of fog particle sizes, this information is useful in understanding light scattering.
- Transmissometer – used in measuring the Meteorological Optical Range (MOR) a light emitting diode and camera are used under a static distance to measure the optical effects of the fog.

4 Useful References

The following documents may be useful in understanding the scope and context of the experiments.

Shish, Kimberlee H., et al. "Survey of Capabilities and Gaps in External Perception Sensors for Autonomous Urban Air Mobility Applications." AIAA Scitech 2021 Forum. 2021.

Redman, Brian J., et al. "Measuring resolution degradation of long-wavelength infrared imagery in fog." *Optical Engineering* 58.5 (2019): 051806.

Wright, Jeremy B., et al. "Optical characterization of the Sandia fog facility." *Degraded Environments: Sensing, Processing, and Display* 2017. Vol. 10197. International Society for Optics and Photonics, 2017.