



Perception Testbed Fog Chamber Data Documentation

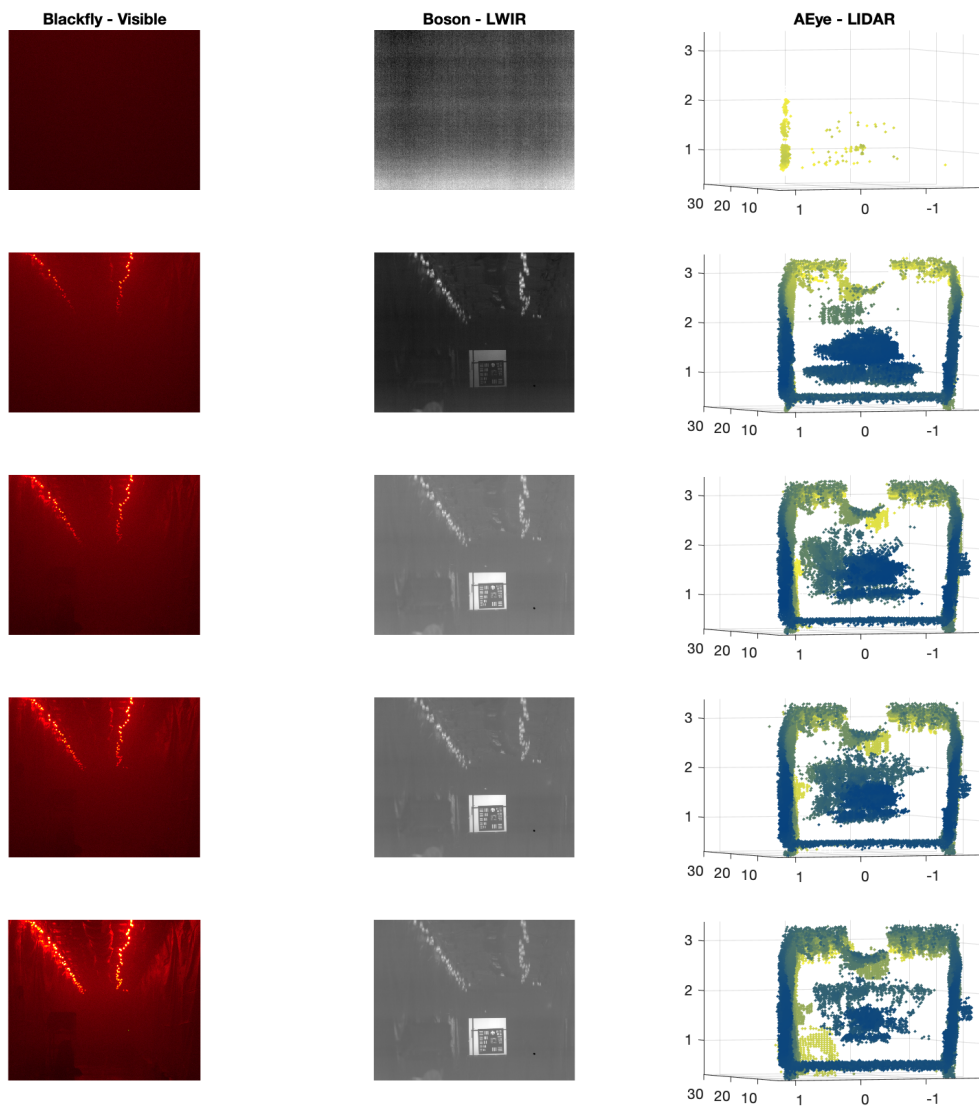
November 1, 2021

Experiment Name: fog15
Start Time: 12-May-2021 16:08:11.260
Duration: 01:22:05.925
Target: USAF-1951
Target Distance: 45.6692 meters
Target Temperature: 37 C
Environment Notes: None.

File Information:
Visible Spectrum: 45034 Images
Longwave Infrared: 49259 Images
LIDAR: 6440 Data & Images

1 Data Snapshot: fog15

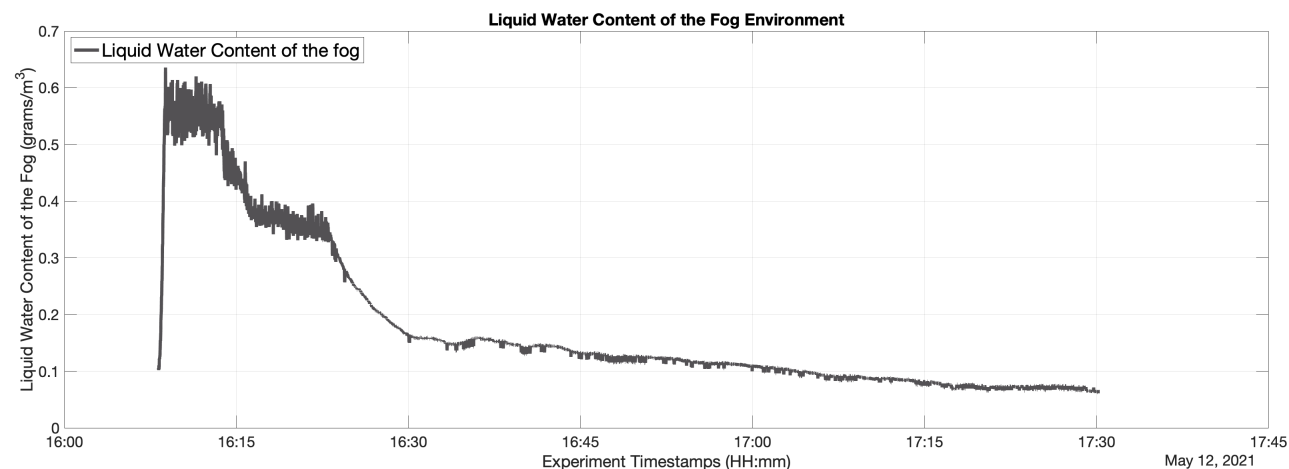
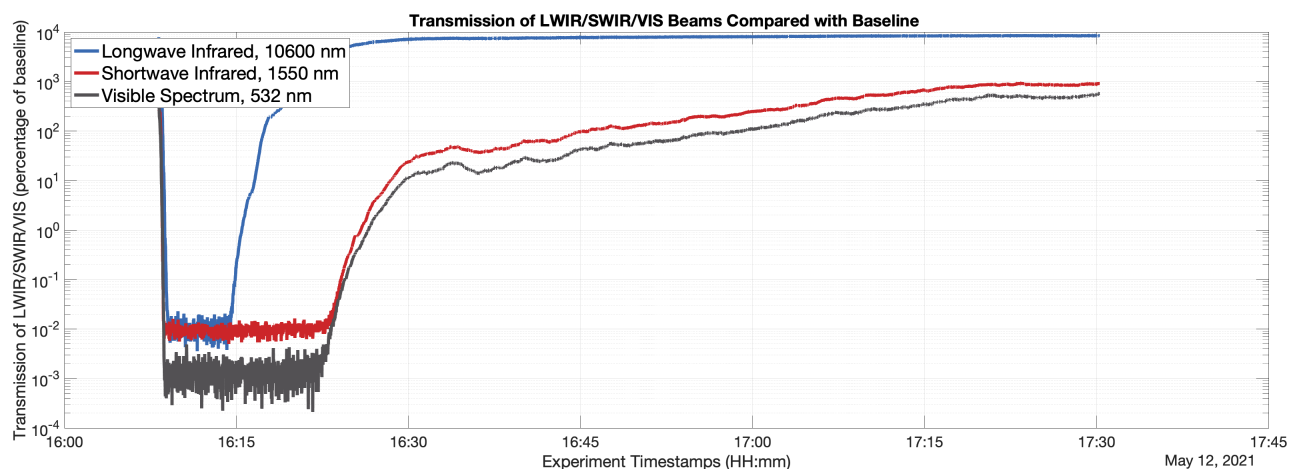
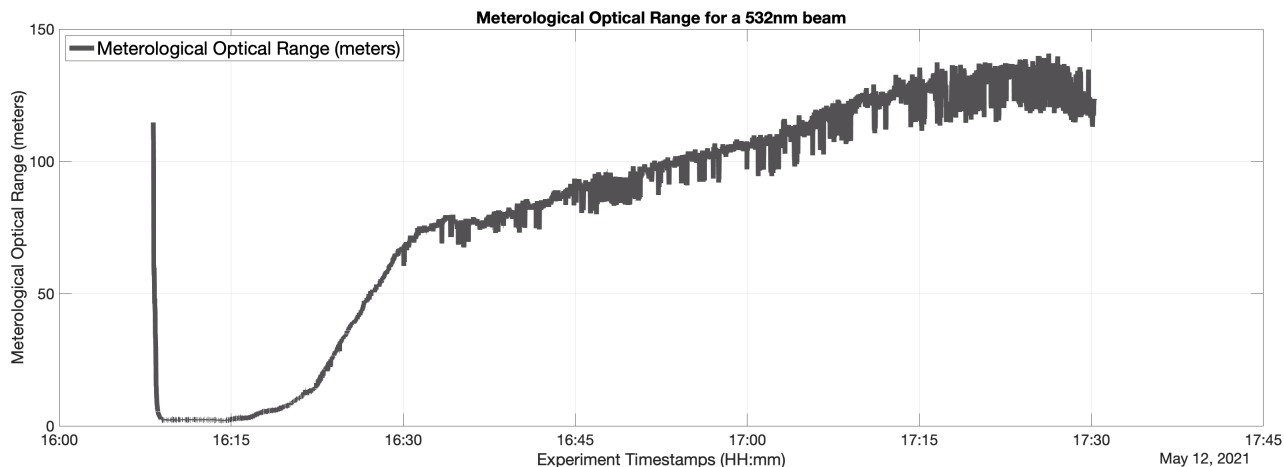
The following images describe the variation in data during the experiment.





2 Experiment Environment: fog15

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.