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Sandia National Laboratories

Sandia Fog Facility

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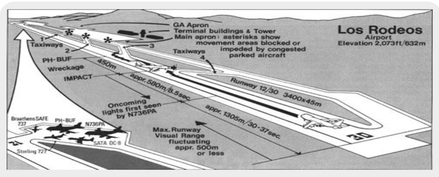
Problems caused by fog

The decreased visibility due to fog is a major problem for navigation and se

11 dead in helicopter crash off Florida Coast due to thick fog: WINK News, March 11, 2015.

2 separate accidents 90 vehicles 2 dead. Tule Fog SFGATE Feb 5, 2002.

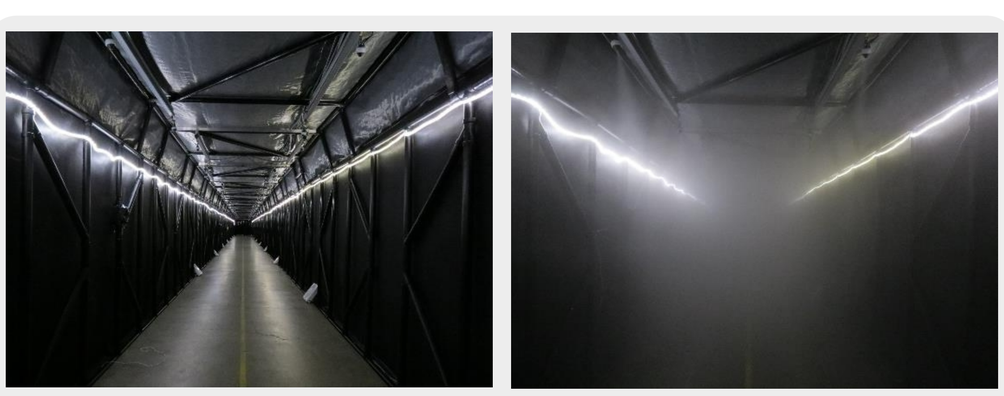
Lt.j.g. Pete Lee, www.navy.mil



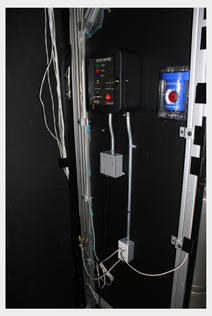
Tenerife Airport Disaster –Fog a major contributor- 583 dead March 27,1977

Capabilities

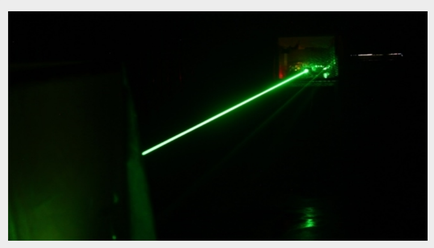
The Sandia Fog Facility allows for repeatable quantitative measurements of instrument performance over a long distance in characterized fog conditions.



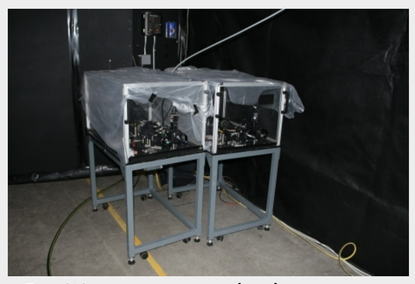
One of the largest fog facilities in the country at 10 by 10 by 180 feet. 80 spray nozzles on three independently controlled banks allow for spatial variation of fog.



Can safely operate up to Class 4 lasers.



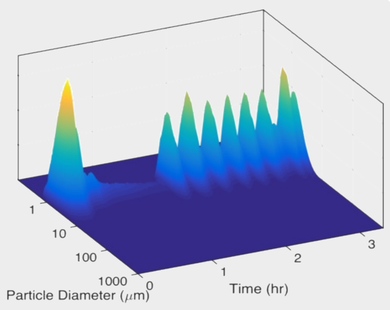
A transmissometer measures the attenuation of the fog.



Positive pressure dry boxes are used protect instruments.

Temperature control

www.malvernpanalytical.com



A Malvern Spraytek measures the distribution of the particles ranging in diameter from 0.1 to 1000 µm.

Advancing the Field

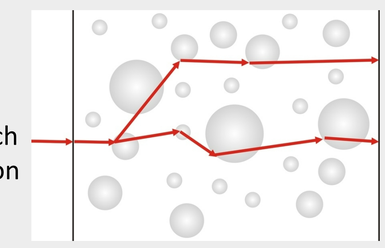
Metrics such as visibility or meteorological optical range are poorly suited for characterizing fog and don't work for inputs into optical design optimization. Additionally many of the models used to simulate fog have not been updated as instruments have gotten better at measuring particle size distribution.

With the combined expertise ranging from fog physics to optical design, we have a unique ability to shift the paradigm on how we describe, characterize, and see through fog.

LDRD research

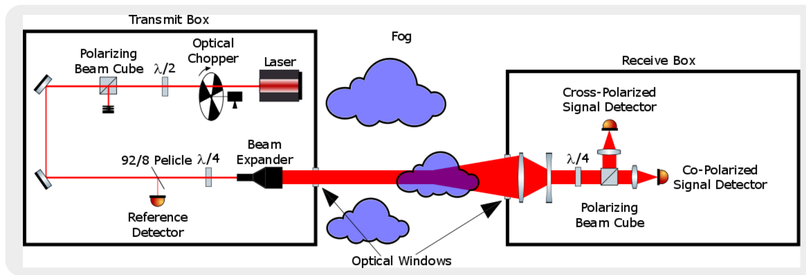
Fog Simulation

We have developed a Monte Carlo simulation of signal persistence for arbitrary scattering particle sizes distributions.



Polarimetric imaging

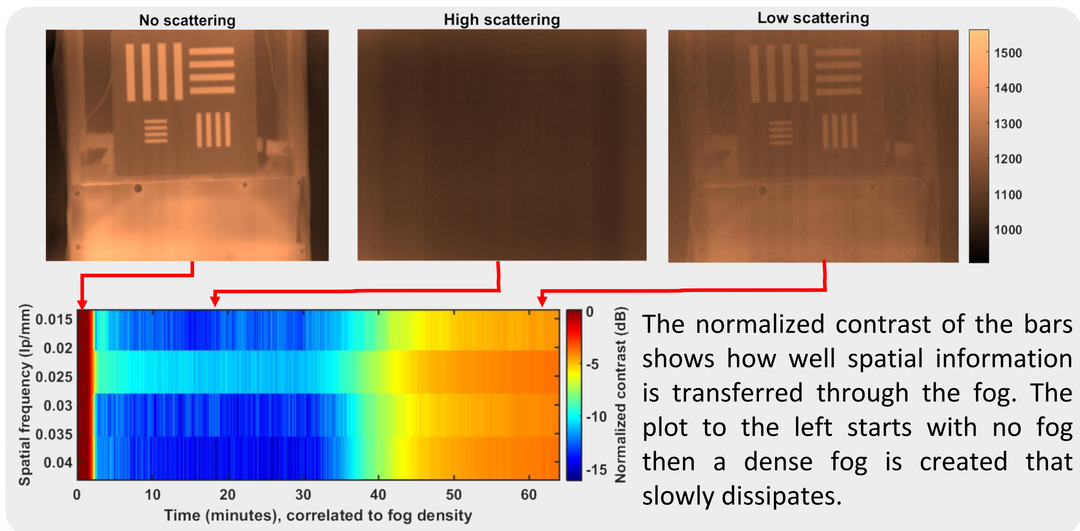
The simulations indicated Circular polarization increases range and target detection in fog environments.



We designed and are testing a short-wave infrared instrument to exploit the increased persistence of circular polarization.

Long-wave infrared passive imaging

We are testing the resolution degradation of Long-wave infrared in varying fog densities to see if has better performance than visible.



The normalized contrast of the bars shows how well spatial information is transferred through the fog. The plot to the left starts with no fog then a dense fog is created that slowly dissipates.

Collaborations

In addition to LDRD funded research, we have worked with other government and non-federal agencies to test optical performance in fog. Contact Jeremy Wright if you are interested in collaborating - jbwrigh@sandia.gov.

U.S. DEPARTMENT OF ENERGY
National Nuclear Security Administration

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