3D LIDAR Aerosol Cloud Profiling System

Army RDEC, 2012

Mr. Lindquist and Mr. Fred Smith worked with other OptiMetrics' employees to adapt the 3D LADAR Multi-Band System described elsewhere for 3D profiling of countermeasure obscurant clouds. Those enhancements included development by Mr. Lindquist of software algorithms to invert the LIDAR (or LADAR) returns to produce quantitative 3D measurement of the backscatter and extinction coefficients of the obscurant clouds. Examples of results of these trials are shown in a following figure.

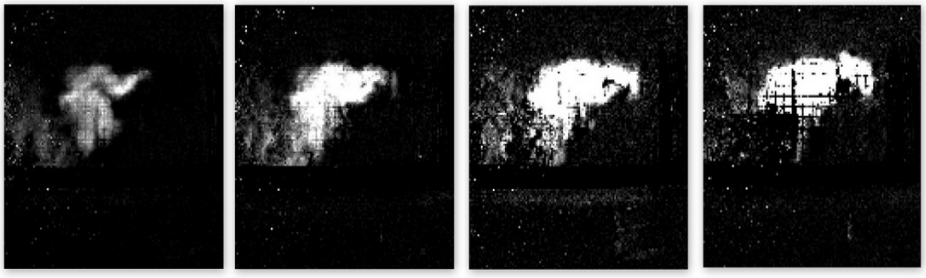
This event was of a fog oil type obscurant created by vaporizing a volatile liquid on a hot surface. The upper image is from passive visible camera. This is a relatively thin smoke, however, note that in the visible image the background is totally obscured at the center of the obscurant plume.

The middle four images are calibrated backscatter 'slices' extracted from the example trial's Flash LIDAR returns. Those images are labeled by the range from the sensor to the center of the slice. The intensity of the signal represents the intensity of the backscatter from that volume of the obscurant. Note that the front of the cloud is at approximately 23 meters from the sensor, and the cloud extends behind the grid at about 30 meters from the sensor.

Because we have a true 3D representation of the cloud, we can integrate the through the cloud to compute the total optical density of the cloud a viewed from any direction. The lower two images show the total optical density of the cloud as seen horizontally and from the top.

3D Aerosol Cloud Measurements

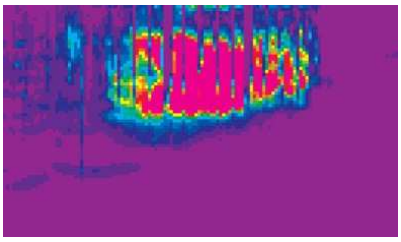
Visible Cloud Image



Measured Backscatter Internal to the Cloud

Total Cloud Density

Side View



Total Cloud Density

Top View