



## ENGINE EXHAUST GAS SPECTRAL ANALYSIS USING LASERS

### SUMMARY

White Sands Test Facility (WSTF) maintains facilities to test fire engines in altitude chambers that can be configured to support plume spectral analysis studies.

### BACKGROUND

The composition of engine exhaust gas can be determined using laser technology. The composition of the plume can be analyzed and used to evaluate the performance of the engine. Also, knowing an engine's plume "signature" may be necessary in Department of Defense-related applications.

### PROCEDURE

WSTF has supported several plume spectral analysis projects using laser technology. In each case, the customer supplied the laser equipment and was responsible for acquiring and analyzing the spectral data. WSTF installed the laser equipment in an altitude test chamber and provided the necessary facility interfaces, such as liquid nitrogen systems, to cool the equipment, power supplies, and event indicators to trigger the laser equipment during the test firing. WSTF personnel were also responsible for the installation of the engine and for the operation of the test facility, engine, and altitude simulation systems.

The test engine is installed so the laser light is shown through the plume between the engine's nozzle and the inlet to the altitude system's diffuser. During the firing, laser light is directed through the exhaust gas and is captured opposite the plume with a sensor. Comparing the characteristics of the light detected at the sensor with the known properties of the emitted laser light enables the customer to determine the composition of the engine exhaust gas. Wavelengths of light absorbed by the plume indicate the composition of the exhaust gas.

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