NASA SBIR/STTR Technologies

Proposal No.: T9.01-9975

Hydroxyl Tagging Velocimetry for Rocket Plumes

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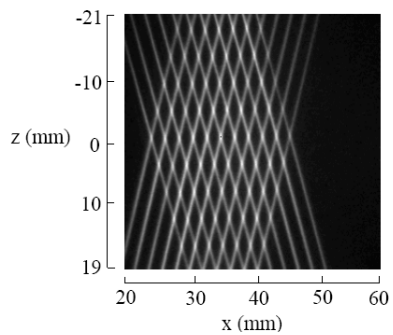
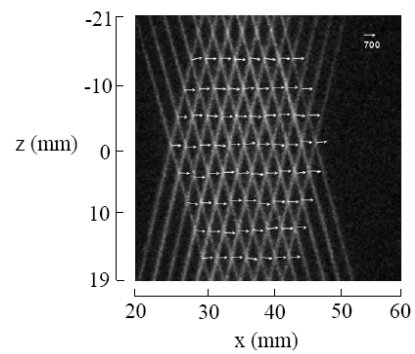
Identification and Significance of Innovation

A laser-based velocity diagnostic for rocket plumes is proposed that does not require flow seeding, works in high or low temperature flows, and can be used over a broad range of velocities. Hydroxyl tagging velocimetry (HTV) "writes" a line of OH molecules into the flow and interrogates them after a short delay to determine the velocity. The proposed diagnostic will provide measurements not obtainable by current methods, enabling experimental data for validating computer models that will greatly reduce development costs.

Expected TRL Range at the end of Contract (Level 4):



Grid of 11 x 11 OH lines "written" by 193-nm laser in a Mach 2 flow at zero delay.



Grid after 2 µs, showing the velocity vectors at each point calculated from the displacement. (Taken from Lahr et al., AIAA 2006-0040)

Technical Objectives and Work Plan

The specific objectives of this Phase I effort are:

1. Define the target operating envelope for a rocket plume velocimeter in terms of the temperature, pressure, species concentrations, and velocity of the exhaust gases.
2. Determine which portions of the desired operating envelope are accessible by the proposed HTV system.
3. Demonstrate velocity measurements at one or more sets of conditions within the desired envelope.
4. Produce a plan for incorporating the technique into NASA's rocket test facilities.

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NASA and Non-NASA Applications

NASA applications: Validation of computer models for rocket performance, leading to improvements in efficiency and reduction in cost of hardware development programs.

Non-NASA applications: Worldwide aerospace propulsion industry, rockets, missiles, scramjets, and turbine engines, new concepts in propulsion, pulse detonation engines, etc. Commercial applications include advanced turbofan development.

Firm Contacts

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NON-PROPRIETARY DATA