

FINAL PROJECT SUMMARY NASA SBIR PHASE I

Firm: MetroLaser, Inc.
Contract Number: NNX10CE88P
Project Title: A Novel, Portable, Projection, Focusing Schlieren System

Identification and Significance of Innovation:

The schlieren technique has been used for flow diagnostics in wind tunnels since the beginning of aerospace research, due to its ability to make airflows – especially shock waves and turbulence – visible. This proposal describes a novel type of schlieren system that would increase efficiency, capability, and productivity for ground test facilities. The concept and the availability of state of the art components make the system more portable, easier to align, and more versatile than existing systems. A major drawback of current schlieren systems and one that has restricted their widespread commercial use is that they require exact alignment between a pair of widely separated mirrors or grids, which takes time and limits portability, and costs are prohibitive for most such applications. This problem is partially relaxed by focusing schlieren methods. The proposed concept incorporates features of existing schlieren systems while removing the primary limitations. All of the elements that require precise alignment are contained within a camera body and can be relatively inexpensive. Also, very large fields of view are made possible. This is advantageous in wind tunnel facilities, since experiments are frequently installed only to be torn down shortly afterwards.

Technical Objectives and Work Plan:

The objective of this project is to develop a digital, projected-grating, focused schlieren method for applications in wind tunnels of interest to NASA. The fundamental concept has already been proven in preliminary laboratory experiments. This research must now develop the concept into a practical tool for NASA, and determine its limitations. The resulting system will be a portable, versatile, high-speed schlieren system that can be easily set up and aligned in a short time.

Technical Accomplishments:

In Phase 1, we built a breadboard projection schlieren system, and used this system to take schlieren images of a variety of test subjects such as hot air jets, turbulent helium jets, and hypersonic air jets. The projection schlieren system is portable and has an adjustable focus and an adjustable field of view.

NASA Application(s):

Applications exist in all forms of research and development associated with flow fields where schlieren viewing could be useful, including aero-optics, flow control, drag, boundary layer transition, and flow separation. The proposed developments could be extremely important in enhancing ground test facility capability.

Non-NASA Commercial Application(s):

Potential commercial applications include aero-optics, flow diagnostics, flow control, free-space laser communication, active laser imaging, high bandwidth video transmission, spectroscopy, and high-resolution imaging.

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