PHASE 2 PROJECT SUMMARY

Firm:	**MetroLaser, Inc.**
Contract Number:	**NNX09CA26C**
Project Title:	**An All Electronic, Adaptive, Focusing Schlieren System for Flight Research**

Identification and Significance of Innovation

Schlieren imaging uses the distorting effect of a flow field upon images of light sources behind the flow field to visualize the flow field itself. Because schlieren imaging provides important insights for understanding aerodynamic flowfields, considerable interest exists in imaging the flow field around full sized aircraft in flight. The source of light for such schlieren images can be the sun, moon, clouds, stars, or structures on the ground. The goal of this project was to develop the next generation of schlieren for Aircraft in Flight (SAF) systems taking advantage of the very latest in electronic imaging hardware and software. The project resulted in the development of a novel and revolutionary SAF system that is far superior to conventional SAF systems in versatility, applicability, reliability, and quality of data.

Technical Objectives and Work Plan

1. Develop the next generation of Schlieren for Aircraft in Flight systems using electronic imaging technology.
2. Design and construct a versatile prototype SAF system that can be employed for developing ground-to-air, air-to-air, and SAF arrays.
3. Develop robust and flexible software both for instrument control and for synthetic TDI analysis of video.
4. Demonstrate field applications of SAF for visualizing shock waves generated by supersonic aircraft as well as other aircraft generated flow fields.

Technical Accomplishments

1. Developed and demonstrated a novel synthetic time delay and integration concept that is superior to existing methods for schlieren for aircraft in flight applications.
2. Developed a unique polar analysis schlieren (PASS) concept for SAF data reduction that produces high quality, high resolution SAF images.
3. Constructed and fielded two SAF systems.
4. Demonstrated ground-to-air SAF on full-size aircraft.

NASA Application(s)

Flight testing is often used as a final critical check of the aerodynamic designs developed by computational and wind tunnel methods because the amount of reliable information obtainable in wind tunnels is somewhat limited and subject to interference. Outdoor schlieren systems using naturally available or dynamically changing backgrounds make it possible to examine shock waves and other phenomena from aircraft in flight. The proposed developments could be extremely important in flight-testing, where few such instruments can perform in a flight environment.

PHASE 2 PROJECT SUMMARY, continued

Non-NASA Commercial Application(s)

Applications exist in all forms of research and development associated with turbulent flow fields, including aero-optics, flow control, drag, boundary layer transition, and flow separation. 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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