

PHASE I PROJECT SUMMARY

Firm: Michigan Aerospace Corporation

Contract Number: NNX12CD70P

Project Title: Optical Mach Probe

Identification and Significance of Innovation

Michigan Aerospace Corporation has designed and analyzed a system to simultaneously measure velocity, temperature and density in high speed flows up to 3987 m/s and temperatures from 200 to 800 K. The proposed system has a CRLB about 1.6 times better than current state of the art systems using PMTs and can produce samples at up to 100 kHz.

Technical Objectives and Work Plan:

During the course of this Phase I project, Michigan Aerospace performed: A requirements analysis to determine the needs of the instrument and its specific optical configurations; An initial optical, electrical, and mechanical design and simulation of a prototype instrument; Performed trade studies for various architecture and inversion strategies.

Technical Accomplishments:

MAC has designed and analyzed a system to simultaneously measure velocity, temperature and density in high speed flows up to 3987 m/s and temperatures from 200 to 800 K. The proposed system has a CRLB about 1.6 times better than current state of the art systems using PMTs and can produce samples at up to 100 kHz.

NASA Application(s):

The proposed instrument will be useful at aerospace ground and flight research support facilities for characterizing and understanding of the complex flow behavior in terms of flow quality, turbulence intensity, and Mach number measured up to and including hypersonic speed regimes. The probe also could be used for on-board monitoring of propulsion processes as well as in aiding the development of new computational models. Detecting and studying atmospheric turbulence will also be possible.

Non-NASA Commercial Application(s):

Other organizations (US Air Force, US Navy, etc.) and prime contractors will have similar uses for this technology. Commercial and military aircraft turbulence warning with optical air data system capability. Technology can be applied to turbulence warning and wind mapping for ground applications, such as for wind farms and military artillery and other fire-control activities.

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