



MHz Frame Rate Imaging System for Optical Velocimetry Measurements

Technology

The National Aeronautics and Space Administration (NASA) seeks to transfer a NASA-developed MHz repetition rate imaging system designed to provide nonintrusive planar velocimetry measurements in unsteady high-speed flow environments.

Benefits

- Pulse burst mode laser provides high-energy laser pulses with highly flexible interpulse time separations
- MHz frame rate camera system with high spatial resolution and large dynamic range
- Direct measurement of unsteady flow-field properties can be used to verify computational fluid dynamics (CFD) codes.

Commercial Applications

- Quantitative light-scattering-based planar velocimetry measurement including Digital Particle Image Velocimetry (DPIV) and Planar Doppler Velocimetry (PDV)
- Unsteady short-duration aeronautic and propulsion testing in wind tunnels, engines, and flight hardware

Technology Description

The imaging system comprises a MHz repetition rate pulse burst mode laser built in-house and a commercial MHz framing rate charge-coupled device (CCD) camera. The laser, containing six flashlamp-pumped Nd: YAG amplifier stages, is capable of producing a burst train of high-energy

pulses (on the order of 10) of approximately 10 ns duration, each with interpulse spacings ranging between 500 to 20 000 ns. Individual pulse energies exceeding 75 mJ per pulse (at 532 nm) have been demonstrated. The nominal flashlamp repetition rate is 5 Hz.

Specific laser features include the use of precision matched Pockels cells for pulse train generation, a phase conjugate mirror for pedestal removal and integrated temperature stabilization for thermally sensitive components.

The camera, having a single optical input, comprises an internal image splitter unit and four individual intensified frame-straddling CCD camera modules. Each module has a high bit depth (12 bits per pixel) high-resolution (1280 × 1024 pixel) CCD image sensor. The intensifiers provide interframing



MHz repetition rate pulse burst mode laser.

times down to 500 ns, allowing for a sequence of eight full resolution frames to be acquired in rapid succession.

The combined laser and camera system provides image rates ranging from 75 KHz up to 2 MHz, suitable for use in high-speed unsteady light-scattering-based velocimetry measurement techniques.

Options for Commercialization

One of NASA's missions is to commercialize its technology. The NASA Glenn Research Center is interested in commercializing the MHz repetition rate pulse burst mode laser and MHz frame rate imaging system. Additionally, new applications are being sought for this technology. The NASA Glenn

Research Center is willing to demonstrate the technology and assist in the characterization of the laser pulse frequency content for future spectroscopic applications.

Contact

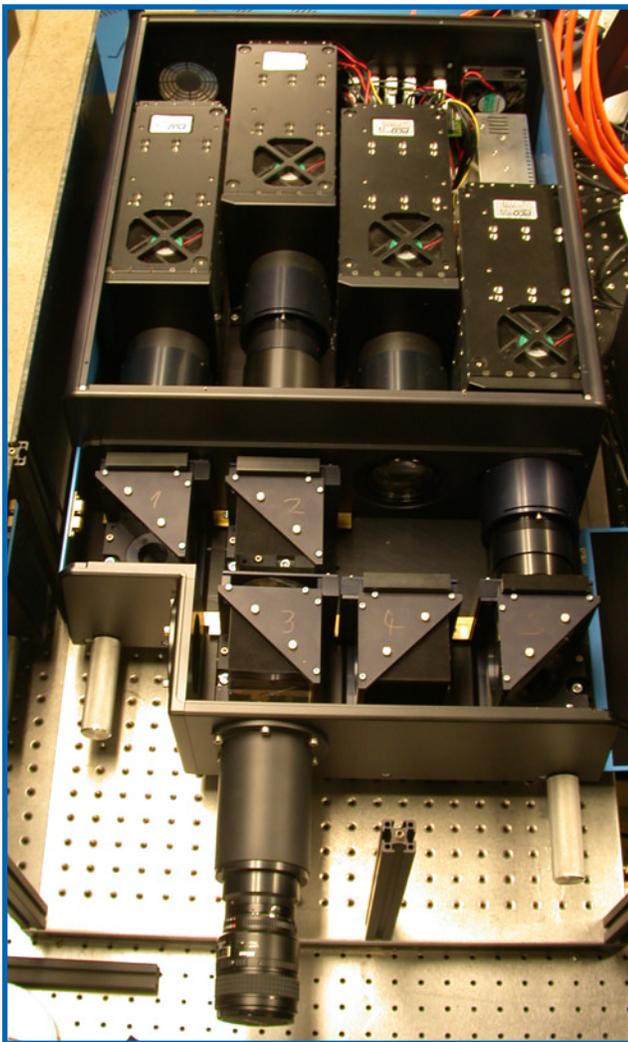
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References

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Key Words

MHz repetition rate laser
Pulse burst mode laser
MHz frame rate camera
MHz frame rate imaging system
High-speed velocimetry
Particle Image Velocimetry
Planar Doppler Velocimetry



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