An innovative new technique for path resolved laser doppler velocimetry is being developed that uses a continuous wave (CW) source. The use of a CW rather than the conventional pulsed laser should result in a light, compact, rugged and more reliable LDV system suitable for use in both spacecraft and aircraft. In addition, the use of multiple CW beams and complimentary pseudo random codes should allow the vector wind to be measured without scanning the beams. Potential applications are global remote sensing of atmospheric winds, wind shear and turbulence detection and primary air instrumentation. In order to obtain range resolved wind and develop the required signal to noise ratio, pseudo random, diphase modulation of the laser and a novel detection scheme has been used. Additional applications for this lidar system are path resolved optical remote sensing of chemical species (DIAL), temperature and pressure.
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AUTHORS OF REPORT: J. Fred Holmes

LIST OF MANUSCRIPTS SUBMITTED OR PUBLISHED UNDER ARO SPONSORSHIP DURING THIS REPORTING PERIOD, INCLUDING JOURNAL REFERENCES:

J. Fred Holmes and Badih J. Rask, “Optimum, optical local oscillator levels for coherent detection using photodiodes,” submitted to Applied Optics, September 1993; accepted for publication.

J. Fred Holmes, John S. Peacock and Douglas C. Draper, “Optical remote sensing of surface roughness through the turbulent atmosphere,” submitted to Applied Optics, August 1993; accepted for publication.


8. SCIENTIFIC PERSONNEL SUPPORTED BY THIS PROJECT AND DEGREES AWARDED DURING THIS REPORTING PERIOD:

Dr. J. Fred Holmes (Faculty)
Mr. John M. Hunt (Senior Engineer)
Mr. Badih Rask (Ph.D. Student)
Mr. Feng Chen (Ph.D. Student)
Ms. Chunyan Zhou (Ph.D. Student)
Ms. Li Lin (Undergraduate Student Research Assistant)
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Mr. Brian McAleer (Undergraduate Student Research Assistant)

9. REPORT OF INVENTIONS (BY TITLE ONLY):

NONE

10. PROJECT SUMMARY

An innovative new technique for path resolved laser doppler velocimetry is being developed that uses a continuous wave (CW) source. The use of a CW rather than the conventional pulsed laser should result in a light, compact, rugged and more reliable LDV system suitable for use in both spacecraft and aircraft. In addition, the use of multiple CW beams and complimentary pseudo random codes should allow the vector wind to be measured without scanning the beams. Potential applications are global remote sensing of atmospheric winds, wind shear and turbulence detection and primary air instrumentation. In order to obtain range
resolved wind and develop the required signal to noise ratio, pseudo random, diphase modulation of the laser and a novel detection scheme has been used. Additional applications for this lidar system are path resolved optical remote sensing of chemical species (DIAL), temperature and pressure.

11. HIGHLIGHTS

- First successful operation of a CW, pseudo random code (PRC) modulated, range resolved, coherent Lidar.

- First path resolved measurements of radial atmospheric winds using the Doppler shift induced by moving aerosols and using a CW, PRC modulated, coherent lidar.

- First path resolved measurements of atmospheric cross winds using speckle-turbulence interaction and a CW, PRC modulated, coherent lidar.

- Verified experimentally that speckle phase decorrelation does not necessarily restrict the averaging time that can be used to recover the signal from a coherent Lidar. This result is contrary to popular opinion and could potentially have a significant impact on Coherent Lidar System design.

- Invited to organize a symposium on Optical Remote Sensing and to give an invited paper on this new Lidar System at the SPIE meeting on Atmospheric Propagation and Remote Sensing III, April 5-8, 1994, Orlando, Florida.

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