PROGRESS IN COHERENT LASER RADAR

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Considerable progress with coherent laser radar has been made over the last few years - most notably perhaps in the available range of high-performance devices and components and the confidence with which systems may now be taken into the field for prolonged periods of operation. Something of this increasing maturity was evident at the 3rd Topical Meeting on Coherent Laser Radar: Technology and Applications (3CLRM), which was held at Great Malvern last summer. As a matter of policy this series of meetings has sought to bring together the device physicists, the system builders and the end users. The conference attendance was well above expectation with 135 registrants, nearly one quarter from North America. Equipment, both systems and components, was shown by 7 industrial firms and 61 papers were given.

Presentation of their work was made by representatives from leading institutions in Canada, France, Great Britain, The Netherlands, Sweden, United States and West Germany. Topics included: mesoscale wind fields, nocturnal valley drainage and clear-air down bursts; airborne Doppler lidar studies and comparison of ground and airborne wind measurement; wind measurement over the sea for comparison with satellite-borne microwave sensors; transport of wake vortices at airfields; coherent DIAL methods; a newly assembled Nd-YAG coherent lidar system; backscatter profiles in the atmosphere and wavelength dependence over the 9-11 μm region; beam propagation; rock and soil classification with an airborne 4-laser system (LIMES); technology of a global wind profiling system; target calibration; ranging and imaging with coherent pulsed and CW systems; signal fluctuations and speckle. Some of these activities will be briefly outlined and reviewed.

On the device physics side a wide range of continuous wave CO_2 lasers, both conventional cavity and waveguide, and RF and DC excited, are now available from several manufacturers, with power levels between 3 and 20 Watts and with good stability and lifetime. Particularly valuable progress has been made with CO_2 oxidation catalysts for extending pulse laser lifetime; tin oxide base material impregnated with platinum and palladium salts is available in different forms and shows high activity. Recent improvements in extra-cavity acousto-optic modulators include increased optical power handling, reduced acoustic back reflection level and easier optical alignment. Detector advances include thermoelectric cooling of a packaged p-type CMT photoconductor device to produce a heterodyne NEP better than 2×10^{-19} W Hz^{-1} and bandwidth of 100 MHz.

During the past 12 months two international working groups have been set up to study aspects of laser sensing from space; both are due to report in the early autumn. ESA established the Space Laser Sounding and Ranging Working Group which has now met on three occasions with a broad brief to consider a wide range of possible tasks. The first meeting of the NASA Working Group on Laser Atmospheric Wind Sounding (LAWS) was held in April 1986 and is aiming more specifically at global wind measurement in the troposphere.

In recent work at RSRE the program of flight trials with the Laser True Airspeed System (LATAS) has continued through the winter and spring. This equipment after four years still shows reliable and efficient performance. It is planned to discuss recent backscatter measurements in the atmosphere at altitudes to 13 km, including flights made north of Tromso in the Arctic Circle, and a series of three flights made in conjunction with passage of the SAGE II limb sounding satellite over the UK in April 1986. The LATAS equipment is now being installed in a Canberra aircraft which will allow flights of greater duration and to greater altitude.