Conference Abstracts

November 4-7, 1975

7th INTERNATIONAL LASER RADAR CONFERENCE

Sponsored by:

COMMITTEE ON LASER ATMOSPHERIC STUDIES
AMERICAN METEOROLOGICAL SOCIETY

STANFORD RESEARCH INSTITUTE
Menlo Park, California 94025 · U.S.A.

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- Organized under the auspices of:
  The Committee of Laser Atmospheric Studies (CLAS)
  of the American Meteorological Society
- Hosted by:
  Stanford Research Institute
  Menlo Park, California

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LASER RADAR SYSTEMS IN JAPAN

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A brief review of recent progress of research and development of the laser radar technology and systems together with their applications in Japan will be given.

Research and development of laser radars in Japan, as one of major fields of laser applications, have been primarily concerned with atmospheric studies through various kinds of scattering in the troposphere, stratosphere and upper atmosphere, along with ranging, detection, transmission and their equipment and system problems. They have been continued in Japan since 1964 when the first laser radar equipment employing a Q-switched ruby laser was installed by a group of Tohoku University, Sendai, and then, shortly after, by Radio Research Laboratories, Tokyo. Several research groups, including Meteorological Research Institute, Tokyo Astronomical Observatory, Technical Research and Development Institute of Japan Defence Agency, and a few universities, and some industrial companies have also been assoicated with them after this initial period.

From some years ago, much of the interest in studying and developing of laser radar techniques was concentrated on the range-resolved and/or trace measurements of atmospheric pollution and also the remote sensing of humidity and temperature. They are capable of analyzing the species and the concentration of molecules and atoms in the atmosphere based on the spectroscopic method accomplished with the optical interactions with matters such as Raman scattering, fluorescence and resonant absorption. There are appreciable activities for these subjects contributed from Tohoku University, Kyushu University, University of Tokyo, Radio Research Laboratories, Air Pollution and Atmospheric Research Co. Ltd., Mitsubishi Electric Corporation, and Tokyo Shibaura Electric Co. Ltd.

In parallel to these activities based on the spectroscopic laser radar schemes, the laser atmospheric studies by means of elastic Mie backscattering such as aerosol scattering in the troposphere and stratosphere, atmospheric attenuation, visibility, turbidity, atmospheric convection, diffusion and fluctuation are also performed. They are mostly associated with research groups in universities and national institutions such as Hokkaido, Tohoku, Nagoya, Kyoto, Osaka, Kyushu Universities, Meteorological Research Institute, Radio Research Laboratories, and Research Institute for Pollution and Resources, and also with some companies including Nippon Electric Co. Ltd., Tokyo Shibaura Electric Co. Ltd., Mitsubishi Electric Corporation, and Japan Radio Co. Ltd.

Moreover, continuous efforts are being devoted to the development of high power lasers and frequency tunable lasers suitable for the laser radar transmitter in the wavelength region from near ultraviolet to infrared. Studies of signal detection based on the digital regime, monostatic and bistatic optical techniques as well as data processing and displays are also being pursued from the systems point of view. For an example, a laser radar system using a frequency-doubled Nd:YAG laser for simultaneous measurement and processing of multiple atmospheric parameters such as humidity, visibility or extinction coefficient, Mie backscattering coefficient, Raman backscatter from atmospheric nitrogen, and so on has been developed and operated by Tohoku University. This system accommodating with on-line data processing has demonstrated to increase substantially the potentiality of laser radar systems for laser atmospheric remote sensing.

Besides these research and development primarily concerned with atmospheric probing and pollution detection, some works should also be noted involved in tracking, position and velocity measurements, and lunar laser ranging experiment which are being carried out by Hitachi Ltd., University of Tokyo, and Tokyo Astronomical Observatory in connection with Geographical Survey Institute and Hydrographic Department of Maritime Safety Agency.

LASER RADAR ACTIVITIES OF NASA LANGLEY'S ENVIRONMENTAL AND SPACE SCIENCES DIVISION

G. Burton Northam
NASA Langley Research Center, Hampton, Va.

ABSTRACT

The Environmental and Space Sciences Division at NASA Langley Research Center is engaged in a number of in-house and contracted programs to develop, evaluate, and apply LIDAR techniques to the remote measurement of pollutant molecules, trace gases, and physical processes.

These projects vary from the calibration of a ruby excited Raman LIDAR to measure 500 to 1000 ppm SO_2 at a stack exit to the evaluation of the capability of LIDAR to make environmental measurements from the Space Shuttle orbiting 200 km above the Earth.

A UV differential absorption LIDAR system has been used to measure SO_2 in the atmosphere 250 m downwind from the local heating plant. Average concentrations over the measurement path ranged from 15 to 150 ppb.

A ruby pumped dye laser LIDAR has been assembled to conduct H_2O vapor differential absorption measurements in the 715 to 740 nm region with an output line width of 0.01 nm with an energy of 10 millijoules. In the current experiments, part of the ruby beam is being simultaneously propagated and used as the reference wavelength.

The Langley Research Center 48-Inch mobile LIDAR has been used by the Environmental and Space Sciences Division to study the horizontal and vertical dispersion and decay of the stratospheric aerosol layer resulting from Fuego as the aerosol layer was transported over Hampton, Virginia.

A tunable dye laser pumped by a frequency doubled ruby laser is currently being assembled to provide nearly simultaneous two wavelength propagation to evaluate the effects of atmospheric scintillation on differential absorption measurements. The time between the double pulses of the ruby laser can be varied from a few to 400 microseconds with a pockel cell being used in the dye laser cavity to switch the lasing from one tuning element to the other between pulses of the pump laser. These measurements will be made using NO_2 in a 20 m long by 2 m diameter open-ended calibration chamber, located 300 m from the laser, that allows for simultaneous measurement of the NO_2 concentration.

7th INTERNATIONAL LASER RADAR CONFERENCE

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Ontario, Canada

Tuesday, November 4
2:00-3:30 p.m.
Session 2: Spectroscopic Lidar Techniques I

Chairman: Dr. H. Inaba, Tohoku University, Sendai, Japan

Tuesday, November 4
3:45-5:15 p.m.
Session 3: Spectroscopic Lidar Techniques II

Chairman: Dr. C. M. Penney, General Electric Company, Schenectady, New York

Wednesday, November 5
9:00-10:45 a.m.
Session 4: Stratospheric Observations

Chairman: Dr. M. P. McCormick, National Aeronautics and Space Administration, Hampton, Virginia

Wednesday, November
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Session 5: Meteorological Lidars and Observations

Chairman: Dr. G.W. Grams, National Center for Atmospheric Research, Boulder, Colorado

Thursday, November 6
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Session 6: Tropospheric Scattering Studies I

Chairman: Dr. E. E. Uthe, Stanford Research Institute, Menlo Park, California

Thursday, November 6
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Session 7: Tropospheric Scattering Studies II

Chairman: Dr. R. M. Schotland, University of Arizona, Tucson, Arizona

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Chairman: Dr. J. Weinman, University of Wisconsin, Madison, Wisconsin

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Chairman: Dr. A. C. Holland, NASA, Wallops Island, Virginia

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Session 10: Aerosol Scattering Studies

Chairman: Dr. B. M. Herman, University of Arizona, Tucson, Arizona

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Session 11: Business/Activities of CLAS/Post-Deadline Papers

Chairman: Dr. Vernon Derr, National Oceanic and Atmospheric Administration, Boulder, Colorado

Progress on Lidar Atmospheric Applications Handbook
N.L. Abshire, M.J. Post, and V.E. Derr
NOAA, Boulder, Colorado