RESEARCH AND DEVELOPMENT OF LASER RADARS IN JAPAN

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A general survey of recent research and development of the laser radar technology and its applications to various fields in Japan will be presented.

In Japan, laser radar studies has been continued since 1964 when the first laser radar equipment using a Q-switched ruby laser was constructed by a group of Tohoku University, Sendai, and then, shortly after, by Radio Research Laboratories, Tokyo. Several research groups including Meteorological Research Institute, Osaka University, Tokyo Astronomical Observatory, Technical Research and Development Institute of Japan Defence Agency and a few industrial companies have also been associated with the research and development of laser radars and their applications after this initial period. They have been primarily concerned with tropospheric scattering and upper atmospheric studies along with ranging, detection, transmission and their equipment problems.

From 1969, much of the interest in studying and developing of laser radars was concentrated on the remote sensing of atmospheric pollution based upon the spectroscopic method such as Raman scattering, fluoresence and resonant absorption. There are appreciable activities for developing and operating mobile monitoring systems equipped with laser radars and also laser monitoring systems to be installed in stations of the Environment Agency and in Environmental Monitoring Centers in each Prefectures in Japan.

Continuous efforts are also being devoted to the development of high power lasers and frequency tunable lasers suitable for the laser radar transmitter, signal detection, monostatic and bistatic optical techniques, data processing and displays as well as aerosol scattering studies in the troposphere and stratosphere, remote sensing of atmo-

spheric parameters such as humidity, temperature, visibility and turbidity, observations of atmospheric convection, diffusion and fluctuation and the upper atmosphere and space measurements.

On the basis of these laser radar activities in Japan, the First National Laser Radar Symposium was held in Sakunami Spa, Miyagi near Sendai, July 25, 1972 (24 papers presented and 70 attendants), and the Second National Laser Radar Symposium in Yokohama, July 24 and 25, 1973 (26 papers presented and 115 attendants) organized by the Japanese Committee on Laser Radar Studies. Also, the Committee for Fundamental Studies and Applications on Laser Radars (Chaired by H. Inaba) was established in 1973 supported by the Grant-in-Aid for Scientific Research from the Ministry of Education of Japan, which steers a research group including almost all workers in the field of laser radars.

The following list enumerates universities, institutions and industrial companies actually involved in research and development of laser radars in Japan:

* Research Institute of Applied Electricity, Hokkaido University, Sapporo.
* Research Institute of Electrical Communication, Tohoku University, and Upper Atmosphere and Space Research Laboratory, Tohoku University, Sendai.
* Institute of Industrial Science, University of Tokyo, and Tokyo Astronomical Observatory, University of Tokyo, Tokyo.
* Water Research Institute, Nagoya University, and Department of Electronic Engineering, Faculty of Engineering, Nagoya University, Nagoya.
* Department of Electrical Engineering, Faculty of Engineering, and Department of Electrical Engineering, Faculty of Engineering Science, Osaka University, Osaka.
* Research Reactor Institute, Kyoto University, Kumatori, Osaka.
* Department of Physics, Faculty of Science, Kyushu University, Fukuoka.

* Radio Research Laboratories, Ministry of Posts and Telecommunication, Koganei, Tokyo.
* Meteorolgical Research Institute, Japan Meteorological Agency, Tokyo.
* Electrotechnical Laboratory, Ministry of International Trade and Industry, Tanshi, Tokyo.
* National Research Institute for Pollution and Resources, Ministry of International Trade and Industry, Tokyo.
* Technical Research and Development Institute, Japan Defence Agency, Tokyo.
* Geographical Survey Institute, Ministry of Construction, Tokyo.
* Hydrographic Department, Maritime Safety Agency, Tokyo.
* Japan Meteorological Association, Tokyo.

* Air Pollution and Atmospheric Research Co. Ltd., Tokyo.
* Hitachi Ltd., Totsuka Works, Yokohama, and Central Research Laboratory, Kokubunji, Tokyo.
* Japan Electron Optics Laboratory Co. Ltd., Akishima, Tokyo.
* Japan Radio Co. Ltd., Research Laboratory, Mitaka, Tokyo.
* Meisei Denki Co. Ltd., Tokyo.
* Mitsubishi Electric Corporation, Kamakura Works, Kamakura.
* Nippon Electric Co. Ltd., Central Research Laboratory, Kawasaki, and Fuchu Works, Fuchu, Tokyo.
* Oki Electric Industry Co. Ltd., Tokyo.
* Sharp Corporation, Osaka.
* Tokyo Shibaura Electric Co. Ltd., Research and Development Center, Kawasaki, and Instrument and Automatic Division, Fuchu, Tokyo.