

# Space Lidar Activities in Japan

Kazuhiro Asai

Tohoku Institutes of Technology

Yagiyama Kasumi 35-1 , Taihaku-Ku, Sendai 982, JAPAN

## 1. INTRODUCTION

The earth observations using satellite remote sensing technique are very important in understanding of the global environment and predicting future environmental changes. Especially, it is strongly expected that the lidar will become a key remote sensor for the global measurement from space to understand the atmosphere. Therefore, researches regarding this key sensor are truthfully required.

National Space Development Agency of Japan(NASDA) has entrusted the study for the purpose of developing a plan for the direction in which we should proceed with Japan's earth observation program in the next 15 to 20 years to Remote Sensing Technology Center of Japan(RESTEC). "Earth Environment Observation Committee" has been organized by RESTEC. Lidar Instrument Panel is involved in it. This panel has been discussing on important problems from the point of view of satellite-borne lidar in various fields, e.g. laser technologies, transmitting-receiving optics, electronics etc.

In this paper, we would like to present summaries with respect to Japan's long-range scenario for the earth observation by the space lidar, based on the results of the Instrument Panel's deliberations. We also like to talk some efforts directed to space lidar technologies in Tsukuba Space Center of NASDA, National Institutes and Universities.

## 2. Japan's long-range scenario for the space lidar

Japan's long-range scenario for the earth observation by the space lidar is shown in Fig.1. NASDA has recently succeeded to develop the H-II launch vehicle as NASDA's main space transportation system in the 1990's to meet the demand for larger satellite launches. On the other hand, NASDA has also been developing the three-stage launch vehicle using Solid Rocket Booster (SRB) of H-II called as J-1, in cooperation with the Institute of Space and Astronautical Science(ISAS) to launch small satellites. The basic J-1 has a launching capability of a payload weight of 800Kg in a circular orbit altitude of 300 Km with an orbit inclination of 30 degrees at low cost in a short time.

According to this scenario, first Japan's space lidar called as an experimental backscatter lidar (E-Lidar) will be launched by J-1 in the end of 1990's. Preliminary flight experiments for DIAL and Japanese Laser Atmospheric Wind Sounder (J-LAWS) are also planned to be launched by J-1 in the 2000's.

## 3. Activities toward space lidar

Tsukuba Space Center of NASDA started the development of lidar three years ago. They have directed their initial efforts to the development of diode laser

pumped Nd:YAG /and Nd:YLF laser with a high wall plug-in efficiency and a high output power. They could achieve an average power of 5 watts with a repetition rate of 50 Hz and the electrical efficiency of more than 8%. A light weight receiving telescope was also designed and fabricated. NASDA/TKSC will start several flight operations with this lidar system soon.

Feasibility studies of E-lidar have been mainly conducted by National Institute of Environment Studies (NIES). Lidar group and meteorological scientists in Japan have discussed on science objectives for the E lidar in the Japanese platform perspective.

DIAL can measure the vertical profiles of water vapor with a high vertical resolution. The data surely improve understanding of the global hydrological cycle, the global atmospheric energy budget and the the global atmospheric circulation. Basic research regard as DIAL was begun in Meteorological Research Institute(MRI). Their system configuration consists in two Ti:Sapphire lasers pumped by two DL pumped Nd:YAG lasers.

Communication Research Laboratories(CRL) has been studying on 2 μ coherent lidar in cooperation with Tohoku Institute of Technology (TIT). We are now developing on the DL pumped Tm:YAG laser transmitter. A preliminary flight experiment using the lidar system is planed in the end of 1995.

CRL has been also carrying on a laser altimeter using a doubled Nd;YAG laser pumped by DL. The measurement accuracy of the system is less than 10 cm on the ground. They had two preliminary flight operations in the sky of sea ice at Hokkaido in 1994.

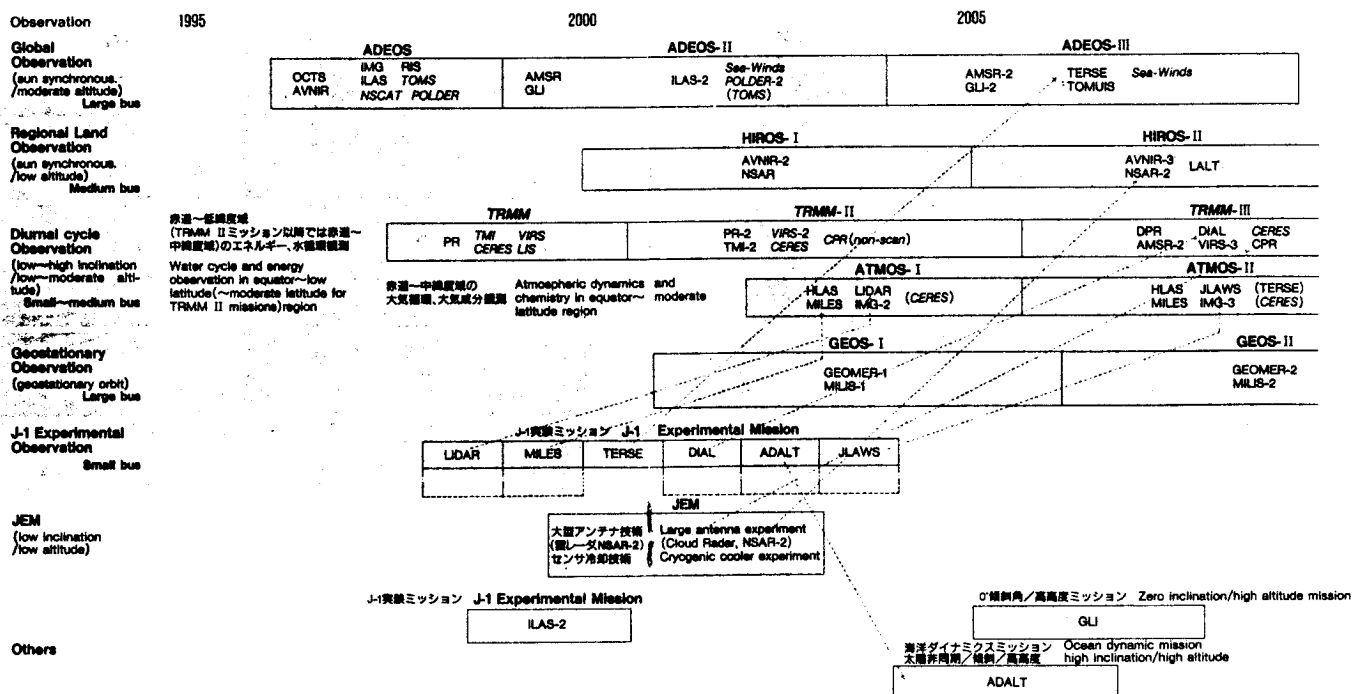


Table 1 Japan's long-range scenario for the earth observation by the space lidar