Status of MDS-lidar (ELISE) project

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This presentation summarized the status of MDS-lidar project, in which a Mie scattering lidar will be developed for a Mission Demonstration Satellite to be launched in early 2000's with primary objectives of demonstrating technical feasibilities of a space-borne lidar. The project also aims at gathering scientific data on clouds and aerosol distribution. Main targets of the MDS-lidar atmospheric measurements are 1) high altitude clouds distribution, 2) multiple layered clouds, and 3) aerosol distributions.

The project consists of several parts covering from lidar equipment development, technical feasibility demonstration experiments, data reduction algorithm studies, data processing software development, validation experiments/analyses, to scientific application. Engineers of NASDA and scientists at universities and national institutes have been and will be working jointly to achieve these.

The fundamental specifications ofthe MDS-lidar is briefly described in Figure 1. The lidar consists of an ND:YLF laser with a fundamental (1053 nm) and a secondary harmonics (527 nm) wavelengths, a large-aperture receiving telescope of one-meter diameter. Three channels of detector systems are employed with one analog-mode detection for 1053 nm signal, and two photon counting detection for 1053 and 527 nm signals (Figure 2). The analog mode is used for measuring mainly clouds during daytime and nighttime. The photon counting detection is applied mainly for aerosol measurements. Wavelength dependence data is expected to derive size distribution information. Figure 3 shows the layout of instruments. The develoment schedule is shown in Figure 4.

A scientist group will be established to conduct researches necessary for the project. Algorithms, observation strategy, data utilization to climate model studies, and so on will be investigated in the scientist group (Figure 5 and 6). Validation experiments must be appropriately designed and executed. It will be a matter of future discussion and negotiation to officially invite foreign scientists to the scientist group activities. International collaboration, however, will be indispensable to the success of the project.

ELISE The performance of Laser transmitter

	Fundamental	SHG
Laser	LD pumped Q-switch Nd:YLF laser + KTP	
Wavelength	1053 nm	527 nm
Output energy	84 mJ	10 mJ
PRF	100 pps	
Pulse width	40 ns	
Beam divergence	0.17 mrad	
Beam quality	Low order Gaussian beam	
Life time	$\geqq 3 \times 10^9$ shots	

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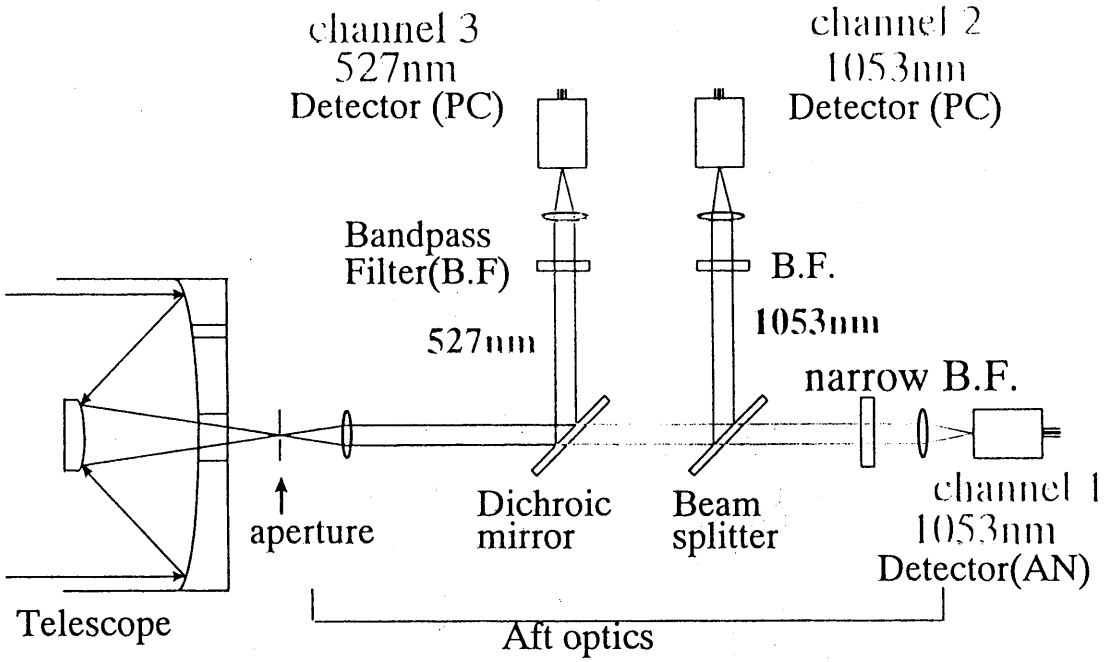
ELISE The Schematic diagram of Receiver



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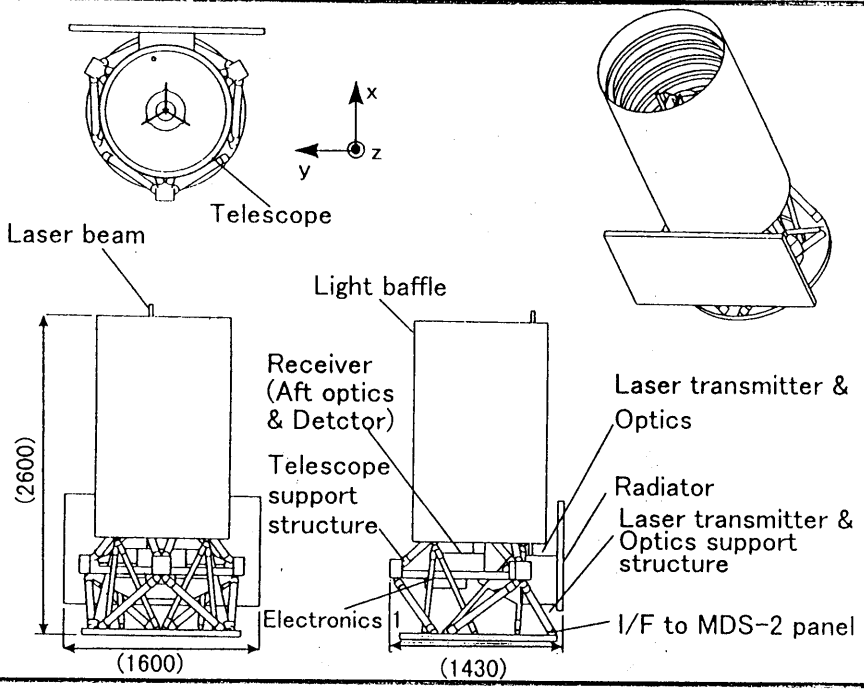
ELISE

ELISE instrument layout



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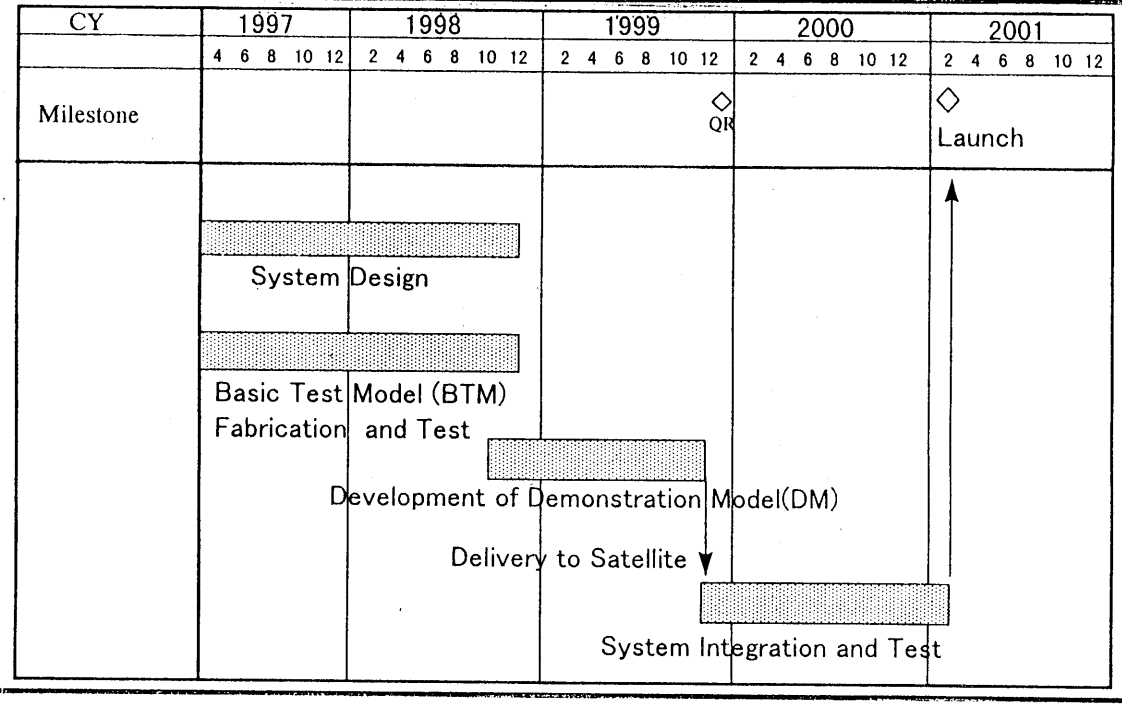
ELISE

The Schedule of the development of ELISE



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Research fields

- Climatological (statistical) analysis of upper clouds and cirrus clouds

- Identification and climatological (statistical) analysis of the vertical distribution and multi-layer structure of clouds

- Identification of clouds and the radiation balance by conducting simultaneous ground-based observations

- Research on the formation process of cirrus clouds, such as validation of a formation process model, by understanding the structure of cirrus clouds

- Wide-area three-dimensional distribution of tropospheric aerosols

- Wide-area distribution of stratospheric aerosols and the atmospheric circulation

Researches to be conducted by the Science Team

1) Research on the methods of data processing and analysis
   - Evaluation of the multiple scattering effect
   - Calibration methods (matching method, sea/ground surface clutter)
   - Quantitative analysis method (optical thickness of clouds)
   - Utilization of multiple wavelength data (data on the size of aerosols)

2) Ground-based observations
   - Development of lidar for validation
   - Validation observation and analysis
   - Simultaneous ground-based and aircraft observations, and analysis

3) Research on observational strategies
   - Study on the observational strategies for constructing a global data set that is statistically useful
   - Feasibility study on combination analysis using observational data acquired by other radiometric observation instruments

4) Effective utilization of lidar data on clouds by climate models
   - Analysis of the relations between clouds and the radiation balance
   - Improvement of climate models