P2-33 **Present Status of JEM-borne Coherent Doppler Lidar**

Toshikazu Itabe, Kohei Mizutani, Mitsuo Ishizu# and Kazuhiro Asai*
Communications Research Laboratory
Ministry of Posts and Telecommunications
Nukui-kita, 4-2-1, Koganei, Tokyo 184-8795, JAPAN
Tel;+81-42-327-7546 and 6955, Fac:+81-42-327-6692 and 6667
E-mail : itabe@crl.go.jp,mizutani@crl.go.jp

Electronic and Information Technology Lab.
Office of Research and Developmen
NASDA
2-1-1,Sengen,Tsukuba, Ibaragi, 305-0047, JAPAN
E-mail : Ishizu.Mitsuo@nasda.go.jp

*Tohoku Institutes of Technology
Yagiyama Kasumi 35-1 , Taihaku-Ku, Sendai 982-, JAPAN
E-mail : asai@titan.tohtech.ac.jp

1 Introduction

Global wind measurement is crucially important for both Numerical Weather Prediction and studies on the global climate as meaning of the initial state p problem. Temperature and humidity profiles and surface pressure in addition to the wind height profile are needed for the initial state condition for the Numerical Weather Prediction and the global climate model. The wind height profiles are now available only from a global network of radio sonde observations. Very little information about the height profiles of the horizontal wind field is available from the ocean, in the tropics and in the southern hemisphere. If the present data deficiency of the global wind could be solved, it is believed that the Numerical Weather Prediction and the global climate model will be improved dramatically. Now, measurement of the wind profile in the troposphere from space can be realized only by using the Doppler lidar in space.

There are two method to measure the atmospheric wind with the Doppler lidar from space. One of them is a coherent Doppler and another an incoherent one. The resources of the incoherent Doppler lidar is too big to install in a standard payload of the ISS/JEM of which envelope are 850mm x 1000mm x 1850mm. We consider that the coherent Doppler lidar is the only one candidate for ISS/JEM.

A program of Japan for development of the coherent Doppler lidar in space was started by Communications Research Laboratories (CRL) from 1997 FY under the support of one of the Phase II studies of Ground Research Announcement of NASDA and Japan Space Forum. Objective of the program is to make a feasibility study of the coherent Doppler lidar for ISS/JEM. The coherent Doppler lidar will be designed to installed in a standard payload of 2nd ISS/JEM mission. The mission of this lidar is made a demonstration of the wind measurements from space.

2 A Coherent Doppler Lidar for ISS/JEM

The JEM/CDL will be packed in one of the standard payloads of ISS/JEM and is now under a phase of the feasibility study. Present characteristics of the coherent Doppler lidar are shown in table.1.

Table 1 Characteristics of ISS/JEM-borne CDL

Transmitting Laser	Tm.Ho:YLF (λ :2.06 μ m), Osc.-Amp. Laser
Output	2 Joule
Repetition	10pps
Wall-plug efficiency	over 2% (Electrical-optical efficiency)
Telescope system	Diameter 40cm The following ways are considered 1) Si-wedge step scanner with one telescope 2) ste[side-scanning with two telescopes 3) two telescopes directed to two different fixed angles

Telescope system will be selected one of them in near future. The Si-wedge scanner is the same one of the SPARCLE of NASA as shown in fig.1.

The side-scanning is used two telescopes. One of the telescopes of the side-scanning will be installed to look forward at the angle of 60 degrees from the direction of ISS movement and another to look backward at the same angle as shown in schematically in fig2. The both telescopes will be step-swung from 6 to 30 degrees around the direction of ISS movement.

The third scanning way is to use two telescopes, which are directed to different fixed angles. So the third way is no-scanning one. Now, trade-off of three telescope systems is in under way.

LOS wind error is estimated by using an equation of the pulse-pair algorithm (Zrnic, 1979, Kane, 1984). The lidar parameters shown in table 1 and total optical efficiency including the heterodyne efficiency is assumed as 0.04. The following aerosol height profiles is used in the calculation of the LOS wind error of JEM/CDL.

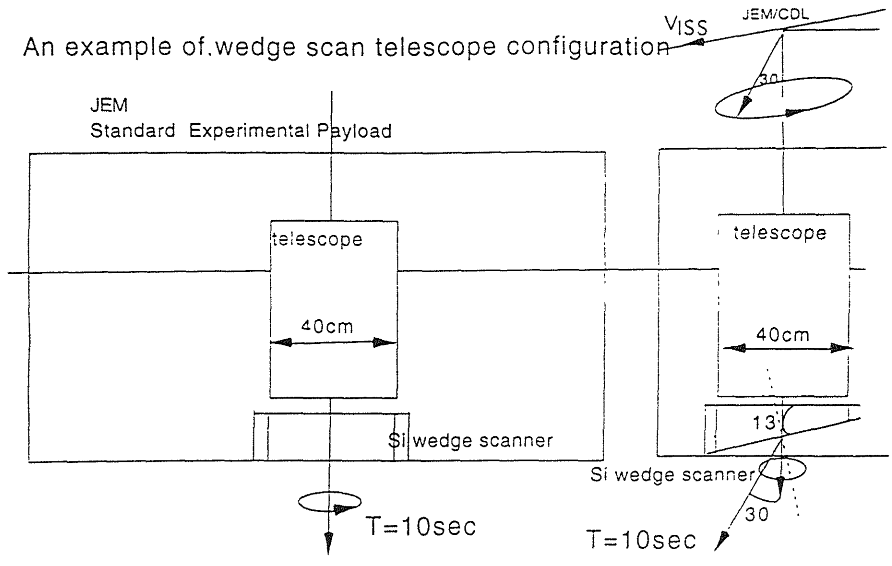

Fig.1 An example of a wedge scan telescope configuration

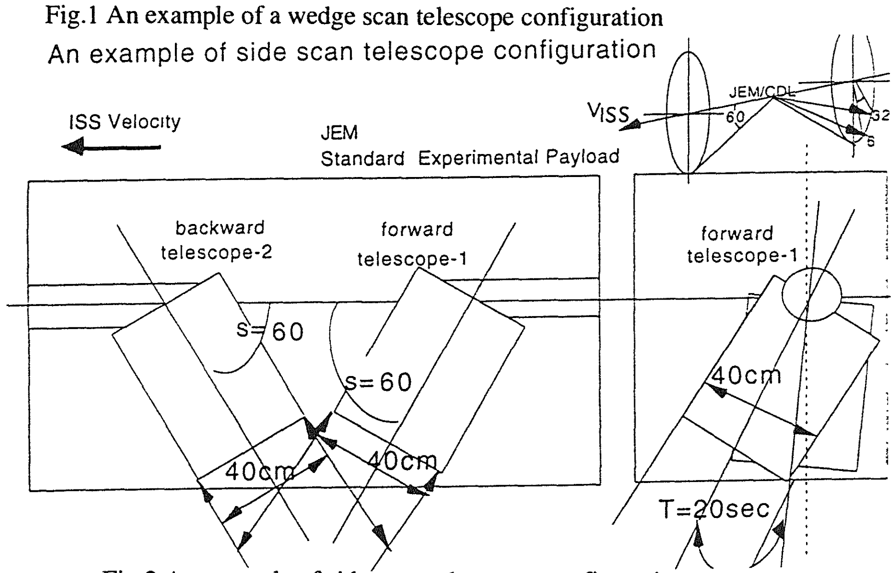

Fig.2 An example of side scan telescopes configuration

When we will average the wind measurements during whole shots within 100km x100km horizontally and 1km vertically, the wind errors of all of the three scanning ways can satisfy the science requirement describe in the JEM/CDL science plan (Iwasaki, 1999).

Table 2 aerosol height profile β (z))
for the studies the LOS wind error

Height	aerosol height profile β (z)
0-----2 km	2×10^{-8} (1/m/str)
2-----5km	1×10^{-8} (1/m/str)
5-----12 km	8×10^{-9} (1/m/str)

3. Concluding remarks

A program of Japan for development of the coherent Doppler lidar in space was started by CRL from 1997 FY under the support of the Phase II studies of the Ground Research Announcement of NASDA. Objective of the program is to make a feasibility study on the coherent Doppler lidar for the Japanese Experiment Module (JEM) of the International Space Station (ISS). The ISS/JEM-borne coherent Doppler lidar can measure tropospheric LOS winds from space in accuracy of 1-2 m/s in the vertical resolution of about 1 km and the horizontal resolution 100km x100km. Results of the feasibility study will be used for a proposal of 2ed JEM mission.

References

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