LASER RADAR SYSTEM LOADED ON A ROCKET FOR MEASUREMENTS OF UPPER ATMOSPHERE

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ABSTRACT

Laser radar system loaded on a rocket has been developed and applied for the measurements of aerosol in upper atmosphere. Figure 1 shows a block diagram of this system.

Four GaAs semiconductor lasers were drived simultaneously at the repetition rate of 1 kHz. Back-scattered light from aerosol was collected and guided to a photomultiplier (PMT) by a Cassegrainian set of mirrors. Laser diodes and PMT tube were cooled by liquid N_2. Output pulses from PMT were amplified and detected by a synchronous photon counting technique. (S+N) gate was opened at the same time of laser shot and (N) gate was opened after 50 μsec from the laser shot. Gate widths were 1 μsec for both channels. Digital counts of every half second were converted to analogue quantity, transfered to the telemeter and transmitted to the ground. All the instruments were set in the aluminium box of 250×250×270 mm.

Rocket observation experiments were performed at 20.30 on 19th Sept. 1970 and at 21.00 on 3rd Sept. 1971 by using L-3H-5 and L-3H-7 rocket of University of Tokyo, respectively. In the stratosphere, the intensity of the scattered light decreased with the increase of altitude. And also the scattering layer were detected at the altitude of 90 -110 km, 255 - 270 km and 320 -340 km. First layer seems to come from aerosol reported already, and the scattering cross section of this layer was

estimated to be $\sim 7\times10^{-12}$ cm^{-1} $sterad^{-1}$, compared with the scattered intensity at the altitude of 20 km.

The dust layers at the altitude of 255 - 275 km and 320 - 340 km were not expected to exist, but these layers were observed both up- and down-ward in rocket trajectory. The scattered signals from these layers are explained qualitatively by the existence of very rare but large particles, because a few but strong signals were observed.

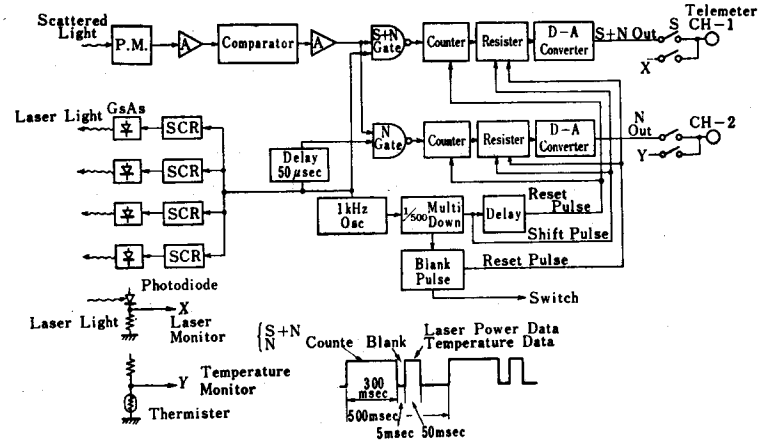

Fig. 1 Block diagram of laser radar system