

A NEW "EYE SAFE" ERBIUM LASER CEILOMETER

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ABSTRACT

Earlier work with a Q-switched Er^{3+} Lidar operating at 1.54μ showed satisfactory performance in the measurement of cloud heights under a variety of weather conditions. The instrument was able to range off clouds out to 11 km, it could penetrate several thin cloud layers, and it showed characteristic signatures for the return pulse from water droplets, snow, or ice crystals. It provided good agreement with RBC measurements over the latter's useful range of up to 1,000 m.

The redesigned unit described here has the same range capability as the earlier model, but it is substantially reduced in size and weight and has incorporated a number of special design features. The instrument will weigh approximately 50 kg and is intended to be capable of ranging to clouds at 5 km under conditions where the average atmospheric transmission is down to 50% per km. A 35 nano-second pulse of 40 mJ in energy is generated by a mechanical Q-switch from a 75 mm long clad erbium laser rod, 4 mm core diameter and 6 mm OD. The aperture of the beam from the laser rod is expanded by an 8x afocal telescope to give a transmitted beam divergence less than 0.4 mrad. The collector is a 25 cm aperture, F1.8 parabolic reflector, and the detector is a Texas Instruments germanium avalanche photodiode. New designs are used for the boresighting apparatus and the optics to provide a coaxial geometry for the transmitter and receiver beams. The time-variable-gain and other signal processing features will be described.