MEASUREMENT OF ATMOSPHERIC VERTICAL TEMPERATURE PROFILES BY RAMAN LIDAR

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ABSTRACT

This paper presents the results of continuing tests at the Lewis Research Center on the remote measurement of atmospheric temperatures using a Raman Lidar System. Standard lidar techniques are employed to simultaneously record the light intensities of two spectral bands within the Raman return spectrum. The ratio of these intensities is then directly related to the temperature of the sampled air.

The specific spectral bands that are examined are resolved by using a pellicle beam splitter and optical interference filters. Some inconsistencies in the temperature data obtained with this system have been traced to small temporary or permanent changes in the transmittances of the filters. It was found that such changes are common and because they can result in serious errors in the measurement of absolute temperature their occurrence must be considered in the evaluation and design of this measuring system. A normalization process has been devised and tested which accounts for filter value changes during relative temperature measurements.

Because experimental results acquired in horizontal path testing compared well with those predicted, the lidar system was revised to operate vertically. Other system revisions have also been made that include the addition of new detection and data processing electronics. The impact of these revisions along with the range and accuracy capabilities of the Raman lidar technique to make temperature profile measurements are currently being evaluated in vertical tests of the system.