# EVALUATION OF A GaAs LIDAR FOR THE MEASUREMENT OF VISIBILITY

J. V. Winstanley
Plessey Radar, Cowes, Isle of Wight, England
and
G. J. Burrell
Royal Aircraft Establishment
Farnborough, Hants, England

## ABSTRACT

A GaAs Lidar has been constructed for the purpose of assessing the feasibility of using such a system for the remote measurement of visibility. A trials programme has been undertaken to evaluate the equipment and to acquire by measurement of the spatial distribution of the fog, statistical data on the inter-relationship between the atmospheric extinction coefficients measured vertically and horizontally.

The initial Lidar trials were carried out over a horizontal range and the results were compared with measurements obtained from adjacent transmissometers over a range of 110 metres. The average R. M. S. error in the range integral of the extinction coefficient ( $\int_0^R \sigma(R)dR$) was found to be 9%, which may be considered to be good confirmation of the ability of the Lidar to determine visibility for a wide range of fog conditions ( $\sigma$ = 2 - 65 $km^{-1}$).

Solution of the lidar equation for the above trials results, indicated a value for the backscatter index 'n' (in the empirical backscatter relationship $\beta(\pi) = A\sigma^n$) very close to 2. This figure is higher than expected from theoretical considerations and earlier published work on aerosol scattering. This was attributed to the particular side-by-side geometry of the lidar and the relevant particle size distributions encountered at this particular coastal trials site. The extinction coefficient profiles determined by the lidar were found to be insensitive to relatively large variations in this parameter. Results obtained during this part of the trials programme

will be presented, including comments on systematic errors, signal processing and data analysis techniques.

Further trials have since been carried out using the lidar in both the horizontal and vertical modes; the results from these trials will also be discussed.

Calculations of second, third and higher mode corrections for the contributions due to various orders of scattering have been made, on the assumption that $N^{th}$ order scattering is the result of N single scatterings. Comparative solutions using this modified lidar equation, to allow for the multiply scattered contribution to the signal return, will be presented.

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