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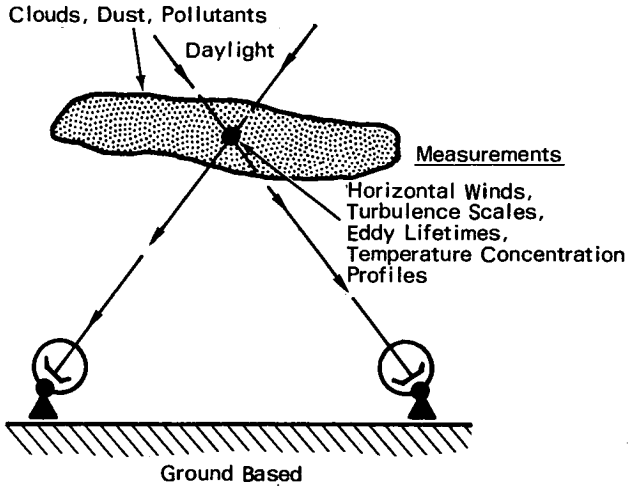
NASA TECH BRIEF

Marshall Space Flight Center

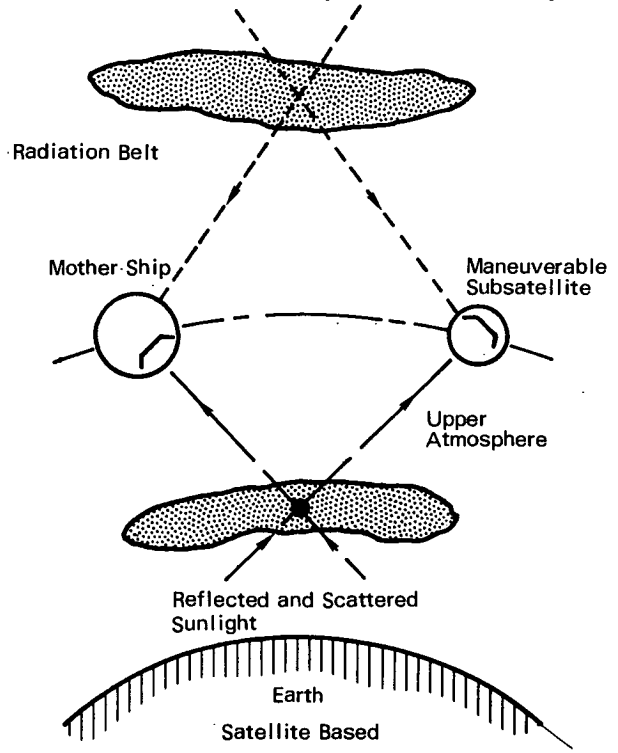
Atmospheric Pollution Measurement by Optical Cross Correlation Methods: A Concept

A concept employing the cross correlation of two narrow light beams for remote sensing can be used to detect foreign matter of a given particulate size and consistency in the atmosphere.



Most optical methods such as schlieren, shadowgraph systems, or spectrometers integrate the received signal along the line of sight. In this case, however, information is desired for a particular spot along the line of sight. A second beam can be adjusted to intersect the first at the point of interest. Integration along the two beams is then eliminated by a cross correlation of the detected fluctuations. The figure shows two simplified versions of the technique described.

A paper has been prepared indicating how this new concept of combining standard spectroscopy with a statistical cross correlation analysis might be used for turbulence investigations in model tests and in the atmosphere. The concept has been demonstrated successfully by the laboratory comparison of hot wire measurements with optical cross correlation results. Since remote sensing methods are not limited by scale, Aerodynamics Advisory Panel (AAP) applications are conceivable. The main problems in atmospheric



and AAP experiments are presented in question form, so that the background information needed to establish the feasibility of particular experiments becomes apparent.

Cross correlation of optical signals has previously been used for remote sensing in jet shear layers. Concentration fluctuations of a water vapor fog were re-

(continued overleaf)

solved with good accuracy in space and time. In principle, the method should also work on an atmospheric scale in investigations concerning the generation and motion of atmospheric constituents such as clouds, nuclear debris, ozone, radiation belts, etc.

Notes:

1. A related innovation is described in NASA Tech Brief B67-10030, "Local Measurements in Turbulent Flows Through Cross Correlation of Optical Signals."
2. Requests for further information may be directed to:

   Technology Utilization Officer
   Code A&TS-TU
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: TSP71-10224

Patent status:

No patent action is contemplated by NASA.

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