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NASA TECH BRIEF

Marshall Space Flight Center

Self-Calibrating Remote Atmospheric Electromagnetic Probe and Data Acquisition System

A self-calibrating remote atmospheric electromagnetic probe and data acquisition system was designed to measure wind speed, turbulence levels, and aerosol content, and to provide a detailed, real-time, three dimensional map of the atmosphere. The system contains transmitter and receiver optics, a transmitter source (laser), and data processing equipment. In remote atmospheric probing, it appears that LIDAR (light equivalent of radar) systems offer the greatest advantage. The fundamental probing concept of this method is to use "fan beam" geometry to locally measure various atmospheric parameters at a number of matrix points to allow a determination of the atmospheric structure.

In studying exhaust plume rise from an industrial complex, for example, an imaginary fluid volume element (a cube) is described in the atmosphere entirely enclosing one "slice" of the exhaust plume. Probing at defined matrix points in this volume are two remote atmospheric probes with four received fields of view per fan receiver. Atmospheric parameters can be determined from range gating and correlation theory, using a minimum of six or a maximum of forty-eight correlation combinations. Various fan beam and intersection configurations can produce other matrix patterns depending on the atmospheric phenomena under observation.

The telescope that serves as both the transmitter and receiver is of a tri-sectional Cassegrainian design, which provides overlapping transmitted fields of view into the received field of view. A laser supplies a donut-shaped beam of light which is imaged out at some distance. The transmitting and receiving lenses of the telescope are designed so that at prime focus the outgoing beam goes through the same space as the incoming beam.

Normally, due to the nature of the returned signal, the signal must be stored in an analog fashion unless 100 megaword per second analog to digital converters, with 1024 word high speed scratchpad memories per individual fan beam, are available. Thereafter, from scratchpad memory to correlation processing, to final disposition in the mass storage, and to display, the data is under direction of the computer background process controller. A foreground process controller maintains matrix positions of the remote probes along with coordinate and target boundary identification in real-time for on-line control of the experiment.

Notes:

1. Information concerning this innovation may be of interest to personnel engaged in meteorology and air pollution studies. Potential applications also exist in fluid flow monitoring and stack exhaust measurement.
2. Requests for further information may be directed to:
   Technology Utilization Officer
   Marshall Space Flight Center
   Code A&PS-TU
   Marshall Space Flight Center, Alabama 35812
   Reference: B72-10665

Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

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Category 02, 03