

length pins technique. In the resistive pin approach, a standard pin in a male connector is replaced with a pin that has a uniform resistivity along its length. This provides a variable resistance on that pin that is dependent on how far the pin is inserted into a socket. This is essentially a linear potentiometer.

The discrete approach uses a pin (or a few pins) in the connector as a displacement indicator by truncating the pin length so it sits shorter in the connector than the other pins. A loss of signal on this pin would indicate a discrete amount of displacement of the connector. This approach would only give dis-

crete values of connector displacement, and at least one pin would be needed for each displacement value that would be of interest.

*This work was done by Ellen Arens, Janine Captain, and Robert Youngquist of Kennedy Space Center. Further information is contained in a TSP (see page 1). KSC-13210/559*

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## **In Situ Aerosol Detector**

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An affordable technology designed to facilitate extensive global atmospheric aerosol measurements has been developed. This lightweight instrument is compatible with newly developed platforms such as tethered balloons, blimps, kites, and even disposable instruments such as dropsondes. This technology is based on detection of light scattered by aerosol particles where an optical layout is used to enhance the performance of the laboratory prototype instrument, which allows detection of smaller aerosol particles

and improves the accuracy of aerosol particle size measurement.

It has been determined that using focused illumination geometry without any apertures is advantageous over using the originally proposed collimated beam/slit geometry (that is supposed to produce uniform illumination over the beam cross-section). The illumination source is used more efficiently, which allows detection of smaller aerosol particles. Second, the obtained integral scattered light intensity measured for the particle can be corrected for the beam

intensity profile inhomogeneity based on the measured beam intensity profile and measured particle location. The particle location (coordinates) in the illuminated sample volume is determined based on the information contained in the image frame. The procedure considerably improves the accuracy of determination of the aerosol particle size.

*This work was done by Andrei Vakhtin of Vista Photonics and Lev Krasnoperov of New Jersey Institute of Technology for Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15879-1*

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## **Multi-Parameter Aerosol Scattering Sensor**

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This work relates to the development of sensors that measure specific aerosol properties. These properties are in the form of integrated moment distributions, i.e., total surface area, total mass, etc., or mathematical combinations of these moment distributions. Specifically, the innovation involves two fundamental features: a computational tool to design and optimize such sensors and the embodiment of these sensors in actual practice.

The measurement of aerosol properties is a problem of general interest. Applications include, but are not limited to, environmental monitoring, assessment of human respiratory health, fire detection, emission characterization and control, and pollutant monitoring. The objectives for sensor development include increased accuracy and/or dynamic range, the inclusion in a single sensor of the ability to measure multiple aerosol properties, and developing an overall physical package that is rugged,

compact, and low in power consumption, so as to enable deployment in harsh or confined field applications, and as distributed sensor networks. Existing instruments for this purpose include scattering photometers, direct-reading mass instruments, Beta absorption devices, differential mobility analyzers, and gravitational samplers.

The family of sensors reported here is predicated on the interaction of light and matter; specifically, the scattering of light from distributions of aerosol particles. The particular arrangement of the sensor, e.g. the wavelength(s) of incident radiation, the number and location of optical detectors, etc., can be derived so as to optimize the sensor response to aerosol properties of practical interest. A key feature of the design is the potential embodiment as an extremely compact, integrated microsensor package. This is of fundamental importance, as it enables numerous previously inaccessible applications.

The embodiment of these sensors is inherently low maintenance and high reliability by design.

The novel and unique features include the underlying computational underpinning that allows the optimization for specific applications, and the physical embodiment that affords the construction of a compact, durable, and reliable integrated package. The advantage appears in the form of increased accuracy relative to existing instruments, and the applications enabled by the physical attributes of the resulting configuration.

*This work was done by Paul S. Greenberg and David G. Fischer of Glenn Research Center. Further information is contained in a TSP (see page 1).*

*Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steven Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18634-1.*