

A Small, Sensitive, Light-weight, and Disposable Aerosol Spectrometer for Balloon and Unmanned Aerial Vehicle Applications

H. Telg¹, T. Bates², S. Ciciora³, D.W. Fahey³, R.S. Gao³, J.E. Johnson², R. McLaughlin³, A.E. Perring¹, A.W. Rollins¹, J.P. Schwarz¹, T.D. Thornberry¹ and L. Watts¹

¹Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309; 303-497-6566, E-mail: hagen.telg@noaa.gov

²University of Washington, Joint Institute for the Study of the Atmosphere and Ocean and NOAA Pacific Marine Environmental Laboratory, Seattle, WA

³NOAA Earth System Research Laboratory, Boulder, CO 80305

In situ sampling with particle size spectrometers is an important method to provide detailed size spectra for atmospheric aerosol in the troposphere and stratosphere. The spectra are essential for understanding aerosol sources and aerosol chemical evolution and removal, and for aerosol remote sensing validation. These spectrometers are usually bulky, heavy, and expensive, thereby limiting their application to specific airborne platforms. Here we report a new type of small and light-weight optical aerosol particle size spectrometer that is sensitive enough for many aerosol applications yet is inexpensive enough to be disposable. 3D printing is used for producing structural components for simplicity and low cost. Weighing less than 1 kg individually, we expect these spectrometers can be deployed successfully on small unmanned aircraft systems (UASs) and up to 25 km on weather balloons. Immediate applications include the study of Arctic haze using the Manta UAS, detection of the Asian Tropopause Aerosol Layer in the Asian monsoon system and SAGE III validation onboard weather balloons. Results from recent test flights onboard the Manta UAS will be presented.

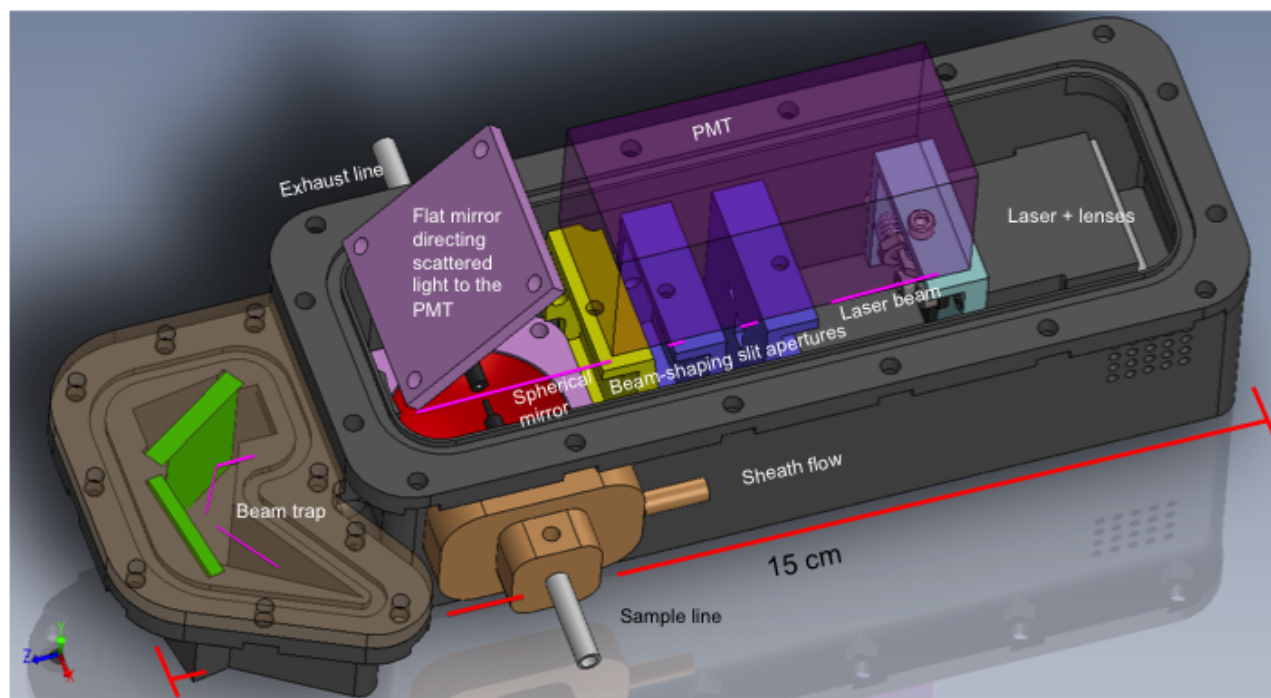


Figure 1. Computer-aided Design model of the small and light-weight optical aerosol particle size spectrometer.