Paper ID: 52372
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IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Astrobiology and Exploration (6)

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# CHARACTERIZATION AND MEASUREMENT OF SPACECRAFT AIRBORNE PARTICULATE MATTER

**Abstract**

The International Space Station (ISS) gives a 6-member astronaut crew the ability to live and work in low Earth orbit. It is a unique indoor environment, which has served as both home and workplace to over 230 people since the year 2000. In this low gravity environment, smoke does not rise and cookie crumbs do not settle the way they do on Earth, causing airborne particulate matter, or aerosols, to behave differently and pose unique hazards for crew members. In its existence, virtually the same volume of ISS air has been continuously conditioned and 'revitalized,' including the removal of particles by filtration. While gaseous constituents of ISS air are monitored meticulously, sparse data exists on the indoor aerosols. The quantity and types of ISS airborne debris have been investigated in NASA's recent Aerosol Sampling Experiment. Both active and passive samplers successfully collected airborne particulate matter in U.S. segments of the ISS, which were returned to Earth for characterization by microscopy and other techniques. The resulting data has informed the design of candidate particle instruments for spacecraft. In 2020, a reference-quality aerosol instrument will be flown to ISS, and will provide real-time data of particle concentrations in various modules. Smaller, more compact instruments will be necessary in future space missions, for example, in smaller vehicles, in habitats on lunar and planetary surfaces with ubiquitous dust, and also for use as wearable technology throughout missions. Miniaturized aerosol sensors, though lower fidelity than reference-quality instruments, can monitor the environment well when calibrated appropriately. Indoor air quality in spacecraft is fundamentally important to human health and comfort, and several particulate monitoring technologies will be at sufficient technology readiness levels for operational use within the next two years. Results of the Aerosol Sampling Experiment will be presented, along with the status of NASA's aerosol instrument technology demonstrations on ISS.