Air Quality in the International Space Station

Dr. Marit E. Meyer

Research Scientist

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The International Space Station (ISS) gives a 7-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 250 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 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. Particles have been sampled and measured in real-time through ISS technology demonstration payloads, and the results differ vastly from typical terrestrial indoor spaces. This presentation will cover particle types, quantities, and sources in the unique ISS environment.

Bio:

Dr. Marit Meyer has been a Research Aerospace Engineer in the Low Gravity Exploration Technology Branch at the NASA Glenn Research Center in Cleveland, Ohio since 2010. She works on indoor air quality in spacecraft cabins, determining the sources, sizes, and quantities of particles in the air that astronauts breathe, as well as selecting instruments to monitor aerosols on future missions. She has been principal investigator and project scientist for four aerosol experiment payloads on the International Space Station since 2016. Marit attended the University of Arizona in Mechanical Engineering, earning her bachelor's degree in and a master's degree with an emphasis in fluid mechanics. She then pursued her PhD at Washington University in St. Louis after working in the defense industry for 8 years.

Progress and Challenges in Spacecraft Fire Detection

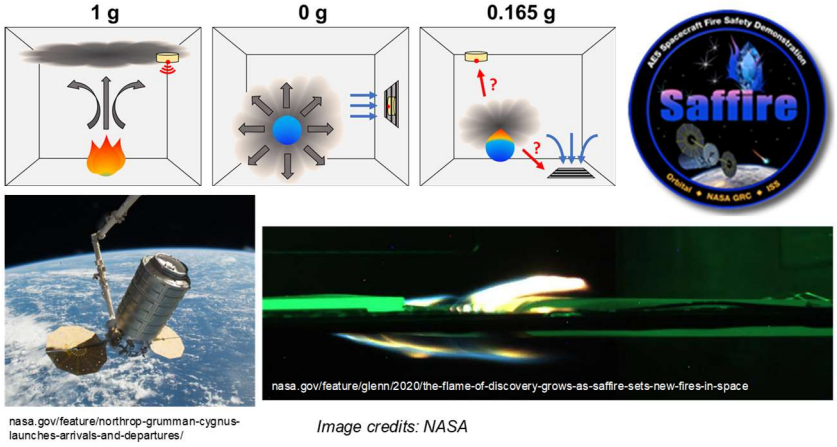
Dr. Claire Fortenberry

Research Aerospace Engineer

Universities Space Research Association at NASA Glenn Research Center

Spacecraft fires pose a major threat to the future of lunar and deep-space exploration. Currently, there exists no single optimal strategy for spacecraft fire detection. On Earth, buoyancy drives smoke plumes upwards, allowing for convenient placement of smoke detectors on ceilings. In microgravity, this buoyant transport does not occur, and because spacecraft cabin air is typically well mixed, detectors are instead placed behind ventilation system intakes. Modeling studies have shown that high particle filtration rates imposed by spacecraft life support systems rapidly outpace smoke accumulation in the cabin and may extend times to alarm, particularly in the event of an early-stage (pre-flame) fire. Additionally, flight experiments have demonstrated that microgravity smoke particle formation is sensitive to several factors, including fuel type, overheating process, and air velocity. Although spacecraft smoke detection studies to date have focused on microgravity smoke, these factors continue to challenge the success of future lunar missions as NASA plans to return to the moon under the Artemis program.

Plans for a future long-term human presence on the moon and deep-space exploration necessitate improved smoke detection technology and strategies in low and partial gravity. This talk will present an overview of spacecraft smoke detection research to date, including recent results from NASA's spacecraft fire safety (Saffire) series of experiments. Remaining challenges for spacecraft smoke detection in both lunar and microgravity will also be discussed.



nasa.gov/feature/northrop-grumman-cygnus-launches-arrivals-and-departures/

Image credits: NASA

Bio:

Dr. Claire Fortenberry has been a research aerospace engineer with Universities Space Research Association at NASA Glenn Research Center since May of 2020, following completion of her PhD at Washington University in St. Louis. Her work at NASA focuses on improved spacecraft fire detection and smoke particle transport in microgravity and lunar gravity. She is responsible for analysis of smoke particle properties from spacecraft-relevant fire conditions in ground and flight studies, including NASA's spacecraft fire safety (Saffire) series of experiments. Additionally, she conducts modeling studies to explore the effects of lunar gravity on smoke plume transport to inform optimal fire detector placement in a future lunar habitat. In addition to her PhD, Claire holds a BS in Chemistry from the College of William and Mary in Virginia.

Logistics:

The seminars will be held on **June 15, 2022, from 12:00-1:00 pm PT** at DRI's Reno Campus Stout-A/B Conference Rooms (see map below) with video to DRI Las Vegas room SNSC 181/182. Lunch will be served. **Please RSVP to Vicki Hall (Vicki.Hall@dri.edu) if attending in Reno or Talitha LaPutt (Talitha.LaPutt@dri.edu) if attending in Las Vegas.**

You can also join the seminar remotely via MS Teams meeting:

Join on your computer or mobile app
Click here to join the meeting
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883550304@t.plcm.vc
Video Conference ID: 119 919 253 3

Alternate VTC instructions

Please be sure to mute the microphone or phone during the presentation.

If you want to meet individually with Drs. Meyer and Fortenberry, to discuss common interests or explore collaborations, please contact Dr. Xiaoliang Wang (Xiaoliang.Wang@dri.edu) for scheduling.