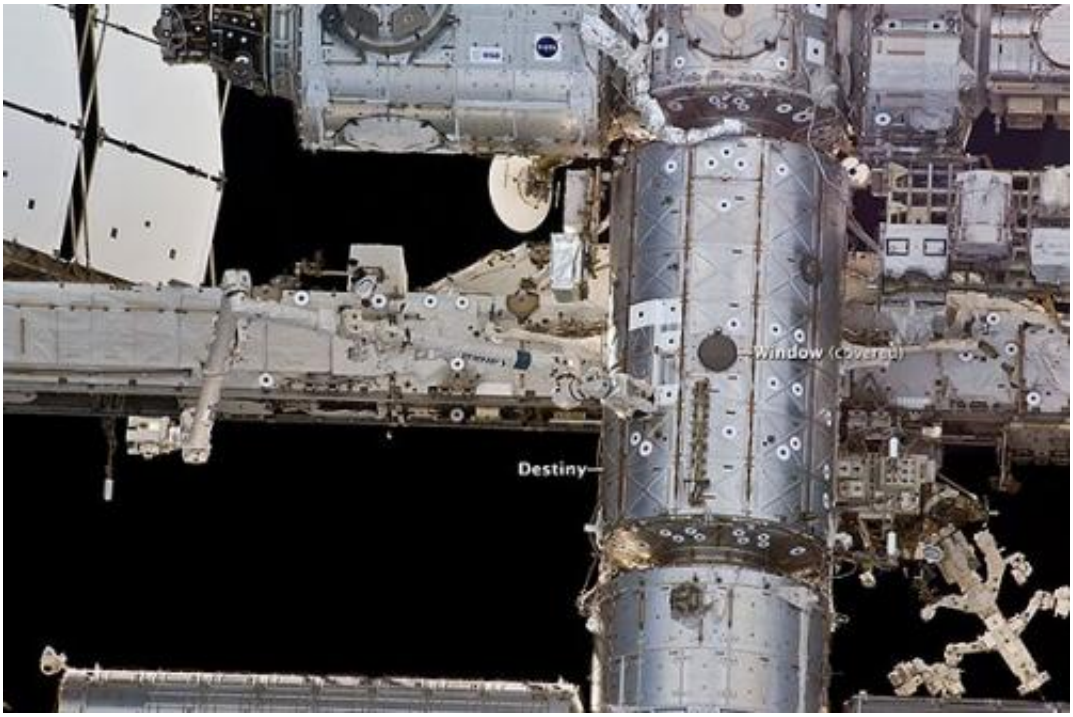
Monitoring meteor showers from space

August 13 2014, by Melissa Gaskill



This is the location of the Window Observational Research Facility in the Destiny Module. Credit: NASA

Those who enjoy the spectacle of the Perseids, Geminids or other annual meteor showers likely aren't thinking about where these shooting stars originated or whether they might pose a danger. Scientists, however, think about such things and will use the vantage point of a special window on the International Space Station to learn more about the composition and behavior of meteors and their parent bodies. The Meteor investigation will help scientists better understand the asteroids

and comets crossing Earth's orbit and how these celestial objects have affected our planet. It also could help protect spacecraft and Earth from potential collisions with this celestial debris.

The investigation, which will launch to the station on Orbital Sciences' third commercial resupply flight, will spend two years recording meteor showers using a special camera installed in the station's Window Observational Research Facility (WORF). The camera is programmed to record predictable showers, and its continuous measurement of meteor interactions with Earth's atmosphere could spot unpredicted ones as well.

Space-based viewing of meteor showers offers many advantages over traditional observation by ground- or aircraft-based instruments. Viewing from the station is not affected by weather or interference from Earth's atmosphere. Instruments on Earth are also limited to short periods of observation time and viewing field, but the camera aboard the station will record for roughly 560 minutes every day. That is the amount of time the station is in darkness as it orbits Earth 16 times a day.

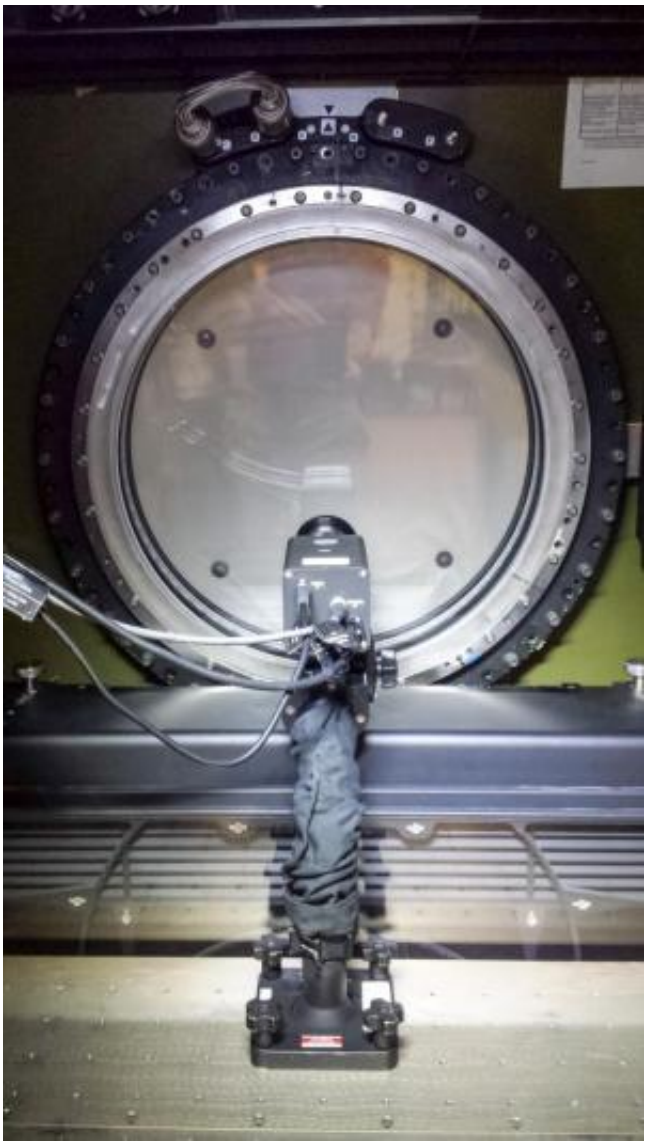
Partners in the Meteor investigation include the Center for the Advancement of Science in Space (CASIS), Southwest Research Institute (SwRI) in San Antonio and Japan's Planetary Exploration Research Center (PERC) at Chiba Institute of Technology.

A Perseid meteor streaks through the Earth's atmosphere, as seen and photographed by astronaut Ron Garan while aboard the International Space Station on August 13, 2011. Credit: NASA

Once installed, the Meteor system will operate mostly on its own. Michael Fortenberry, principal investigator for Meteor and an engineer with SwRI, explains that the crew will only need to adjust the lens focus and change out hard drives that store high-resolution video collected by the camera. A software program will identify and separate video clips that likely include meteors, and those can be further analyzed later on the ground. Scientists can use these images to glean information such as the size of a particle of meteoric dust based on its flight path and light curve.

Going beyond identifying meteors and monitoring their activity, the instrument has the additional capability to help classify their chemical composition. A device on the camera called a diffraction grating

separates light passing through it into different wavelengths or colors, known as spectra, just as a prism does. The device will record spectra of light emitted for specific meteoroids, which investigators can use to determine the abundance of several elements in the meteoroids or meteor dust.



This is a mock-up camera mounted in the Window Observational Research Facility simulator at Johnson Space Center. Credit: Southwest Research Institute

"From previous observation on the ground, we already know the parent body for these meteors," explains Meteor co-investigator Tomoko Arai, Ph.D., a staff scientist at PERC. "The spectral information will tell us more about these parent bodies and help us understand their materials."

The camera is scheduled to record all 12 known major showers. Secondary targets include minor meteor showers and periods with little or no identified regular activity. Observation of de-orbiting spacecraft and other targets also will be made. "There is a chance we could find new minor meteor showers, or observe meteors from an unexpected source like Comet Ison," says Fortenberry.

Meteors are created by the disintegration of comets or asteroids orbiting the sun. Those that enter Earth's atmosphere heat up and burn, causing the visible streak we see during a shower. Although the exact number of meteors entering the atmosphere varies during each event, some major showers can produce a peak of more than 100 visible meteors per hour.

Some meteor-producing bodies have the potential to create meteors so large that they do not burn up completely on their trip through Earth's atmosphere and actually strike the surface. This investigation will collect much more data than was previously possible about what already hits our planet. This data will be correlated with information from other sensors and analysis to determine how many meteors are entering the atmosphere and their characteristics. Those characteristics will help scientists better understand which parent bodies might create meteors that pose a threat to Earth, along with their physical and chemical makeup. In addition, data on orbital debris, both natural and man-made, can be used to time and position spacecraft to keep them safe from collisions in space.

The WORF provides a stable platform for hand-held photography and other research activities at the U.S. Laboratory Science Window, the

highest optical-quality window ever installed on a human space vehicle. The Window enables the use of high-resolution cameras from inside the station rather than outside, where instruments are subject to the vacuum and extreme temperatures of space.

The Meteor investigation adds to other monitoring of meteors on orbit, such as through Crew Earth Observations (CEO). So the next time you enjoy a meteor shower, rest easy knowing that these scientists are keeping an eye on things.

Provided by NASA