

Seeing Earth Through the Eyes of an Astronaut

Melissa Dawson

The Human Exploration Science Office within the ARES Directorate has undertaken a new class of handheld camera photographic observations of the Earth as seen from the International Space Station (ISS). For years, astronauts have attempted to describe their experience in space and how they see the Earth roll by below their spacecraft. Thousands of crew photographs have documented natural features as diverse as the dramatic clay colors of the African coastline, the deep blues of the Earth's oceans, or the swirling Aurora Borealis or Australis in the upper atmosphere. Dramatic recent improvements in handheld digital single-lens reflex (DSLR) camera capabilities are now allowing a new field of crew photography: night time-lapse imagery.

During Expedition 28 in 2011, NASA astronauts Mike Fossum and Ron Garan began experimenting with the automated functions of their onboard DSLR cameras. The intent was to take low-light, long-exposure images of the dark side of the Earth not only to document the nighttime activity of our civilization, but also to provide a profound new insight into humanity's presence and its effect on our planet.

The astronauts used a bogen arm in the Cupola of the ISS to stabilize the camera, which was then set to take an image every 3 s for several minutes. The motion of the ISS allowed those still images to be assembled into dramatic movies, providing spectacular new views of the planet that have never been seen by the general public. The downlinked still images were processed by the ARES Crew Earth Observations (CEO) Office for assembly into final videos (figure 1).

As educational supplements to these videos, CEO has also created

- Annotated time-lapse videos highlighting city and place names
- Time-lapse video alongside a Google Earth tour, which plays simultaneously so the user may see both geographical and geological feature names that can be found in the video
- Narrated time-lapse videos that describe features in the video for the viewer

The videos can be accessed in varying resolutions from 640 x 426 to 1980 x 1080 high-definition within the CEO Web site at <http://eol.jsc.nasa.gov/Videos/CrewEarthObservationsVideos/>. Users may also download the original still images to create their own movies.



Figure 1.– Time-lapsed astronaut photograph of Western Europe (ISS030-E-185649, 03/28/2012, 28 mm), which is part of the video entitled “Aurora Borealis over Western Europe.”

The public and media response to this new class of imagery has been dramatic. The videos have been highlighted by numerous publications (*i.e.*, the Chicago Tribune and USA Today); Web sites (*i.e.*, SpaceflightNow.com, Space.com, NASA.gov, and YouTube); and television broadcasts on most major networks, the Discovery Channel, and the Public Broadcasting System. The public outreach benefit to JSC and NASA as a whole is significant. This imagery has excited the public again about the power of spaceflight not only to inspire our children to study things like math and science, but also to highlight how humanity is indeed one species, populating the same planet floating in the dark, cold void of space.

As the mission of the ISS continues, many more dramatic nighttime videos will be produced, vividly illustrating our presence on the Earth like never before and reminding us of our place and obligation to protect our fragile home (figure 2).



Figure 2.— Time-lapse image of Florida and the southeastern United States at night (ISS030-E-6082, 11/24/2011, 19 mm), which is part of the video entitled “Mexico and the Eastern United States.”

CEO Sites Mission Management System (SMMS)

Mike Trenchard

Late in fiscal year 2011, the Crew Earth Observations (CEO) team was tasked to upgrade its science site database management tool, which at the time was integrated with the Automated Mission Planning System (AMPS) originally developed for Earth Observations mission planning in the 1980s. Although AMPS had been adapted and was reliably used by CEO for International Space Station (ISS) payload operations support, the database structure was dated, and the compiler required for modifications would not be supported in the Windows 7 64-bit operating system scheduled for implementation the following year.

The Sites Mission Management System (SMMS) is now the tool used by CEO to manage a heritage Structured Query Language (SQL) database of more than 2,000 records for Earth science sites. SMMS is a carefully designed and crafted in-house software package with complete and detailed help files available for the user and meticulous internal documentation for future modifications. It was delivered in February 2012 for test and evaluation. Following acceptance, it was implemented for CEO mission operations support in April 2012. The database spans the period from the earliest systematic requests for astronaut photography during the shuttle era to current ISS mission support of the CEO science payload. Besides logging basic image information (site names, locations, broad application categories, and mission requests), the upgraded database management tool now tracks dates of creation, modification, and activation; imagery acquired in response to requests; the status