Blurb for January "Conservation Education" column in the *Society for Conservation Biology Newsletter*

This column features one of several perspectives on conservation education from members of the Society's ad hoc Committee on Education.

Educating Astronauts about Conservation Biology

I work at Johnson Space Center as part of an interdisciplinary team of civil servant and contractor "Earth Scientists" (NASA classifies ecologists as Earth scientists, because they generally only work on this planet). Our primary responsibility is directing and supporting photography of Earth and maintaining the complete database of photographs. My position is not so different from an academic one--I have teaching, research and service responsibilities. My students are astronauts which I brief on ecological and environmental issues, my research involves remote sensing applications of the photographs and efforts to improve distribution of the photography, and my service is on technical committees.

This set of students is unique for obvious reasons. In planning briefings we recognize that they often have broad technical backgrounds, but vary greatly in their exposure to ecology and environmental science. When we surveyed incoming classes of astronaut candidates, we found that few of them viewed conservation biology as a scientific sub-discipline. Our training time is limited: briefings and two field trips for astronaut candidates, and briefings for astronaut crews once they have been selected. In the past, training related to environmental issues was often

driven by the geographical opportunities of the particular mission, or by the interests of individual scientists. We have recently restructured our curriculum to do a better job of preparing astronauts to understand the changes on the Earth that they will observe. We have also integrated our curriculum so that the training given to astronaut candidates provides a better foundation for the mission-specific training that crewmembers later receive. Although our curriculum is a work in progress, I thought others might be interested in what we have done:

Astronaut Candidate Briefings. Candidates are usually either pilots with military backgrounds, Ph.D.'s in science or engineering, M.D.'s, or some combination. A two-hour lecture and workshop focuses on descriptive information about the major terrestrial and marine environments, and theoretical information about the processes of change in those environments. I teach about ecoregions in much the same way as one might in an undergraduate ecology course, but focus on how to recognize different ecoregions from orbit. I briefly introduce special types of habitats such as riparian habitats, wetlands, reefs, altitudinal zones, and human-modified environments. Next I focus on pattern and process in environmental change. We do an exercise in measuring the species diversity—in this group of students almost everyone loves calculating diversity indexes! Finally we discuss changes in communities and ecosystems—keystone species, invasive species, habitat fragmentation and reserve design.

Astronaut Candidate Field Trip. A geological field trip to New Mexico has been part of astronaut training since the *Apollo* missions. We developed an additional field trip around Galveston Bay to integrate across environmental science disciplines and for the practical reason that it could be done in a day trip from Johnson Space Center. It was the brainchild of two office

geologists, Cindy Evans and Dave Amsbury. All 8 office scientists—geologists, geographers, meteorologists, oceanographers, and ecologists—worked together to integrate the field trip, and we take turns making presentations and leading informal discussions. Each stop presents material from a variety of disciplines, supplemented with maps and astronaut photographs. For example, near High Island on the east side of Galveston Bay, we discuss the geology of salt domes, oil and gas development, the importance of High Island as the first stop for Neotropical migrant birds crossing the Gulf of Mexico, and the value of ecotourism for the area. Although our primary purpose is to show how remotely sensed imagery relates to a variety of scientific disciplines, we have discovered the field trip has unanticipated educational values. It helps astronaut candidates who have been brought from all over the world to connect with and understand their new home on the Texas Gulf Coast.

Training of Flight Crews. A year or more before a spaceflight launches, final training of the crew begins. Once a crew is selected, training in Earth science disciplines is only 6-13 classroom hours, spread over a year or more.

Our new curriculum and approach have been refined and guided by Kim Willis who is both a scientist and a trained educator. We use half-hour modules that are broken into a set of core topics for all crews and advanced topics for specific crews. The locations and examples we use within a topic change depending on the season and geographic coverage of a mission, but we make sure that every crew has exposure to the core topics. Some of the core topics relating to conservation are: human population growth and urbanization, habitat fragmentation, wetland functions and modification, water resource issues, coral reef conservation, land use change, biomass burning, and global climate.

The changes in the Earth captured in astronaut photographs over the last 30 years are astounding, and demand explanation and discussion. Astronauts have a unique role in educating the public during their public affairs tours and speaking engagements. Success at communicating about environmental issues when we train astronauts often determines whether or not they photograph an ecological "hot spot" and also influences what photographs they choose to talk about in their speaking engagements. I have become acutely aware of the challenges of educating them about ecological issues, and teaching them how to communicate to a variety of public groups in a non-political but realistic manner.

Julie A. Robinson (julie.a.robinson1@jsc.nasa.gov)