THE LUNAR RECONNAISSANCE ORBITER’S LUNAR WORKSHOP FOR EDUCATORS: 7 YEARS OF EXEMPLARY PROFESSIONAL DEVELOPMENT FOR SCIENCE TEACHERS. A. J. P. Jones1,2, L. V. Bleacher1, S. Buxner2, M. Canipe2, and E. Joseph2, 1NASA’s Goddard Space Flight Center (8800 Greenbelt Road, Greenbelt MD 20771; andrea.j.jones@nasa.gov), 2Planetary Science Institute (1700 East Fort Lowell Road Suite 106, Tucson AZ 85719).

Introduction: The Lunar Workshop for Educators is a weeklong professional development workshop focused on lunar science and exploration designed for grade 6–9 science teachers, sponsored by the Lunar Reconnaissance Orbiter (LRO) and conducted by the LRO Education & Communications (E&C) Team [1]. Since 2010, Lunar Workshops for Educators have been held around the country in locations underserved with respect to NASA workshops and at LRO team member institutions. Since 2013, all workshops in this series have been held at NASA’s Goddard Space Flight Center (GSFC) in Greenbelt, MD, where the LRO Project Office and E&C Team are based, in response to recommendations from the NASA Education Design Team to leverage local, ongoing educational partnerships [2], such as with the GSFC Office of Education.

The workshop model incorporates best practices from pedagogical research of science education [e.g. 3, 4, 5], thoughtful integration of scientists and engineers for both content presentations and informal networking with educators, access to NASA-unique facilities, data-rich hands-on activities aligned with education standards, exposure to the practice of science, tools for addressing common misconceptions, follow-up with participants, and extensive evaluation [6].

The workshops support NASA Science Mission Directorate (SMD) science education objectives of enabling STEM education, improving US scientific literacy, and leveraging efforts through partnerships [7], as well as priorities, such as improving STEM instruction and supporting the STEM teacher workforce, in the 5-Year Strategic Plan outlined by the National Science and Technology Council Committee on STEM Education [8].

An Exemplary Model of Teacher Professional Development: The Lunar Workshops for Educators have been recognized as exemplary. The GSFC Office of Education repeatedly requests that LRO’s Lunar Workshops be included in professional development programs they offer to the network of school districts and educators they support. The LRO E&C Lead was invited to present on the LRO workshop model for the planning committee and conveners of the National Research Council-hosted workshop, Sharing the Adventure with the Student: Exploring the Intersection of NASA Space Science and Education in 2014. The LRO E&C team received a NASA Honor Award for the workshop series in 2014.

Reach: Since 2010, 303 teachers from 30 states and 3 countries have participated in the Lunar Workshops for Educators. Workshop participants reach thousands of students each year, with that number growing each year as trained teachers share share information and activities from the workshops–as well as new information we provide in follow-up–with their students, year after year.

Teachers further share resources and information from the workshop with colleagues, administrators, and their communities. They feature workshop activities in youth and afterschool programs, Science Olympiads, and public events. Many teachers trained through the program are inspired to pursue additional NASA professional development opportunities, and some teachers have been so eager to learn more about NASA science and exploration and to share it that they became certified NASA Solar System Ambassadors.

2016 Workshop: The 2016 workshop included a new opportunity for educators. A new exhibit opened at the Smithsonian National Air and Space Museum (NASM) in early 2016 featuring views from the Lunar Reconnaissance Orbiter Camera (LROC): A New Moon Rises [9]. Teachers were guided through the exhibit by Tom Watters, an LROC scientist based at NASM who helped design the exhibit. NASM Astronomy Educator Program Manager Geneviève de Messières showcased the educational activity associated with the exhibit for the teachers, that the LRO E&C Team helped design.

Sample Survey Data from 2016 Workshop: At the conclusion of the workshop, participants were asked to rate their satisfaction with the workshop as a professional development opportunity for teachers on a scale from 1 (not at all satisfied), to 5 (this was an average workshop based on my experience), to 10 (this was one of the most outstanding workshops I have ever experienced). 100% of teachers rated the workshop 10 or above.

Teachers reported, “This has been one of the best workshops I have ever attended in my 20 years of teaching!! Fantastic job.” “This was the BEST planned and run workshop I’ve ever seen. The mix of seated and standing/active elements, the personal connections with NASA employees, the sequence of activities with,
brilliant scaffolding and how we figured out the science concepts FOR OURSELVES. This workshop provided me with a deep, thorough understanding and thought processes that will influence every time I teach these concepts from now on.”

Findings from 2016 Workshop: 1) The workshop continues to be an overall high quality, effective professional development experience for teaching educators about lunar science and exploration. Participants’ feelings about the workshop and presenters were overwhelmingly positive. 2) Participants increased in their overall knowledge of lunar science and exploration including general lunar topics (e.g. the causes of Moon phases and tides), formation and evolution of the Moon, and current exploration of the Moon specifically related to LRO. Prior to the workshop, participants had little to basic knowledge of these topics, they left with moderate to complete understanding of these topics. 3) Participants gained in their overall knowledge of students misconceptions related to the Moon and ways to effectively address those misconceptions as well as other ways to teach about the Moon. Generally participants’ abilities to name an activity that could be used to address a particular misconception and describe how it would do this increased from before to after the workshop. Additionally, almost all of the participants mentioned using a specific activity or information from the workshop to address students’ misconceptions. Participants were able to use information and activities from the workshop in their descriptions of how to address students’ misconceptions about the Moon. 4) The workshop gave participants resources to teach about the Moon including new activities, information, confidence in teaching the topics, and teaching techniques. In addition to giving participants resources to teach about the Moon, the workshop impacted the teaching practices of some participants more broadly to incorporate more inquiry and other teaching techniques. 5) Workshop facilitators did an effective job recruiting appropriate participants for the workshop. Additionally, the workshops included relevant information and activities that were well-received and valued by participants and have been useful in classrooms of participants [10].

Findings from the evaluation of the 2016 Lunar Workshop for Educators were very similar to the findings from previous years: there were gains in participants’ knowledge, attitudes, and behavior for all target goals [10].

7 Years of Data: We will present detailed evaluation results from the 2016 Lunar Workshop for Educators, including results from the first follow-up survey collected in January 2017, as well as a summary of evaluation data collected from the full duration of the workshop series.

Next Steps: All NASA science education programs and activities have been consolidated through the SMD Science Education Cooperative Agreement Notice [8]. Although the Lunar Workshops for Educators will no longer be conducted due to the consolidation, the LRO E&C Team will continue sharing LRO science discoveries through print and multimedia products, through social media, in public engagement programs such as International Observe the Moon Night (http://observethemoonnight.org), and via the SMD Science Education Collective upon request.

We intend to publish a paper in a peer-reviewed journal outlining our workshop model and the strengths of the program, such that other professional development providers may learn from the experience we have gained in the past seven years and incorporate relevant aspects of the workshop model into their own professional development programs.

The Dynamic Response of the Environments at Asteroids, the Moon, and moons of Mars (DREAM2) of NASA’s Solar System Exploration Research Virtual Institute (SSERVI) designed their DREAM2Explore teacher professional development workshop based on the Lunar Workshop for Educators model [11]. This workshop will continue through 2018, through the duration of the first SSERVI Cooperative Agreement Notice (CAN). Teams selected through the Cycle 2 SSERVI CAN are encouraged to prioritize citizen science and public engagement efforts. DREAM2Explore has received similar feedback and evaluation results as from Lunar Workshops for Educators, further supporting the efficacy of this workshop model.