SPACE SCIENTISTS AND ENGINEERS' ENGAGEMENT IN EDUCATION AND PUBLIC OUTREACH – COMPARISON OF SURVEY RESULTS. J. Grier¹, S. Buxner¹, B. Vezino², and S. Shipp¹, ¹Planetary Science Institute (1700 East Fort Lowell, Suite 106, Tucson, Arizona, 85719-2395, jgrier@psi.edu), ²University of Arizona (Tucson, AZ), ³Lunar and Planetary Institute (3600 Bay Area Boulevard, Houston, TX 77058).

Engineers, Scientists, and the NASA SMD Education and Public Outreach Forums: The NASA E/PO Forums help the Science Mission Directorate (SMD) support scientists and engineers involved in E/PO through resources, communications, opportunities for involvement, and professional development. They have developed a suite of resources that community members, engineers, and scientists can use in their E/PO endeavors. Continued development of these opportunities to increasingly include engineers and engineering in an education context requires a better understanding of engineers as a population, and their views and attitudes towards E/PO. We have conducted two surveys, one of planetary scientists, and one of engineers involved in the space or earth sciences. Comparison of the data allows for insights into the similarities and differences in the needs, attitudes, and involvement of both scientists and engineers in E/PO activities.

Engineers and the Next Generation Science Standards (NGSS): The Next Generation Science Standards (NGSS) [1] are a new set of K-12 science standards that have been developed through a collaborative, state-led process. Based on the National Research Council (NRC) ‘Framework for K-12 Education,’ the NGSS are designed to provide all students with a coherent education possessing both robust content and rigorous practice. Within these standards is an enhanced emphasis on the intersection between science and engineering. The focus is not only on asking questions and finding answers (science) but also in identifying and designing solutions to problems (engineering.) The NASA SMD E/PO Forums have been working with space scientists for many years to assist with their engagement in E/PO efforts, thus supporting the needs of previous science standards. In order to properly address the needs of NGSS, this conversation is being expanded to include engineers.

Approach: We conducted a series of semi-structured interviews (telephone and email) with both planetary scientists and engineers, as well as with educational professionals who work with scientists and engineers. The surveys were designed to allow us to begin to grasp the needs, attitudes, and understandings of E/PO for each group. Most questions asked were the same between each survey, while a few others were specific to each population. Examples of questions included:

- Are you currently engaged in E/PO (including follow up, why/why not/nature and extent of past/present efforts?)
- Does your institute/company encourage discourage involvement in E/PO and how?
- Do you belong to scientific or engineering professional societies, and which?
- If you wanted/needed help with an E/PO effort, where or to whom would you go for help?
- Do you see yourself as a role model or important information holder for students, in the area of engineering?
- Where to you get your information/news regarding updates and changes in your professional field (planetary science or engineering)?

Results and Discussion: Our preliminary examination of our data has offered some insight into specific areas of interest:

Developing New Relationships: Collecting information directly from people requires the development of strong relationships. Connections with others in the engineering community are necessary to initiate conversations, and trust is required for candid responses. Relationships are best built directly person-to-person, not from one institution to another.

E/PO Culture: The culture of E/PO among engineers is highly dependent on the nature of the institution where they are employed. Places that emphasize the importance of E/PO have programs to involve engineers just as they do scientists. In other organizations, E/PO may be pursued personally by scientists, but rarely by engineers.

Cultural Change: Within the space science community, there have been targeted efforts through NASA to encourage cultural change around E/PO. These successful efforts have created differences between how scientists and engineers approach E/PO. For example, engineers seem less likely to ask about or expect potential funding or any other kind of support for E/PO, including resources or professional development.

Help with E/PO: As was found through surveying scientists, if an engineer seeks help with an E/PO effort, they will first choose to reach out to a personal contact.

Products and Resources: Engineers are generally not aware of products that have been created, or places to go for resources in E/PO.
National Standards: Engineers are generally not aware of changes in the standards for education (NGSS) that now put more emphasis on understanding engineering (i.e. identifying and solving problems using the engineering design cycle.)

Future Directions: We will continue to build new relationships and strengthen existing relationships with engineers, engineering professional societies (such as IEEE and WISE), and members of the education community who work with this population. We will continue direct conversations, collecting more data, and restructuring our questions and approach as necessary. As appropriate, we will consider new areas such as systems thinking, creativity, optimism, collaboration, ethics, and communication as aspects of engineering as a profession, and how it relates to education.


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