STRATEGIES FOR ENABLING LUNAR EXPLORATION: A NEXTGEN PERSPECTIVE. R. N. Watkins[1,2], K. Runyon[3], T. E. Caswell[4], L. R. Ostrach[5], E. R. Jawin[4], H. M. Meyer[6], J. L. Mitchell[6], and the NextGen Group. [1]Washington University in St. Louis, Department of Earth and Planetary Sciences, St. Louis, MO 63130, USA, rclegg-watkins@psi.edu, [2]Planetary Science Institute, Tucson, AZ 85719, [3]Johns Hopkins Applied Physics Laboratory, Laurel, MD 20723, [4]Department of Earth, Environmental and Planetary Sciences, Brown University, Providence, RI, USA 02912, [5]U.S. Geological Survey, Astrogeology Science Center, Flagstaff, AZ 86001, [6]School of Earth and Space Exploration, Arizona State University, Tempe, AZ, USA 85282.

Introduction: The Next Generation Lunar Scientists and Engineers ("NextGen") Group consists of graduate students, post-docs, and early career professionals who will lead future lunar science and exploration efforts [1,2]. Returning to the lunar surface will begin a new era of lunar science; however, there are many critical investigations that must be carried out beforehand to enable future lunar exploration activities. Here we outline critical strategies for enabling future lunar exploration and the crucial role that NextGen will play in their implementation.

Defining Exploration Priorities: While the expertise of senior researchers is essential for planning future missions, it is imperative to include early career scientists/engineers when defining priorities for future lunar exploration. NextGen provides fresh perspectives on destinations, scientific objectives, and exploration strategies. Actively including NextGen in discussions centered around future exploration (e.g., on strategic action teams and on SSERVI teams) will safeguard institutional knowledge, and ensure that the next generation is prepared to lead the way back to the Moon.

Integrating Science and Engineering: NextGen recognizes the value of bringing scientists and engineers together in a way that optimizes the planning and implementation of future lunar missions. The integration of science and engineering is enhanced by increasing effective communication between scientists and engineers, and by providing opportunities for cross-training between the two fields. JPL's TeamX and APL's ACE Runs [3] exemplify science-engineering synergy, and the JPL Planetary Science Summer Seminar is one program that provides cross-training between the two fields, producing a generation of scientists/engineers who can navigate the balance between science and engineering and can apply this practical knowledge to mission planning.

Field Training and Analog Studies: Developing techniques for planetary field geology is vital for human exploration of any planetary body. Advanced sampling tools and protocols have progressed significantly in recent years [4]; however, further work remains to be completed: e.g., the functional equivalents of a Brunton Compass or a hand lens have not been developed, yet these tools are essential in characterizing rock orientations and textures and for placing samples in geologic context. NextGen members are currently working to fill these capability gaps.

NextGen will actively preserve and extend institutional knowledge of planetary field geology beyond the current knowledge base; a strategic investment, especially if further delays occur in sending astronauts back to the Moon. NextGen envisions this investment taking the form of new, high-fidelity analog field campaigns, building off the experience gained from Desert RATS 2010 [5,6] and involving NextGen members in astronaut field geology and spacesuit testing (e.g., [7]).

Support for Exploration Science Research: Grant funding is difficult to obtain, especially for early career researchers, and few programs exist solely to provide support for exploration science-focused research. Though exploration science projects are often included within extended mission proposals, having programs focused on exploration science would broaden the scope and improve the quality of such investigations. A program that *does* support this – and that we believe should be nurtured by NASA HQ – is Planetary Science and Technology through Analog Research. Funding for exploration science investigations would provide opportunities for early career and senior researchers who are not active mission team members to carry out exploration research studies. Additionally, targeted exploration science funding for early career researchers would ensure NextGeners have the resources necessary to contribute fresh perspectives and innovative methods to exploration science questions.

Commercial Partnerships: Partnering with commercial companies (such as NASA's current ISS resupply contracts with SpaceX and Orbital/ATK) will lower costs and accelerate technology development, while building strong relationships with private industries. Similarly, the Google Lunar X-Prize competition may soon result in commercial companies successfully landing on the Moon. Partnerships with such companies (NextGen already has established ties with Moon Express) will promote science/engineering integration, which will in turn enable continued lunar surface exploration at lower costs and with higher scientific return.

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