CREATING AND MAINTAINING A LUNAR TRAINING GROUND IN NORTHERN ARIZONA: A GUIDE TO CINDER LAKE CRATER FIELD. A. L. Gullikson[1], L. A. Edgar[1], M. E. Rumpf[1], [1]U.S. Geological Survey, Astrogeology Science Center (2255 N. Gemini Drive, Flagstaff AZ, 86001; agullikson@usgs.gov).

Introduction: Terrestrial analog sites are used for a variety of reasons, including testing new technologies, investigating robotic and human mobility in relevant terrains, assessing geologic processes and products in environments similar to off-world sites, and studying the effects of long-term isolation on humans [e.g., 1-3]. Field analog sites enable researchers to evaluate the performance of instruments and test field methods in real-world environments [3]. Many terrestrial analog sites are found in extreme environments, acting as on-world proxies for conditions expected or observed on other planetary bodies [e.g., 4,5]. While these locations may be remote, from both a financial and logistical standpoint, troubleshooting issues and applying fixes on Earth is *much* safer, easier, and faster when compared to resolving the same issues on another planetary body [e.g., 6].

Notably, the Cinder Lake crater fields located near Flagstaff, Arizona, were designed and constructed to replicate part of the lunar surface (**Fig. 1**) and provide a unique and valuable opportunity for Apollo astronauts, engineers, and scientists to train, test instruments, and carry out simulations in preparation for missions to the Moon [8]. Today, these sites are not only of historic importance, but they can still be used as training grounds for on-going preparation for missions to the Moon, Mars, and beyond.

TARGET Program: In 2019, the USGS Astrogeology Science Center (ASC) developed the Terrestrial Analogs for Research and Geologic Exploration Training (TARGET) program. The focus of this service-oriented program is to provide analog-focused training resources, sample collections, and data archiving to the planetary community [e.g., 9–11]. The development of multipurpose field guides for widely used analog locations in northern Arizona is one of the program's primary objectives. Our intent for these field guides is to increase inclusivity by designing them to be used virtually, making them accessible for a wide range of target audiences. Developing guides in an interactive, digital format removes the need to be physically present at such locations to take full advantage of the guide and its activities.

Cinder Lake Crater Field Guide: Presented here is TARGET's third field guide, the Cinder Lake Crater Field Guide. This guide provides a visual and written history of the two Cinder Lake crater fields, detailing how and why the sites were constructed, and the types of training that took place there. Additionally, we explore these crater fields in their current state (**Fig. 2**), (virtually) replicate activities that were carried out on site, and provide lessons on a plethora of topics, such as crater morphology, landform degradation and erosion, map scales, and the importance and usefulness of sun angle on resolving the shape of features on the ground.

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References: [1] Léveillé, R. (2010) *Planet. And Space Sci., 58,* 631-638. [2] Moores, J.E. et al (2012) *Adv. In Space Res., 50,* 1666-1686; [3] Foucher, F. et al. (2021) *Planet. and Space Sci, 197, 105162;* [4] Lee, P. and Osinski, G.R. (2005) *Meteor. and Planet. Sci. 40, no. 12*, 1755-1758; [5] Amils, R. et al. (2006) *Planet. And Space Sci. 55,* 370-381; [6] Léveillé, R. (2009) *Evolution (Biogenesis) 8*, 637-648; [7] Schaber, G.G. (2005) *USGS OFR 2005-1190*; [8] Bailey, N.G., et al. (1969) *U.S. Geol. Survey Prof. Paper,* D172-D179; [9] Gullikson, A.L., et al. (2021) *USGS OFR 2021-1072*, 37 p. [10] Rumpf, M.E. and Hunter, M.A. (2022) *53rd LPSC,* abstract #2631. [11] Gullikson, A.L. et al. (2024) USGS Data Release, DOI: 10.5066/P9OGAJ8P.

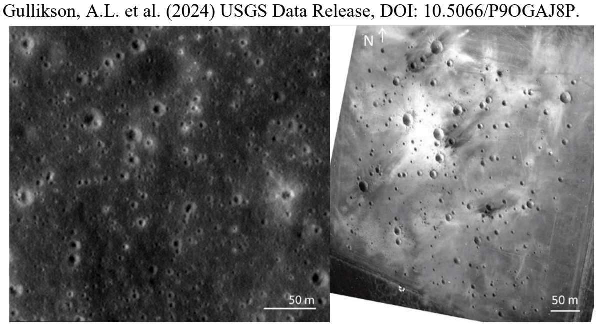

Figure 1. The Moon versus the Cinder Lake crater field 2 replica. **Left:** Location on the Moon chosen to be replicated, *LROC WAC basemap.* **Right:** Completion of Cinder Lake crater field 2, 1968. *Image from [7], figure 56d.*

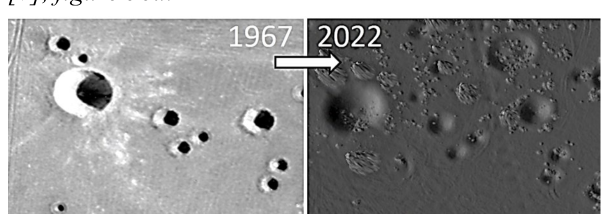

Figure 2. Crater degradation at Cinder Lake crater field 1. **Left:** Newly created craters in 1967. *USGS photo, unnumbered.* **Right:** Present day craters, from *DEM hillshade model generated from UAS 2022 data.*