DEVELOPING ADVANCED EVA INFORMATICS FOR FIELD PORTABLE INSTRUMENTATION AND SCIENCE OPERATIONS DURING CREWED PLANETARY SURFACE EXPLORATION. K. E. Young[1], A. D. Rogers[2], Z. Morse[3,1], C. Honniball[4,1], C. Achilles[4,1], B. Feist[5,6], P. Whelley[7,1], J. Richardson[7,1], S. Scheidt[3,1], J. M. Hurtado Jr.[8], A. McAdam[1], C. Knudson[7,1], C. Pittman[5,6], A. Baldridge[9], C. Edwards[10], A. Horchler[11], G. R. Osinski[12], L. Edgar[13], T. Graff[5,6], N. Schmerr[7], P. Niles[6], A. Jones[1], and T. D. Glotch[2]; [1]NASA GSFC, Greenbelt, MD, 20771; [2]Stony Brook University, Stony Brook, NY, 11794; [3]Howard University, Washington, DC, 20059; [4]Universities Space Research Association, Columbia, MD, 21046; [5]Jacobs, Houston, TX, 77058; [6]NASA Johnson Space Center, Houston, TX, 77058; [7]University of Maryland College Park, College Park, MD, 20742; [8]University of Texas El Paso, El Paso, TX, 79968; [9]St Mary's College, Moraga, CA, 94575; [10]Northern Arizona University, Flagstaff, AZ, 86011; [11]Astrobotic, Pittsburgh, PA, 15222; [12]University of Western Ontario, London, Ontario, N6A 3K7; [13]USGS Astrogeology Science Center, Flagstaff, AZ, 86011; corresponding author email: kelsey.e.young@nasa.gov

Introduction: The Remote, In Situ and Synchrotron Studies for Science and Exploration (RIS[4]E) team was funded by NASA's SSERVI (Solar System Exploration Research Virtual Institute) team was funded from 2014-2019. In part, RIS[4]E research focused on evaluating both the utility of using field portable instrumentation for crewed planetary surface exploration and the implications of including these technologies on EVA (extravehicular activity) timelines. RISE2, the next generation of the RIS[4]E project, has been funded from 2020-2024 in part to evaluate the incorporation of field deployable payloads and associated advanced EVA informatics systems and how these informatics systems will support the execution of scientifically-motivated EVAs.

RISE2 Fieldwork: RISE2 fieldwork will use the Kilbourne Hole maar volcanic crater, located in the Potrillo Volcanic Field, NM, which is a lunar and martian analog that was used to train Apollo crews. Near-term fieldwork will include a preparatory trip in Fall 2020 to prepare for EVA simulations to take place in Spring 2021. The 2021 deployment will also bring journalism students to the field to report on the field campaign as part of a semester-long science journalism program conducted with the Stony Brook School of Journalism.

Field Portable Instruments: A variety of field instruments will be tested in RISE2 fieldwork, both individually among instrument teams to determine their ideal operational modes, and as a part of EVA simulations to explore how data will be visualized and managed to make tactical decisions both within one EVA and throughout a mission. Technologies tested will include: (a) handheld instruments, e.g., field-portable laser induced breakdown spectroscopy (LIBS), handheld X-ray fluorescence spectroscopy (hXRF), visible-near infrared spectroscopy (VNIR), and Raman spectroscopy; (b) tripod or rover-mounted instruments such as Light Detection and Ranging (LiDAR) and hyperspectral imaging; (c) surface-deployable payloads like X-ray Diffraction (XRD) and seismic instrumentation; and (d) uncrewed aerial vehicles (UAVs) to provide high-level context data and a platform with which to explore data integration.

RISE2 Objectives: Following the success of the RIS[4]E research, RISE2 will define a new paradigm for integrated spatial and temporal data management and visualization strategies for crewmembers and science support teams during planetary surface exploration.

Science Objectives: We will evaluate the eruptive history of Kilbourne Hole and general formation mechanisms of maar volcanic craters using field portable instruments. This task will provide a new test of formation hypotheses for Kilbourne Hole and the development of a surface analysis strategy for explosive basaltic deposits throughout the solar system.

Exploration Objectives: While evaluating the eruptive history of maar volcanic craters, we will define exploration protocols and a concept of operations (ConOps) for portable instruments using different operational modes, including reconnaissance of the entire feature and detailed site characterization.

Finally, we will explore strategies for processing, assimilation, visualization, and management of diverse data types for mission support. Field portable instruments, while valuable in increasing scientific knowledge of an area during exploration, yield high volumes of data. These data must be assimilated by extravehicular (EV) crewmembers and science support teams in real-time to inform both tactical decision-making within one EVA and strategic decision-making across a mission and the larger Artemis program. We need a robust informatics capability available to both the EV crew and science support teams to inform this decision-making. RISE2 work will focus on this critical need and will design a prototype in order to advance recommendations for what future mission support software should include. This task will define data stream workflows for field portable instruments and provide recommended requirements for spatial and temporal data management, assimilation, and visualization.

Conclusions: This presentation will review RIS[4]E accomplishments and highlight plans for RISE2 testing, which will develop recommendations, a ConOps, and a data management strategy for NASA's Artemis Program.