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Author: Mr. Leonardo Turchi
European Space Agency (ESA), Italy

Mr. Francesco Sauro
Alma Mater Studiorum - University of Bologna, Italy
Dr. Samuel Payler
European Space Agency (ESA), Germany
Dr. Riccardo Pozzobon
University of Padua, Italy
Dr. Igor Drozdovskiy
European Space Agency (ESA/EAC), Germany
Ms. Loredana Bessone
ESA, European Astronaut Centre (EAC), Germany

THE ELECTRONIC FIELDBOOK: A FIELD SCIENCE OPERATIONS SUPPORT SYSTEM FOR ASTRONAUT TRAINING AND HUMAN PLANETARY EXPLORATION

Abstract

Scientific exploration will form an important part of future human missions to the Moon. In order to enhance the scientific return of these missions, it is important to accurately record, index and store all the scientific information collected during exploration, and then rapidly distribute it in a structured way amongst the relevant mission support personnel. Such capabilities will be essential for the ground-based science teams supporting these future missions for maintaining situational awareness, enabling them to provide useful and timely feedback to the astronauts and thereby enhance the scientific expertise present on the lunar surface. The Electronic FieldBook (EFB) is a deployable and modular system being developed to address these requirements. It is designed to support field mission operations, scientific data gathering and direct interaction with support teams through the automatic exchange of information. The system provides near real-time situational awareness to mission support teams during scientific traverses. It achieves this through several methods. The system provides a structured way to collect data. Users can document a sampling procedure, retrieve information from several sensors or analytical tools, look up reference information, and take notes. All the information gathered is automatically geo-located and tagged to ensure it is associated to specific sites or samples along a traverse. Decision support for tasks such as sample selection is also provided by the EFB. When interfacing with analytical tools (e.g. handheld spectrometers), the system can analyse the data produced using embedded machine learning modules to characterise the samples and inform on their scientific value. The EFB comes as a fully integrated package, including portable devices for data collection and field-deployable wireless mesh data transmitters. The system ensures disruption tolerant information exchange, allowing users to continue working regardless of temporary or extended loss of connection. Provided connectivity is present, any user of the system will receive information gathered in near real time, enabling them to direct or support the operations, and provide relevant and informed scientific advice where required. EFB has been the key supporting tool for ESA's PANGAEA/PANGAEA-X 2018 and PANGAEA 2019 field campaigns, which offer planetary geology training integrated with operations and technology testing. Within this context, the EFB has co-evolved to support both ESA training and testing activities, and provides a solution to the data integration challenge presented by future human scientific exploration in space.