Temporal Activation of Extravehicular Activity Science and Operations Data: How Rise2's Enablement of a Novel Data Management Prototype Influenced ISS and Artemis Advancements B. Feist[1], Matthew J. Miller[1], David Charney[1], Cameron Pittman[1], Jackie Vu[1], K. Young[2], Patrick L Whelley[3], J. E. Bleacher[4], P. B. Niles[5] [1]Jacobs, NASA Johnson Space Center, [2]NASA Goddard Space Flight Center, [3]University of MD, NASA Goddard Space Flight Center, [4]NASA Headquarters, [5]NASA Johnson Space Center

Introduction: SSERVI's RIS4E and Rise2 nodes provided early and repeated opportunities to prototype the organization and visualization of science and field operations data together via temporal vs. type-indexing. This data management approach was first explored in our Apollo in Real Time[1] initiative through its meticulous reconciliation and integration of Apollo 11, 13, and 17 mission data, providing an unparalleled temporal and contextual understanding of these historic missions. The positive results from these prototypes served as precursor examples of what eventually became the Collaborative Operations Data Activation (CODA) application at NASA Johnson Space Center (JSC) [2].

RIS4E Prototype: By aligning voice, image, video data, and geologic data in a searchable, synchronized framework, the Apollo in Real Time project showed the potential to apply this methodology to field analog data to establish scientific context. When co-authors Bleacher and Whelley became aware of Apollo in Real Time in 2016, they invited co-author Feist to participate in RIS4E field operations. Feist subsequently built the RIS4E data visualization prototype. The positive outcome from this prototype played an important role in gaining acceptance for the concept at JSC to support ongoing and future mission programs.

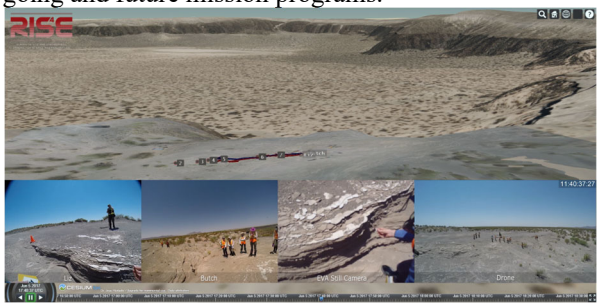

Figure 1 The RIS4E prototype featuring GPS tracks, two crew audio/video feeds, crew still camera, overhead drone and XRF data in context

Neutral Buoyancy Laboratory Prototype: In 2018, the Neutral Buoyancy Laboratory (NBL) at JSC saw the potential of temporal data management largely due to a demonstration of the RIS4E prototype to NBL leadership. This provided us the opportunity to build another prototype for the NBL using NBL data. The resulting visualization was of clear benefit to the NBL and the NASA Flight Operations Directorate (FOD) in general.

Enthusiasm for the concept within FOD resulted in our group being tasked to build a new, enterprise application that could serve all flight operations across missions, tests, and analogs. This application became known as CODA.

CODA: Released in 2021, CODA is an enterprise-grade software system now serving NASA flight operations across missions, tests, and analogs at JSC. Used daily in Mission Control, CODA was awarded the JSC Software Excellence and NASA Major Space Act Awards in 2022 and is slated to support mission and science operations on the Artemis Program.

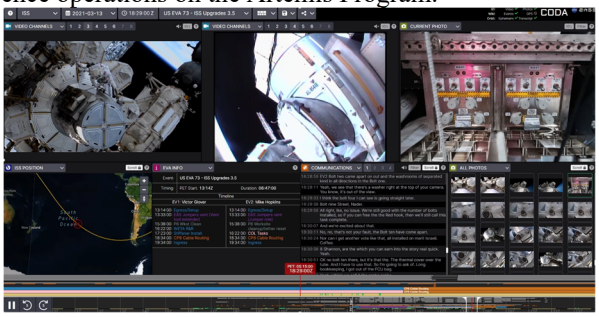

Figure 2 CODA application displaying an ISS EVA putting ISS telemetry, EVA procedure, comm, orbital position, photography, and nine video downlinks into context

Rise2 EVAs: In 2023, data produced during the Rise2 series of analog EVAs were integrated into CODA, bringing the concept full circle by putting Rise2 analog data into the system born from the first RIS4E prototype built in 2017. The CODA representation of the 2023 EVAs provided valuable insights into the EVAs themselves and further demonstrates the support CODA will provide to Artemis EVAs in the coming years by aligning disparate data within mission context.

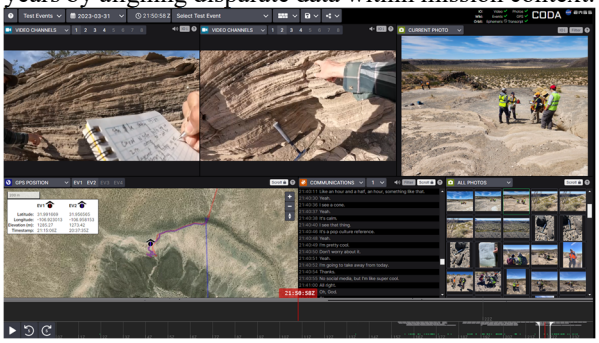

Figure 3 CODA application displaying a 2023 Rise2 EVA including GPS tracks, crew audio/video, and photography into context

[1] NASA. (2018). *Documenting of Geologic Field Activities in Real-Time in Four Dimensions: Apollo 17 as a Case Study for Terrestrial Analogues and Future Exploration.* Retrieved from https://ntrs.nasa.gov/citations/20180002453

[2] Miller, Matthew & Montalvo, James & Feist, Ben & Charney, David & Rynearson, David & Vu, Jackie & Heinemann, Katie & Davis, Trey & Lin, Stephen & Baig, Omar & Pittman, Cameron. (2023). Supporting Exploration Missions by Enabling Exploration Mission System Software.