MoonCapture: Concept for Transforming Lunar Document Archives into an Online Lunar Discovery and Planning Tool M.L. Rilee[1], P.E. Clark[2], S. Bailin[3], D. Portree[4], J.S. Hughes[5], [1]Rilee Systems Technologies LLC, Herndon, VA, [2]Catholic University of America@NASA/GSFC, Greenbelt, MD 2071, [3]Knowledge Evolution Incorporated, Washington DC, [4]USGS Astrogeological Branch, Flagstaff, AZ, [5]Jet Propulsion Laboratory, Pasadena, CA (Correspondence email: Pamela.E.Clark@NASA.gov).

Problem: Access to crucial metadata related to lunar surface exploration, much of it found in as yet undigitzed and unprocessed collections of Apollo era documentation, would, if made available, provide an essential context for more comprehensive understanding and more effective analysis and modeling of the extensive archive of lunar data, as well as for development of more effective field techniques to support lunar surface science activities and missions [1]. We have proposed to address this problem by completing the online archiving, by developing MoonCapture, a state of the art semantic web based knowledge management tool to provide this access and analysis capability for lunar surface information (Figure 1).

Context: Mooncapture incorporates the recently discovered extensive collection of Apollo-era planning, simulation, and training source materials uniquely well preserved as hardcopy and available at the USGS Flagstaff RPIF, and linking currently archived lunar data, maps, reports and other online resources, including those at RPIF and PDS facilities, to these materials, to create a 'lunar data clearinghouse' with automated data ingest and concept extraction capabilities. This semantic web based tool would provide the basis for conceptual analysis of planning, simulation, training for lunar surface exploration that can be applied to future robotic or human mission planning, as well as for a 'one stop shopping' process to discover previously unseen relationships between techniques, hypotheses, and measurements that could be useful, for example, in providing further insight into lunar samples and orbital data at the PDS. We are designing MoonCapture to provide the basis for a generic tool for linking and providing a context for in-depth analysis of all lunar and planetary data and metadata useful for RPIF and PDS nodes. Ultimately, Mooncapture would provide the basis for uniquely linking the relatively inaccessible hardcopy collections at NASA RPIFs with digital data collections from related missions.

Methodology and Tasks: This work utilizes, leverages, and expands 1) Best practices and existing expertise for preserving, collecting, and cataloging multimedia archival material being utilized in the USGS RPIF facility, including recent [2]and ongoing efforts and interest in finding and establishing an archive to include 'missing' Apollo era source materials relevant to lunar exploration, including activity planning, simulation, and training documents for both lunar surface and field analog studies; 2) State-of-the-art knowledge capture tools to index, trace and analyze development of key science hypotheses and methodologies, provide a metadata 'context' for understanding lunar science measurements and techniques, and provide search criteria and links between the these and other Apollo era documents and other online lunar sources, including remote observations, photos and maps, and the Apollo Lunar Surface Journal; 3) Preliminary analysis of Apollo planning, simulation, and training documents, including those involving use of terrestrial analogues, to establish a 'baseline' for effective surface science activities for future lunar missions [1]; 4) Development of state-of-the-art, open access user friendly search tools, interfaces, and use case test scenarios representing broad user communities [3].

The work involves three major tasks. Apollo Era Document Digital Archiving involves creating an online archive of such documents in the USGS RPIF collection, processing, selecting, indexing, creating a catalogue entry, and scanning. Development and testing of the knowledge management toolkit for lunar data, otherwise known as MoonCapture, creates the basis for a lunar data clearinghouse that can establish links between information to support diverse user interests. Use case scenarios developed for testing Mooncapture represent a broad range of disciplines and viewpoints. Finally, conceptual Analysis of Apollo era Documents involves registering documents as objects with key attributes, and study of those attributes as a function of time.

Products: 1) Online catalog and digital archive at USGS RPIF to preserve large collection of 'missing' Apollo era planning/simulation/training documents and associated source materials. 2) Toolkit for generation of metadata from sources to use as contextual search material, and linking to existing online sources, including map, sample data, and image data archives, with capability for automated concept extraction. 3) Demonstration of tool for several user scenarios associated with program or mission planning, science, engineering, or educational uses. 4) Using the toolkit, analysis of the development of key concepts, techniques, and methodologies in lunar surface exploration to establish a 'baseline' for effective human or robotic lunar surface exploration using state of the art knowledge management tools. 5) Book on Methodologies for surface exploration developed for the Moon to be published by Springer.

References: [1] Clark, 2010, EMP, 106, 2-4, 133-157; [2] Schaber, 2005, USGS OFR 2005-11990 ; [3] Clark et al, 2012, AIAA Space, 10.2514/6.2012-5241.

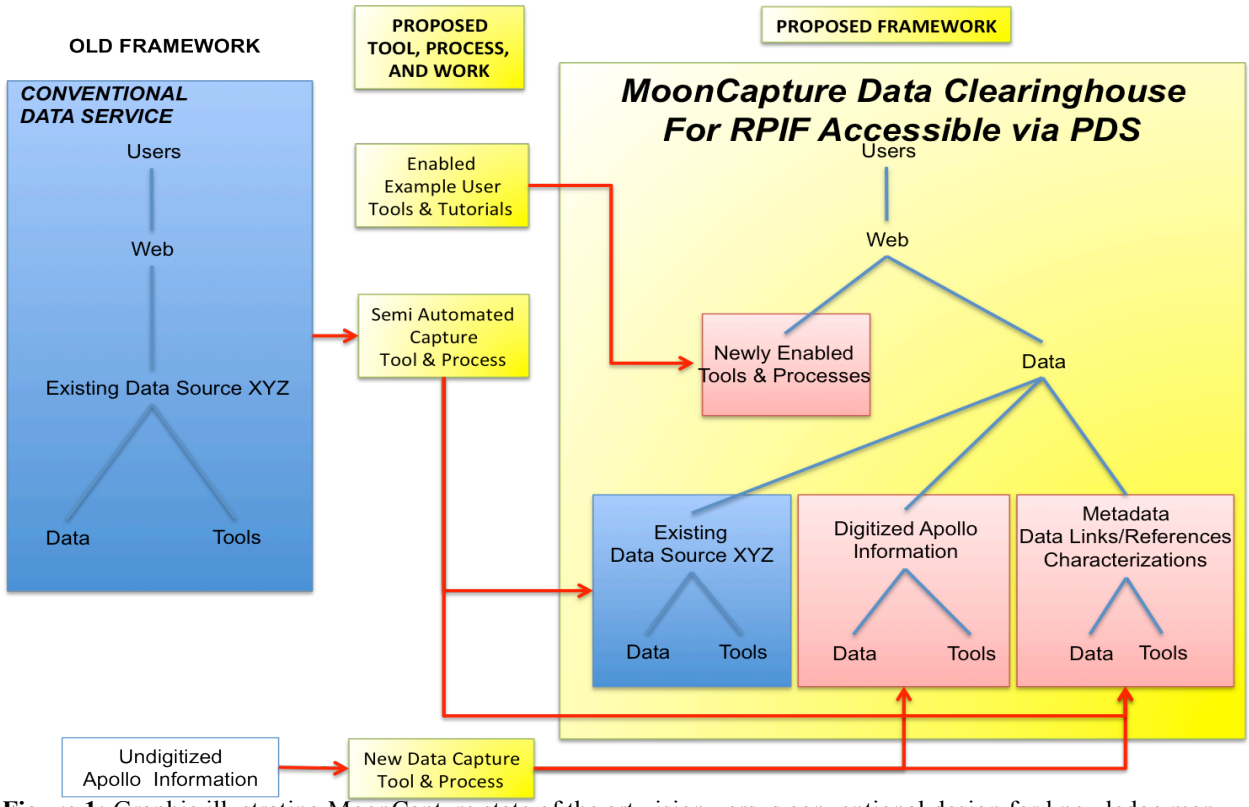

Figure 1: Graphic illustrating MoonCapture state of the art vision versus conventional design for knowledge management toolkit for RPIFs and PDS as described in text.