IMPROVING THE AQCUISITION AND MANAGEMENT OF SAMPLE CURATION DATA.

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Introduction: This paper discusses the current sample documentation processes used during and after a mission, examines the challenges and special considerations needed for designing effective sample curation data systems, and looks at the results of a simulated sample result mission and the lessons learned from this simulation. In addition, it introduces a new data architecture for an integrated sample Curation data system being implemented at the NASA Astromaterials Acquisition and Curation department and discusses how it improves on existing data management systems.

Role of Data Management in Sample Curation: Data management is integral to successful sample curation. A sample curation data system must: document sample acquisition process and conditions during sample collection, provide a complete history of all data collected and all actions taken on a sample from the moment it is collected and throughout its lifecycle, provide all information needed about a sample to assist scientists in the selection of samples for future study, compile collection statistics that allow Curators and allocation committees to make decisions regarding the allocation and disposition of samples, and document allocation and analysis history of a sample.

Current Sample Curation Documentation Processes:

Sample Documentation During the Mission. During the Apollo missions, samples were documented through any of the following: photographic documentation of sample prior to collection in its native, photographic documentation of area of sample collection after specimen is removed, correlation of photo numbers to samples collected, documentation of collection conditions, locations, sample descriptions, and sample storage through transcripts of mission conversations, and tracking of samples through container numbers used for storage and transport.

During the unmanned Genesis and Stardust missions, samples data was collected prior to the mission through the documentation and tracking of collector materials, including photographic documentation. All other documentation occurred after the missions were completed.

Sample Documentation After Mission Completion. Existing data systems are mission-specific. Every sample collection is tracked in disparate data repositories that vary depending on the sample type. Access to data is done through different interfaces but each collection also contains data from common repositories. Some systems directly interface to the common data repositories while others rely on lab processors entering the appropriate data from the other systems. Collection metrics are generated using ad-hoc querying methods against data.

Important Considerations in the Design of Sample Curation Data Management Systems: In designing a new data and user interface architecture for documenting samples, there are many factors that need to be considered. Perhaps the most important is that data acquisition should start as early as possible to ensure data preservation and integrity. The recording of collection conditions is crucial because such conditions can help uncover relationships that would otherwise be hard to envision. For example, to properly study a sample, we need to be able to provide precise recording of time and location of sample collection, sample orientation, remarkable features, tools used, analyses performed, possible sources of contamination, and any other data compiled throughout a mission. In addition, ample photo documentation of the collection process is a must to maintain sample context information.

Proper sample management should include the ability to properly tag, store, and record all transactions. Also, data acquisition from lab equipment should be tightly integrated with the sample curation system. Data collection should be as unobtrusive as possible and well suited for the particular environment. Improving sample documentation workflows is a vital part of any new system design.

Architecture of an Integrated Sample Curation Data System: The design of an improved system for maintaining sample curation data will be discussed. The system is comprised of a modular implementation that separates common functionality and data repositories from collection specific functions, which are encapsulated outside these functional units so they can be changed depending of a collection's needs. The system would include data interfaces to lab equipment to allow for the automatic collection and processing of sample data with minimal intervention of lab processors. File handling modules allow users to upload, categorize, process and associate documents and photos to specific samples, including searchable image annotation. Built in data/document generation capability will produce all required data products from data repository.