GENESIS SOLAR WIND – CAPTURE, RETURN, CURATE AND ANALYZE: LOOKING BACKWARD AND CREATING A TIMELINE. J. H. Allton[1], M. C. Rodriguez[2]. [1]NASA/JSC, Mail Code XI2, 2101 NASA Parkway, Houston TX 77058, judith.h.allton@nasa.gov, [2]GeoControl Systems, Inc., JETSII, at NASA/JSC Houston, TX.

Introduction: In 1997 NASA'S Discovery Program selected the Genesis mission proposal to return solar wind samples to Earth for laboratory analyses. Principal Investigator Donald S. Burnett and the science team defined the purity of collector materials and ability to analyze solar wind composition to the precision required for planetary science. As a small mission, focused on a well-defined science goal, yet needing careful attention to engineering details, the communication among scientists and engineers, nurtured by Don Burnett, was exceptional.

Genesis Mission and Curation Legacy: Genesis, as the first U. S. spacecraft to return astromaterial samples since Apollo, not only integrated the mission planning and flight teams, but also the science and sample curation teams during the mission development period. Since Genesis is a sample return mission, the Science Team was essential in certifying the collectors (sample containers for solar atoms). From inception, Genesis established mission funding for returned sample curation [1]. JSC was lead in contamination control during mission preparation, including establishment of an ISO 4 cleanroom facility and use of ultrapure water (UPW) for cleaning flight hardware (and, as it turned out, for cleaning collectors after the mishap). Reliable, fast communication among scientists, engineers and curators at the hands-on level established deep respect among team members and efficient decision-making. JSC's 50-years of astromaterial sample curation provided experienced sample processors onsite during recovery in Utah (a deep bench for emergency response). Post-recovery curation included iterative collaboration with science sample users to clean or verify cleanliness of samples. The science legacy from Genesis is addressed by Burnett and Jurewicz, this volume.

In The Beginning: After Apollo sample return, Burnett and Marcia Neugebauer at JPL began discussing a solar wind sample return, with Neugebauer arguing that separate collection of solar wind regimes was essential science. By 1992 a solar wind sample return mission was presented at a workshop, and by 1994 a mission was proposed named Suess-Urey. The mission was re-proposed under a new name GENESIS and selected in 1997. Susan Niebur captured the Genesis mission history and stories, from high level management documents and from many interviews with participants [2]. Her account lets readers glimpse personality of participants in quotations from interviews.

Need and Scope for Detailed Technical Timeline: A timeline constructed from lower level task documents has been initiated to document the resources and skills actually used, as well as task sequence or concurrency. Timelines for high level mission events are captured in two documents [1] [2] and for detailed re-entry events in [3]. A detailed technical timeline for Genesis mission and curation activities will provide data points for lower level tasks, such as ISO 4 curation facility construction time, preparation for nominal sample field recovery, mishap recovery, and UPW expansion.

Changes in technology context 1990-2024. Semiconductor technologies were easily accessible in the U.S.A. (1990-1999), and the Genesis team used those resources for cleanroom design and UPW system expansion. Image documentation was changing from film to digital during cleanroom construction and payload cleaning (1997-2001). Engineering design was done using computer aided design proprietary software, making more difficult the archiving of payload configuration and materials. Email of documents, tracked delivery service and virtual meeting capability greatly improved communication efficiency.

Information sources –

Pre-launch mission preparation: Examples of mission science, engineering and contamination control are collector purity testing, payload design/fabrication and ISO 4 cleanroom construction. Information on timing of these activities comes from facility readiness reviews, management reviews, shipping documents, procurement documents, test reports, travel documents, laboratory logs, Quality Assurance documents, dates on images, participant notebooks and emails.

Information sources –

Sample return re-entry and field recovery activities: Information comes from event timelines produced by Mid-Air Recovery team, Lockheed team lead notes and from chase video, JPL Quality Assurance. Information also comes from images and logbooks from UTTR cleanroom operations and from curatorial documents.

Information sources –

Resulting science and sample cleaning processes. Agendas from the annual gatherings of the science team initially trace testing for collector purity/cleanliness, and after sample recovery, include collector cleaning and cleanliness assessment. Post-recovery documents include curatorial orders and procedures, sample allocation documents and LPSC abstracts.

Timeline Objectives: A simple spreadsheet timeline with headers DATE, EVENT, PEOPLE, COMMENT, INFORMATION SOURCE has been initiated and currently has over 90 entries. While this is not definitive historical research, it is a quick look at the evolution of Genesis curation with pointers to documents or people with information. Engineers for future missions may find useful points of comparison for development of facilities.

References:

[1] Genesis Mission Reference Document, (2011) JPL D-62382.

[2] Niebur S. M., edited by Brown D. W. (2023) NASA's Discovery Program: The First 20 Years of Competitive Planetary Exploration, NASA-SP-2023-4238.

[3] Genesis Mishap Investigation Board Report, Vol. 1 (July 2005).