

UPCOMING DATA COLLECTIONS RESTORED BY THE LUNAR DATA PROJECT / PDS LUNAR DATA NODE. David R. Williams¹, H. Kent Hills², Patrick T. Taylor³, Stephanie A. McLaughlin⁴, Edward A. Guinness⁵, ¹Code 690.1/NSSDCA, NASA Goddard Space Flight Center, U.S.A. (david.r.williams@nasa.gov), ²Code 690.1/NSSDCA, Adnet Systems Inc., U.S.A., ³Code 698/Planetary Geodynamics, NASA Goddard Space Flight Center, U.S.A., ⁴Code 690.1/NSSDCA, Telophase, Inc., U.S.A., ⁵Department of Earth and Planetary Sciences, Washington University in St. Louis, U.S.A.

Introduction: The Apollo 11, 12, 14, 15, 16, and 17 missions all returned large amounts of data from science experiments, including years of data from the long-lived Apollo Lunar Surface Experiments Packages (ALSEP) deployed by the astronauts. Absent a systematic and enforceable archiving protocol, much of these data were never archived, and even those that were deposited typically were missing documentation or are on obsolete media and in outmoded formats.

The Lunar Data Project and the Planetary Data System (PDS) Lunar Data Node were formed to take data collections already archived at the National Space Science Data Center (NSSDC, now the NASA Space Science Data Coordinated Archive, NSSDCA) and restore and prepare them to be archived with PDS. That mission has expanded to include locating lunar data that were never archived, bringing them into NSSDCA, and then archiving them through PDS. Preparing these data for archiving involves reading data from the original media (magnetic tape, microfilm, microfiche, or hard-copy document), converting the outmoded, often binary, formats when necessary, putting them into a standard digital form accepted by PDS, collecting the necessary ancillary data and documentation (metadata) to ensure these data are usable and well-described, summarizing the metadata in documentation to be included in the data set, adding other information such as references, mission and instrument descriptions, contact information, and related documentation, and packaging the results in a PDS-compliant data collection. The data collection is then validated and reviewed by a group of external scientists as part of the PDS final archive process. We present an overview of the data collections being readied for PDS review and validation.

Apollo 17 ALSEP ARCSAV Lunar Surface Gravimeter Data Collection: The Lunar Surface Gravimeter (LSG) was deployed as part of the Apollo 17 ALSEP. Although the instrument did not work as a gravimeter, the data can be used for seismic studies. The original data were read from a set of ALSEP data archival (ARCSAV) tapes, consisting of raw data transmitted from the Moon covering the period from 2 April 1975 through 30 June 1975. They were recovered through a PDART program under direction of

Seiichi Nagihara. The data were extracted from the ARCSAV tapes by Yosio Nakamura and organized for PDS archive. The collection consists of ASCII tables of LSG data.

Apollo 17 Lunar Ejecta And Meteorites Experiment Raw Data Collection: The Lunar Ejecta And Meteorites (LEAM) experiment was deployed on the lunar surface by the Apollo 17 astronauts and returned data for 6 months before failing due to overheating. The experiment was designed to measure the speed, direction, and total kinetic energy of particles impacting the lunar surface. These data, extracted from the Apollo 17 ALSEP Work Tapes, cover the period from 1 March 1976 through 18 July 1976 and consist of raw instrument data in the form of ASCII tables.

Apollo 17 LEAM Calibration Notebook Collection: The LEAM Principal Investigator, Otto Berg, kept an extensive notebook documenting the development and operation of the LEAM instrument. The notebook has been scanned and is available in digital form (PDF/A) as ancillary data to accompany the LEAM raw data set. TIFF versions of the scans will also be available at the NSSDCA.

Apollo 16 Orbital Mass Spectrometer Digitized Data Outputs Collection: The Orbital Mass Spectrometer mounted on a boom extending from the Apollo 16 Service Module was a neutral magnetic mass spectrometer that measured ambient gas at the orbital distance of the spacecraft. The original data were microfilm records archived at the NSSDC, they have been scanned and compiled as a digital (PDF/A) collection. TIFF versions of the scans are available at the NSSDCA.

Apollo 16 Orbital Mass Spectrometer Document Collection: The collection contains ancillary documents, provided as digital (PDF/A) files for use with the Orbital Mass Spectrometer data described above.

Apollo 17 Surface Electrical Properties Experiment Digitized Data Plots and Final Technical Report Collection: The Surface Electrical Properties Experiment was operated by the Apollo 17 astronauts

as part of their EVA activities. The experiment was run to obtain data about the electromagnetic energy transmission, absorption, and reflection characteristics of the lunar surface and subsurface. Plots and the final technical report were archived at the NSSDC and preserved on microfiche. The microfiche has been scanned and converted to a digital image (PDF/A) collection. TIFF versions of the scans are also archived at the NSSDCA.

Apollo 17 Surface Electrical Properties Experiment Document Collection: The collection contains ancillary documents provided as digital (PDF/A) files, for use with the Surface Electrical Properties data described above.

Apollo 17 Far-Ultraviolet Spectrometer Digitized Data Graphs Collection: The Far-Ultraviolet Spectrometer was mounted in the Apollo 17 Service Module Scientific Instrument Monitor (SIM) bay and operated while in orbit around the Moon and also during trans-Earth coast. The instrument was an Ebert spectrometer, designed to make measurements of far-ultraviolet radiation from the tenuous lunar atmosphere. The original data archived at the NSSDC were plots of averages of the spectra, and time variations in intensities measured at six chosen wavelengths. These were preserved on microfilm. The microfilm has been scanned and the scans converted to digital files (PDF/A) for archive with PDS. TIFF versions of the scans will also be available from the NSSDCA.

Apollo 17 Far-Ultraviolet Spectrometer Document Collection: The collection contains ancillary documents provided as digital (PDF/A) files, for use with the Far-Ultraviolet Spectrometer data described above.

Pioneer 8/9 Cosmic Dust Detector Calibration Notebook Collection: The Cosmic Dust Detector carried on the Pioneer 8 and 9 missions was the same design as the LEAM instrument. The LEAM P.I., Otto Berg, suggested the detailed notebooks he kept on the Cosmic Dust Detector calibration and operation would be useful in interpreting the LEAM data, particularly for calibration information. The notebooks were scanned and saved as digital files (PDF/A). TIFF versions of the scans are also archived at the NSSDCA.

Apollo 17 Metric (Mapping) Camera and Panoramic Camera Photographic Support Data Bundle: The Apollo 17 Metric and Panoramic Cameras operated from the Service Module, imaging the lunar surface as the Command/Service Module orbited the

Moon. The bundle comprises ASCII files of ephemeris and state vectors for each photograph taken. The original data were on microfilm held at NSSDCA. The film was scanned and sent to Arizona State University, where the scans were converted to digital files using OCR.

Apollo Common Documentation Collection: The collection contains digital files of Apollo documents useful as ancillary information in use of the Apollo data. The documents will be archived with PDS as PDF/A files.

Completed Data Sets: Previously completed data sets are available at <http://pds-geosciences.wustl.edu/missions/apollo/>. These include the Apollo 14 and 15 Cold Cathode Ion Gage (CCIG) data, which consist of scans of microfilm plots of the number of neutral gas particles near the surface, measured by the ALSEP CCIG sensor. The Traverse Gravimeter, used by the Apollo 17 astronauts, measured the lunar gravity along a Lunar Rover traverse. These original data were on microfilm and hardcopy documents, and now consist of a table of data from the experiment. The Solar Wind Spectrometer, part of the Apollo 12 and 15 ALSEPs, measured plasma parameters at the lunar surface. Originally archived on magnetic tape, these data are now in the form of digital tables. Portions of the Heat Flow Experiment data, from the Apollo 15 and 17 ALSEPs, originally on magnetic tape at NSSDCA, are now available through PDS as digital tables of the outputs of the thermistors. Soil Mechanics Penetrometer data, originally archived by NSSDCA on microfilm and as hardcopy documents, have been scanned and are available through PDS as image files and digital tables. The Apollo 15 and 16 X-Ray Spectrometer data comprise measures of X-ray counts taken from orbit. The original data were on magnetic tape at NSSDCA, consisting of count rates from three proportional counters and a solar x-ray monitor. These have been converted into digital tables with additional ancillary data and calibration documentation. These restorations are in conjunction with other work done by Seiichi Nagihara, Yosio Nakamura, and Walter Kiefer. Information on the Lunar Data Project is available online at http://nssdc.gsfc.nasa.gov/planetary/lunar/lunar_data