STATUS OF THE RESTORATION OF APOLLO DATA BY THE LUNAR DATA PROJECT / PDS LUNAR DATA NODE

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The Apollo lunar missions from 1969 to 1972 carried a large number of scientific experiments on the orbiting command and service module, on instrumented sub-satellites, on the lunar surface run directly by the astronauts, and in long-lived packages which ran autonomously on the surface long after the astronauts had returned to Earth. Unfortunately, much of the data from these experiments was not submitted for archive, and much of the data that was submitted lacked sufficient ancillary documentation (metadata). Additionally, the storage media (7-track tape, microfilm, microfiche) and formats (typically chosen by the experiment P.I.) were not standardized and have become increasingly obsolete, rendering widespread distribution and use of the data difficult. To combat this problem, in 2003 the NSSDC (National Space Science Data Center, now the NASA Space Science Data Coordinated Archive [NSSDCA]) started the Lunar Data Project with the goal of restoring Apollo data and converting it to usable fully-described digital data sets for archive with the Planetary Data System (PDS). A committee of lunar scientists at Goddard Space Flight Center was convened to determine the highest priority data sets for restoration. The lunar data and documentation that were never archived with NSSDCA were searched for as well. In 2007 the Lunar Data Node was created at NSSDCA under the auspices of the PDS Geosciences Node in order to facilitate the preparation and archive of data sets with PDS.

The largest quantity of scientific data was returned by the Apollo Lunar Surface Experiment Packages (ALSEPs), automated stations set up on the Moon by the Apollo 12, 14, 15, 16, and 17 astronauts. The ALSEPs returned data from deployment until they were turned off by ground command on 30 September 1977. Each ALSEP comprised a central station, a radiothermal power generator, and a suite of experiments connected to the central station by cables. Although smaller in quantity and duration, the data returned by the other experiments are critical restorations as well. Funding for these efforts was provided through NASA resources such as LASER grants. We will report on the status of the data restorations:

Data Sets Fully Restored and Archived at PDS

Apollo 12, 15 ALSEP Solar Wind Spectrometer - Tables of 28-second and 1-hour averages of plasma parameters, primarily solar wind, at the lunar surface.

Apollo 14, 15 ALSEP Cold Cathode Ion Gage - Scanned microfilm plots of lunar surface gas densities and temperatures.

Apollo 15, 17 ALSEP Heat Flow Experiment - Tables of subsampled temperatures and gradients at and immediately beneath the lunar surface.

Apollo 15, 16 Surface Soil Mechanics - Tables and scans of data from the lunar penetrometer, showing the resistance to penetration with depth.

Apollo 17 Surface Traverse Gravimeter - Table of surface gravity measurements at different points along the rover traverses.

Data Sets Restored and Reviewed, now in Lien Resolution

Apollo 15, 16 CSM X-Ray Spectrometer - Tables of X-ray fluorescence event count rates from surface-looking proportional counters and solar monitors. Adding SOLRAD data.

Apollo 14, 15 ALSEP Dust Detector - Scanned microfilm tables of dust detector solar cell voltages and temperatures, uncalibrated and calibrated. Adding metadata.

Data Sets Partially Restored

ALSEP Charged Particle Lunar Environment Experiment - 19.2-second count rate data of low-energy charged particles at the lunar surface on magnetic tape in SDS 92 binary. All but one channel converted to ASCII.

ALSEP Suprathermal Ion Detector Experiment - Total Ion Detector data at the lunar surface in 20 energy channels on magnetic tape in IBM 24-bit binary. Converted to ASCII.

Apollo 12 ALSEP Dust Detector - Digital raw data output from solar cells and thermistors retrieved from housekeeping data, converting to ASCII tables.

Apollo 12, 15, 16 ALSEP Lunar Surface Magnetometer - Magnetic tapes of 0.3-second surface magnetometer measurements in DCS binary format read, converting to PDS. Led by Peter Chi (UCLA/GSFC).

Apollo 14, 16 Surface Active Seismic - Magnetic tape data of seismic "thumper" shots and geophone returns read, converting to ASCII tables.

Apollo 17 ALSEP Lunar Ejecta and Meteorites - Scanned notebooks of P.I. Otto Berg containing ancillary information on the data and experiment, gathering metadata.

Apollo 15, 16 Subsatellite Magnetometers - 24-second averaged biaxial magnetometer data from lunar orbit read from magnetic tape. Converting to PDS. Led by Peter Chi (UCLA/GSFC).

Apollo 17 CSM Infrared Spectrometer - Magnetic tape and ancillary IR data from orbit supplied by the P.I., Wendell Mendell. Organizing tables and metadata.

Apollo 15, 16 CSM Gamma-Ray Spectrometer - 7-track magnetic tapes containing gamma-ray measurements taken from orbit supplied by Co-I. Albert Metzger. Tapes being read and converted to ASCII tables.

Apollo 17 ALSEP Lunar Atmospheric Composition Experiment - Surface magnetic deflection mass spectrometer magnetic tape data in IBM 360 binary read, converting to ASCII tables and gathering metadata.

Future Data Sets

Apollo 17 Surface Electrical Properties - Data from a transmitter/receiver array on surface and subsurface electromagnetic properties on microfiche.

Apollo 17 Corona Densitometer Scans - Hardcopy computer output of scans done on horizon photography showing coronal glow.

Apollo 15, 16, 17 CSM Metric and Panoramic Camera Photography Indexes - Microfilm indexes of the location, altitude, sun angle, etc. for the photographs taken by the Metric and Panoramic cameras.

Apollo 17 Surface Far-UV Spectrometer - Microfilm plots of averages and time variations of ultraviolet spectra of the Moon, Earth, and other celestial targets.

Apollo 15, 16 CSM Mass Spectrometer - Microfilm of computer outputs of orbital mass spectra of the tenuous ambient lunar atmosphere.

Apollo ALSEP ARCSAV Tapes - Near-raw data covering 3 months of return data from all 5 Apollo ALSEP stations are being read from recovered 7-track magnetic tapes. Led by Seiichi Nagihara (Texas Tech).

Apollo ALSEP Housekeeping Data - Data for all Apollo ALSEP stations covering engineering and status have been read from magnetic tape and are being converted to ASCII tables.

Apollo ALSEP Progress/Status Reports - Hard copy weekly reports of the status of the ALSEP stations covering the full operation have been scanned by the Lunar and Planetary Institute Library.