

**APOLLO DATA RESTORATION – 50 YEAR REPORT.** D. R. Williams<sup>1</sup>, P.T. Taylor<sup>2</sup>, S. Nagihara<sup>3</sup>, Y. Nakamura<sup>4</sup>, W.S. Kiefer<sup>5</sup>, S.A. McLaughlin<sup>6</sup>, P. Chi<sup>7</sup>, E.A. Guinness<sup>8</sup>, H.K. Hills<sup>9</sup>, <sup>1</sup>Code 690.1/NSSDCA, NASA Goddard Space Flight Center, U.S.A. (david.r.williams@nasa.gov), <sup>2</sup> Code 61A, NASA Goddard Space Flight Center, U.S.A., <sup>3</sup>Department of Geosciences, Texas Tech University, U.S.A., <sup>4</sup>Institute for Geophysics, University of Texas at Austin, U.S.A., <sup>5</sup>Lunar and Planetary Institute, U.S.A., <sup>6</sup>Code 690.1/NSSDCA, Telophase, Inc., U.S.A., <sup>7</sup>Department of Earth, Planetary, and Space Sciences, UCLA, U.S.A., <sup>8</sup>Department of Earth and Planetary Sciences, Washington University in St. Louis, U.S.A., <sup>9</sup>Code 690.1/NSSDCA, Adnet Systems Inc., Goddard Space Flight Center, U.S.A. (Retired)

**Introduction:** Fifty years ago, as part of their historic but brief sojourn on the lunar surface, Apollo 11 astronauts Armstrong and Aldrin deployed a small scientific package, the Early Apollo Scientific Experiments Package, or EASEP. This was the forerunner of a series of more complex stations, the Apollo Lunar Surface Experiments Packages, or ALSEPs, which were deployed on Apollo 12, 14, 15, 16, and 17. While the EASEP was only designed for a short (few week) lifetime, the ALSEPs were fashioned for years of service on the Moon. These returned data from their deployment (1969-1972) until they were unceremoniously turned off on September 30, 1977. Until then, the five ALSEP stations were faithfully monitoring the lunar environment, continuously returning data on fields and particles, seismic activity, heat flow, dust, meteorites, thermal effects, and the tenuous lunar atmosphere. These data were recorded on the ground and sent to the individual investigators involved with the experiments for analysis. The raw telemetry stream was captured on magnetic tapes over the years and stored under various names, Range Tapes, ARCSAV Tapes, and Work Tapes.

**History:** Unfortunately, there was never any systematic archiving protocol during the Apollo era, and much of these data were lost. As best we can determine, the Range Tapes are permanently lost, and the ARCSAV Tapes may have in large part been lost as well. Data from the later telemetry (on the Work Tapes) was archived at the National Space Science Data Center (NSSDC, now NASA Space Science Data Coordinated Archive, NSSDCA). Some investigators archived their individual experiment data with NSSDC as well, but much of the data had minimal documentation, were not in digital form, or were stored in difficult to translate formats. Data from many experiments were never delivered to the NSSDC. The Lunar Data Project was started to address the problem of both missing and not readily usable data. Our effort has resulted in recovery of some of the ARCSAV tapes, recovery and digitization of a large volume of Apollo scientific and technical documentation, and restoration of many ALSEP and other Apollo data collections.

**Restoration and Archiving:** Restoration involves deciphering formats, assembling necessary ancillary data (metadata), and packaging data in digital format to be permanently archived with the Planetary Data System (PDS). Recovery of the data from the ARCSAV tapes involved having the tapes read on special equipment and extracting the individual experiment data out of the integrated data stream. For other experiment data, the tapes were read on existing equipment at NSSDCA. This was followed by a translation of the formats into readable ASCII, and then determination, using old documentation and discussions with former PIs, Co-I's, and data technicians, of the meaning and calibrations of each of the data entries. These were then restored into standardized formats and the documentation necessary to make use of the data (metadata) written and assembled. Finally the data are reviewed, validated, and archived through PDS and/or NSSDCA. We will report on the history and status of the various recovery efforts.