CLEMENTINE MISSION: THE ARCHIVE OF IMAGE DATA PRODUCTS AND DATA PROCESSING CAPABILITIES; Eric M. Eliason, *U.S. Geological Survey, 2255 N. Gemini Drive Flagstaff, AZ 86001*; Erick R. Malaret, *Applied Coherent Technology, 112 Elden Street Suite K, Herndon, VA 22070*; Gail Woodward, *Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena CA 91109.*

The Naval Research Laboratory (NRL) and NASA's Planetary Data System (PDS) have jointly prepared an archive of digital image data acquired by the Clementine Mission. The archive, to be available on CD-ROM media and through network services, will support the needs of researchers in NASA's upcoming lunar and asteroid science analysis program. The Clementine image archive contains 1) the raw planetary images, 2) supporting ancillary data, and 3) software for image decompression and simple image display. Future companion archive volumes, to be prepared by the PDS and NRL, will contain software and ancillary data that fully support the data collection. The archive elements will include SPICE kernels, radiometric calibration data and software, experiment manifest, sensor console logs, and mission history. The U.S. Geological Survey and Applied Coherent Technology have developed advanced image processing systems for the systematic processing of the Clementine image collection. Versions of these software systems will be made available to the science community for research applications. The Clementine image archive and the supporting software systems that process the data will provide valuable resources for the lunar science investigator.

INTRODUCTION

During its 71 days in lunar polar orbit, the Clementine Mission achieved virtually 100% image coverage of the lunar surface in 11 spectral bandpasses acquiring nearly 1.7 million images [1]. The image data collection acquired by Clementine represents a substantial resource for lunar investigators interested in the composition and geologic history of the Moon [2], [3], [4], [5]. It is the intent of NASA and the U.S. Department of the Defense to make the data widely available to the science community. To this end the NRL and the PDS have prepared an archive of the image data products to be distributed to the science community on CD-ROM media and through network services. The goal is to have the archive distributed to interested scientists in time for NASA's upcoming lunar and asteroid science analysis program. When completed the archive will reside on approximately 85 CD-ROM volumes containing approximately 55 gigabytes of compressed image data files (500 gigabytes of uncompressed image data).

ARCHIVE OF CLEMENTINE IMAGE DATA PRODUCTS

The archive of Clementine image data products is comprised of the raw images acquired by the spacecraft, associated ancillary data, software tools, and supporting documentation. The raw images are pristine in the sense that they contain the artifacts, and radiometric and geometric characteristics of unprocessed and uncorrected data. The only processing performed on the data is to organize and format the data according to the PDS standards. The Clementine images were compressed onboard the spacecraft using a space-hardened Matra chip enabling acquisition of many more observations of the Moon. The compression technique performed "lossy" compression using a Discrete Cosine Transform (DCT) algorithm. The images are kept in the compressed format in order to reduce the total size of the archive collection.

Ancillary data exist on the archive in the form of index tables that describe the data collection. The index tables describe the camera characteristics and viewing geometry of all the images in the archive. These tables can be loaded into a catalog system or spreadsheet application for use in image search and retrieval. The index tables are organized as flat files; each row is an image entry and each column contains an attribute of the image such as geometric location of the image, and camera and observation characteristics. Additionally, the archive contains timeline data for determining spacecraft status during observation sequences.

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Software tools exist on the archive for data decompression and simple image display. The data decompression software exists as source code and executable modules that run on SUN/UNIX, IBM/PC, and Macintosh computer platforms. The decompression software will output decompressed images in a PDS, GIF, TIFF, or unlabeled format. The IMDISP image display software, modified for Clementine data, supports IBM/PC computer compatible users. The NIH IMAGE display software, also adapted for Clementine data, supports Macintosh users. The XV image display system is additionally provided on the archive for support to UNIX users.

ADVANCED IMAGE PROCESSING SOFTWARE FOR CLEMENTINE DATA

The U.S. Geological Survey has developed image processing software tools, operating under a SUN/UNIX environment, for Clementine image data. The system's capabilities include radiometric and geometric correction, image mosaicking, spectral registration for producing image cubes, photometric normalization using the Lommel-Seeliger and Hapke photometric functions, and image display of multispectral images [6]. Additionally, the Applied Coherent Technology Corporation has adopted the M-Shell image processing system, operating under Microsoft Windows and Windows-NT environments, for use in Clementine processing. The M-shell system has similar processing capabilities to the U.S.G.S system. Versions of these software systems will be made available to the science community for research activities that involve processing of Clementine image data. These tools are essential to utilize the full potential of the Clementine image data products.

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