

Introduction. The Mars Orbiter Laser Altimeter (MOLA) and the Mars Orbiter Camera (MOC) continue to give us gigabytes of high quality martian data. However, using these datasets effectively has proven extremely difficult if not impossible for many researchers. This document will explain the steps we have started to take to help alleviate this problem and also to apply more analytical power to the datasets.

Background. We have spent a considerable amount of time and effort to incorporate a host of digital planetary datasets into a GIS. A GIS, or Geographic Information Systems, is an organized collection of computer hardware, software, and geographic data whose operations can be tailored to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information [1]. GIS technologies give one the tools to not only view several different types of data together but also to perform various data analyses including advanced spatial intersections, unions, and robust conditionals [2].

MOLA Approach. The MOLA instrument has proven to be a very accurate and invaluable tool for topographic data collection. Thus far the instrument has collected hundreds of millions of data points, enough data to stress any modern-day system.

The MOLA format of choice is a Precision Experiment Data Record (PEDR). PEDRs are corrected binary files with attached Planetary Data System (PDS) labels. Each PEDR contains one or more tracks with thousands of points recorded for each track. The MOLA team has provided several software tools to help convert the binary point data to a text (ASCII) delimited file. By default, MOLA data points are stored in planetocentric latitude; however, most other datasets are stored in planetographic latitude [3]. The MOLA team has fortunately provided both numbers. To correctly match other GIS bases, which use planetographic latitudes, one needs to use the areodetic_lat column.

Once the file has been converted to an ASCII delimited file, there are several options to generate GIS compatible files. Our GIS platform is Environmental Systems Research Institute's (ESRI) ArcView. ArcView contains a programming language called Avenue. The translation options we have written in Avenue include (1) conversion from ASCII to a point

shapefile; (2) conversion to a linear track shapefile; (3) conversion to a generalize linear track shapefile; and (4) conversion to a georeferenced profile shapefile (see Figure 1). Fortunately, ESRI, has made the shapefile format non-proprietary, thus there are many software applications, some free, which can convert to and from this format. Since shapefiles use the IBM DataBase File format (DBF), nearly any spreadsheet application can view the tabular data.

Because the cost of GIS packages, including ArcView, can be prohibitive, we have designed a GIS website that can be accessed by all [5]. Another option is to download a free GIS viewer created by ESRI, called ArcExplorer. This tool currently only works in Windows, but a Java version is about to be released that should work on any platform.

After the data conversion has been finished, ArcExplorer or the GIS website, can overlay any of these products over the Mars Digital Image Mosaic (MDIM) or MDIM version 2 [4], MOC frames, geologic maps, and other GIS datasets. The user should be aware that until these datasets are brought up to date by using the new spheroid definitions, there might be slight misalignments in the data. Using the advanced query engine the user may create detailed questions about the data. By selecting a feature from one layer the user may intersect it with the MOLA tracks to see which tracks are needed.

Stepping up to ArcView (with 3D Analyst or Spatial Analyst) or another more powerful GIS, gives one the ability to select areas of interest and merge MOLA point files for use in creating Digital Elevation Models (DEM). Creating a DEM opens many statistical avenues. For example, one can create shaded reliefs, slope maps, 3D perspectives, etc.

MOC Approach. The Mars Orbiter Camera has also yielded a hefty dataset. The Flagstaff PDS Imaging Node supports this dataset up to the PDS standards, but we would also like to see headers or file formats which make these images GIS compatible. PDS may soon begin using a more generic file format called GeoTiff. This format is based on the standard Tiff format, but allows both PDS-like and GIS compatible headers. To help facilitate this transition, we hope to offer PDF to GeoTiff translation software. Currently, we have incorporated all the MOC footprints into a GIS format (see Figure 1).

We soon hope to have the software in place to correct and reproject the MOC frames to replace the footprints with the actual imagery when desired.

Once the MOC frames have been converted to the GeoTiff format, several GIS and remote sensing applications can view them in a georeferenced meters space. Because GeoTiff is based on a standard image format most ordinary image packages may also view them. ArcView and ArcExplorer will allow one to bring in multiple MOC frames that can be viewed together. As for image manipulation, ArcView gives one several options for image stretching, however, if the client is using the free viewer, ArcExplorer, this task cannot be done. But, it can be achieved by using a standard image package to stretch the MOC frame. After saving the file, the user can then bring the image back into ArcExplorer for viewing.

Summary. By processing MOLA and MOC data such that it is compatible with GIS applications, we hope to gain the ability to not

only use the data in an image or database program, but also overlay and analyze the two with each other and other spatial datasets in a GIS package.

References. [1] Environmental Systems Research Institute (1995) *Understanding GIS The ARC/INFO Method*, GeoInformation International, United Kingdom, i, 1-10. [2] Hare, T.M., et al. (1997) *LPSC Abs. 28, 515*. [3] Davies, M.E., *Planetary Mapping (1990)* Cambridge University Press, USA, i., 150-151. [4] Kirk, R.L., et al, *this volume (MDIM 2.0)*. [5] Hare, T.M., et al, *this volume*

Additional Information. We hope to soon have MOLA and MOC datasets accessible along with GIS tutorials at the website: <http://webgis.wr.usgs.gov>. To read more about the PIGWAD Web interface and its' functionalities, please read the other abstract by T.M. Hare in this volume.

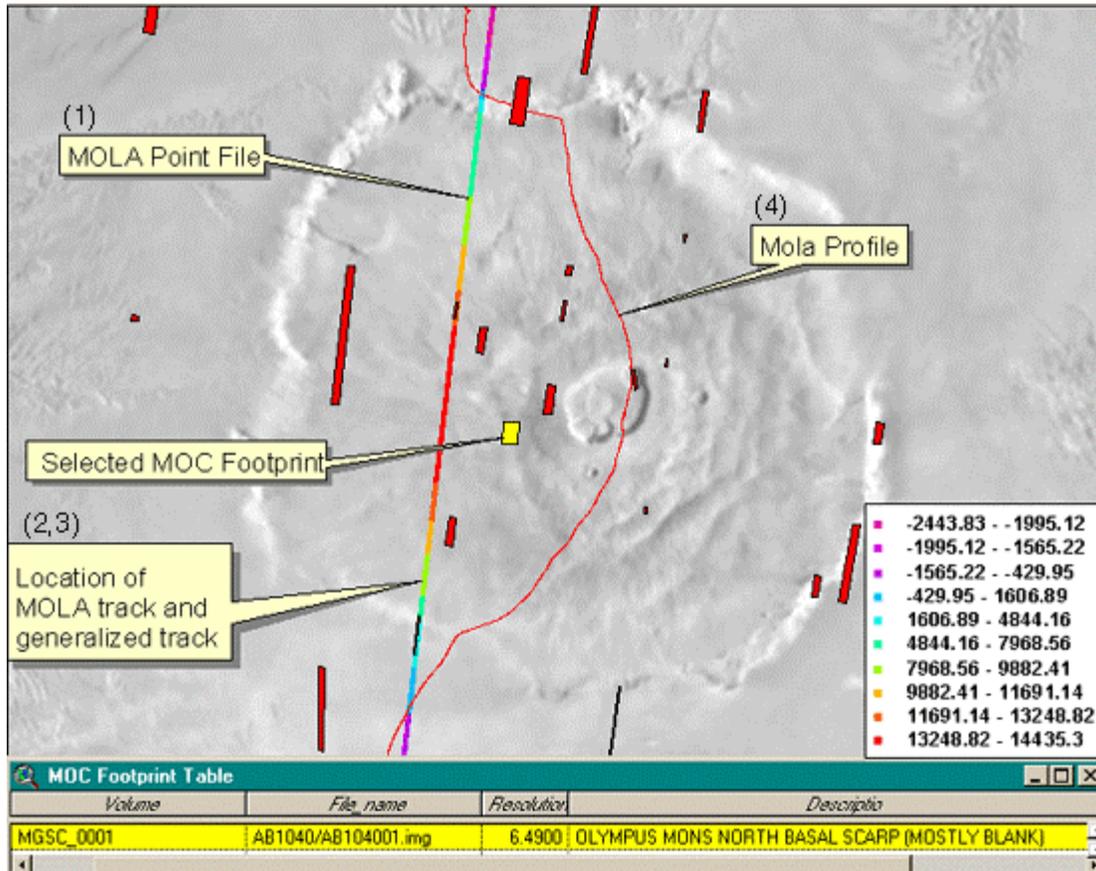


Figure 1. Figure showing the MDIM with registered MOLA data (points), derived profile, and MOC footprints (red) in ArcView. The table shows the information for the selected MOC footprint.