

**GeoTIFF Spatial Referencing for HiRISE JPEG2000 Data Products.** Bradford Castalia, Principal Systems Analyst, HiRISE Operations Center, Department of Planetary Sciences and Lunar and Planetary Laboratory, University of Arizona, 1541 E. University Blvd., Tucson, Arizona 85721-0063, Castalia@Arizona.edu.

**HiRISE Data Products:** The High Resolution Imaging Science Experiment (HiRISE [1]) on board the Mars Reconnaissance Orbiter (MRO [2]) spacecraft has been generating thousands of observations of the Mars surface. After geometric reprojection the Reduced Data Record (RDR) digital images can exceed 55,000 x 180,000 pixels. For 16-bit pixels in three bands this would be over 55 GB of image data. To help make this manageable these HiRISE data products are delivered as standard JP2 formatted files that employ lossless JPEG2000 codestream compression [3]. These files, when accompanied by an appropriate metadata label file, are accepted as a Planetary Data System (PDS) standard [4].

**GeoTIFF:** While the PDS metadata label contains image projection information that can be used for georeferencing purposes, the science community expressed a strong interest in having map projection information embedded in the JP2 file in a form that could be directly used by Geographic Information Systems (GIS) software applications. As of HiRISE data set version 1.1 RDR JP2 files will contain GeoTIFF geospatial reference information encapsulated in a UUID box. GeoTIFF is an industry standard recognized by many GIS software packages. The GeoTIFF UUID box is identified by its first sixteen UUID byte values (shown here in hexadecimal notation): B1, 4B, F8, BD, 08, 3D, 4B, 43, A5, AE, 8C, D7, D5, A6, CE, 03. The remainder of the box contains a standard TIFF (Tagged Image File Format) data set composed of TIFF tags with geospatial reference information derived from the IMAGE\_MAP\_PROJECTION parameters of the PDS label. The details of the GeoTIFF specification, and other related information, can be found at the RemoteSensing organization GeoTIFF web [5].

Testing has shown that the following GIS application software should be able to use the GeoTIFF data in the HiRISE JP2 files: ENVI (ITT Visual Information Solutions), ArcMap Desktop, (Environmental Systems Research Institute), GeoJP2 Viewer, (Mapping Science), GDAL (Geospatial Data Abstraction Library), OpenEV (obviously because it is using GDAL), MapWindow GIS, OSSIM (Open Source Software Image Map), gvSIG (Generalitat Valenciana).

**References:**

- [1] <http://hirise.lpl.arizona.edu/>
- [2] <http://mars.jpl.nasa.gov/mro/>

[3] JPEG 2000 image coding system: Core coding system, ISO/IEC 15444-1 September 15, 2004.

[4] Planetary Data System Data Standards Reference, Version 3.7, JPL D-7669, Part 2, March 20, 2006.

[5] (<http://www.remotesensing.org/geotiff/>).