PIGWAD – SUCCESSFULLY EVOLVING WITH A FEW GROWING PAINS. T. M. Hare and K. L. Tanaka, 2255 N. Gemini Dr., U.S. Geological Survey, Flagstaff, AZ, 86001; thare@usgs.gov

Introduction. PIGWAD or "Planetary Interactive GIS-on-the-Web Analyzable Database," has been operational since May 1999. It currently provides GIS database and analysis support for the research and academic planetary science communities. The use of this cutting-edge online technology can offer many benefits when properly utilized.

Background. The use of Geographic Information Systems (GIS) [1] has continued to boom in the planetary sciences [2]. Not only does it bring together post-mission datasets to address science issues, but also plays an important roll in pre-mission phases to assess feasibility and safety and to formulate objectives. A couple pre-mission examples include the landing-site selection for the Mars Exploration Rover (MER) and camera targeting on Titan. NASA's Planetary Geology and Geophysics Program (PG&G), which enabled PIGWAD to evolve from the drawing board to a useable system on the internet, continues to offer support and guidance as this product develops.

Approach. Our current choices for web mapping applications are based on Environmental Systems Research Institute's (ESRI) ArcView Internet Map Server and Arc Internet Map Server [3]. Both applications permit us to generate a website with predetermined datasets and to then view, query, export, and annotate any combination of datasets. The advanced functions that we will incorporate into PIGWAD include vector streaming, live linkable layers external to a web browser, partial file downloading, image cataloging/virtual mosaicking, and many others. For example, the image cataloging function currently allows us to place the approximately 4-gigabyte Mars Digital Image Mosaic (MDIM) version 2.0 [4] online with very quick refresh times. And for the MER mission, we have built a landing-site ellipse generator that gathers statistical information about a site's rock abundance, elevation, slope, morphological descriptions and other data needed to choose an optimally safe and scientifically interesting landing site [5].

Compatibility issues. The majority of PIGWAD users should not experience problems if their machines are running the supported browsers and have Java installed correctly. However, supporting multiple browsers, versions, and operating systems has been one of the biggest hurdles that we are still working on (Table 1). It seems with every release of Microsoft Internet Explorer or Netscape some problems disappear but others pop in. For example, the latest Netscape release version 6.0, a complete rewrite based on Mozilla technology, will not function with a PIGWAD online mapping site. The Mozilla-based browsers do not have the necessary Java support needed for PIGWAD's mapping applications. Netscape 4.x and 5.x on the Macintosh should work for both ArcViewIMS and ArcIMS applications; however, some users are still running into problems and others have slower than normal access. I can only surmise this may be caused by the weak support for Java on Macintosh computers. Internet Explorer 5.x on the Macintosh platform seems to only function with ArcIMS software, while Internet Explorer or Netscape on Windows usually has no problems with either online application. Netscape 4.x work for both applications on Sun Solaris and RedHat Linux; however, while using ArcViewIMS on Linux, the images turned blue.

To help alleviate most of these browser problems, we are currently looking into a front-end web server. These front-end programs process nearly all the requests on the server side and feed the user a simple web page that nearly all browsers should easily ingest. ArcIMS comes with software links that integrate it with the ColdFusion web server by Allaire. If this solution proves itself worthy, we will quickly adopt it.

Another solution to help remedy some of the browser problems is stand-alone programs that make use of ArcIMS map services. These programs, ESRI's Arc/Info 8.x, ArcView 8.x and the free ArcExplorer Java 3.x, allow you bring in any of the online layers from PIGWAD's map servers and layers local to the user's machine. This will allow the user to create maps, and query data from multiple locations. If other institutions use this technology, their layers could also be pulled in. We are hoping that other planetary facilities like the Planetary Data System Imaging Node (PDS) may begin to serve some of its data in the same fashion. ArcExplorer Java currently runs under Windows and Sun Solaris machines, but the future should bring more platform support. Also this online mapping

technology is non-proprietary, thus other mapping vendors will hopefully make use of it.

Schedule. PIGWAD is currently on-line. As with any website, we will still campaign to keep the databases, software, and content up to date, thus some of the more technical Java sites may be down for brief periods. Web sites presently available include several datasets for Mars and one for Venus. By March of 2001, a lunar site should also be functioning. We are also in the initial phases that should allow the GIS web site to interact with other mapping web sites like the PDS Mapmaker web site. Please visit http://webgis.wr.usgs.gov to experiment with PIGWAD.

Summary. GIS gives 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. By incorporating this functionality into a user-friendly web environment, a wide array of investigators and educators can easily implement the analytical power of a planetary GIS. We also hope that through the use of the tools and tutorials made available on PIGWAD, other sites can also begin to make use of the advanced capabilities of GIS in their planetary work.

References. [1] Environmental Systems Research Institute (1995) *Understanding GIS The ARC/INFO Metho*d, GeoInformation International, United Kingdom, *i,* 1-10. [2] Hare, T.M., et al. (1997) *LPSC Abs. 28, 515*. [3] Hare, T.M and Tanaka, K.L. (2000) *LPSC* #1889. [4] Kirk, R.L. et al, (2000) *LPSC XXXI,* #2011. [5] Hare, T.M. et al, (2000) First Landing Site Workshop for MER 2003, #9020.

Additional Information. The PIGWAD web site can be found at the following address: http://webgis.wr.usgs.gov

Table 1. A chart showing operating system (OS) and browser compatibility using PIGWAD's online mapping sites. The "√" symbol means it should function and an "X" symbol means the user may experience difficulties.

OS and browser	ArcViewIMS	ArcIMS	Quirks
Macintosh, Netscape 4.x, 5.x	√	√	Some users still have problems
Macintosh, Internet Explorer 5.0	X	√	Small I.E. bug fixed while using ArcIMS.
Windows, Netscape 4.x, 5.x / IE 4.x, 5.x	√	√	Need most recent Java release for advanced pages
Sun Netscape 4.5, 4.7	√	√	Users need Java access
Redhat Linux Netscape 4.5,4.7	√	√	Blue image in AVIMS. Users need java access
Netscape 6 (Mozilla)	X	X	