

Lunaserv Global Explorer, 3D. C. E. Miconi, N. M. Estes, E. Bowman-Cisneros, M. S. Robinson, School of Earth and Space Exploration, Arizona State University, cmiconi@ser.asu.edu

Introduction: The Lunar Reconnaissance Orbiter Camera (LROC) Science Operations Center (SOC) develops and maintains Lunaserv Global Explorer (LGE) to support internal operations, researchers, and public interfaces to the LROC data [1]. LGE is capable of visualizing map data in a 2D interface from any Web Map Service (WMS) compatible geographic information system (GIS) software. In addition to the currently capabilities of LGE, a 3D spinning-globe interface to visualize map data is a commonly requested item by both researchers and the public. To satisfy this demand, the LROC SOC is developing a new WMS client software package, Lunaserv Global Explorer 3D (LGE 3D).

LGE 3D utilizes the glob3mobile (G3M) toolkit to introduce this capability independent of platform and leverages all the existing capabilities of the Lunaserv WMS software (Fig. 1) [2]. G3M is a multi-platform visualization framework for making applications that map and visualize various forms of geographic data. G3M is capable of rendering raster maps, terrain, vector data, 3D objects, and symbols from multiple sources. LGE 3D enhances G3M to provide planetary capabilities and a reliable mechanism for retrieving terrain data directly from WMS.

Platform Independence: One of the useful features of G3M is its platform independence, which enables the resulting application, LGE 3D to run inside of web browsers and on the two largest mobile device platforms (iOS and Android). This platform independence allows LGE 3D to reach the largest number of users. Minimal support for complex 3D interfaces like LGE 3D exists on mobile devices, so the capability to provide a native application on these platforms provides a better experience with expected functionality including full multi-touch support, integration into each platform's menu system, and other native application interactions (Fig. 2). Most importantly, G3M's support for the Android and iOS platforms also provides hardware graphics acceleration on those mobile devices.

3D Terrain Support: The G3M framework experimentally supports the rendering of terrain through WMS servers. There are currently a limited number of WMS servers capable of serving full bit-depth terrain at the required resolution. Of the WMS servers capable of serving terrain, many users report that these WMS servers respond with incorrect elevation values under heavy load or when the view area becomes too large [3]. The Lunaserv WMS server is capable of serving full bit-depth terrain at high-

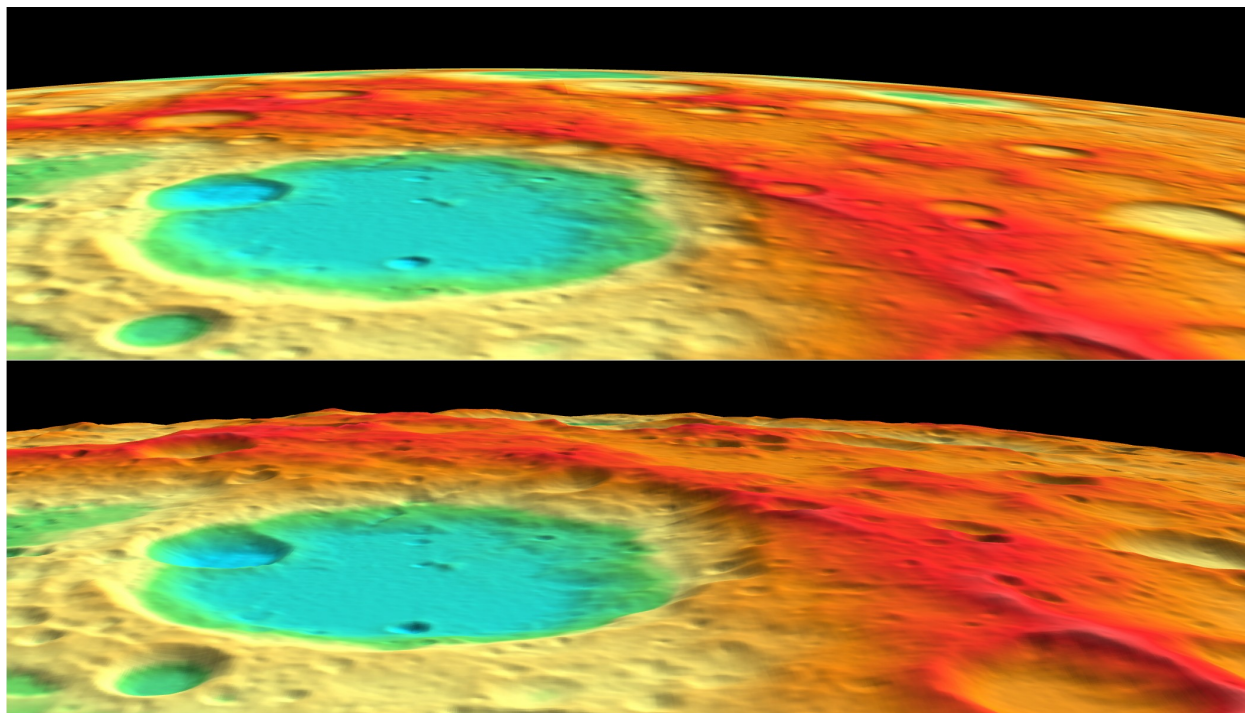


Figure 1 Top: GLD100 color shaded relief rendered in LGE 3D without 3D terrain. Bottom: The same view rendered in LGE 3D with GLD100-based 3D terrain enabled. [4].

resolution and based on extensive testing under load is proven to respond correctly to any number of requests.

With this support, LGE 3D is capable of rendering terrain over the entire globe for any planetary body supported by Lunaserv, for which a digital elevation model (DEM) exists (Fig. 3). The DEM layer loads dynamically via WMS and is automatically scaled and loaded as the zoom-level and orientation of the view change.

For users wanting to serve their own terrain data using Lunaserv, the built-in numeric layer type produces the correct tiles from an ISIS cube source DEM.

3D Interface: LGE 3D renders the map as a dynamic 3D globe either based on a spherical model or with DEM-based terrain. The dynamic globe allows users to pan and rotate the globe to achieve the desired



Figure 2: Screenshot of prototype LGE 3D Android app showing the WAC Normalized Reflectance map with dynamically generated illumination based on the GLD 100 DTM [4,5].

view. Additionally, the view allows adjustment to any angle or direction to facilitate oblique views of the base map and for better visualization of rendered terrain.

Potential Enhancements: Additional effort can go into improving performance of LGE 3D. When loading terrain, LGE 3D puts additional load on Lunaserv that previous 32bit layer consumers, such as JMARS, do not, so further optimization in the Lunaserv numeric base layer type could improve performance. G3M could also be optimized to allow for additional parallel loading of basemap tiles to increase rendering speed.

LGE 3D will be tested with irregularly shaped bodies and if it cannot handle the data, we will attempt to modify the source code. If G3M can be made to handle these shapes, LGE 3D could then be used for visualization of asteroids, comets, and other small satellites.

G3M is capable of rendering small 3D models both in orbit (i.e. spacecraft models), and on the surface (i.e. rovers and landers); future versions of LGE 3D could take advantage of these capabilities along with view scripting to construct interactive 3D tours.

References: [1] Estes, N.M.; et. al.; (2013), <http://www.lpi.usra.edu/meetings/lpsc2013/pdf/2609.pdf>. [2] glob3mobile, <http://www.glob3mobile.com/>. [3] G3M WMS terrain error report, <https://github.com/glob3mobile/g3m/issues/91>. [4] Scholten, F., et. al. (2012), JGR, 117, E00H17, doi:10.1029/2011JE003926. [5] Boyd, A. K.; et al. (2013), AGU, P13B-1744

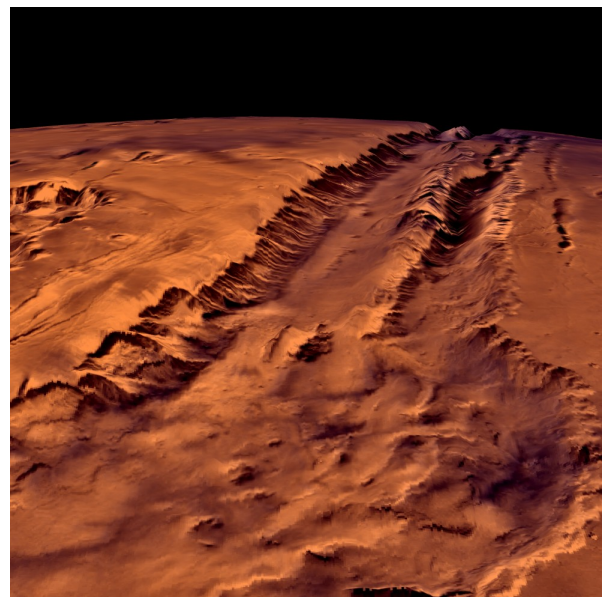


Figure 3: Mars Viking basemap rendered in LGE 3D using the MOLA DEM for the terrain.