IMPACT CRATER ANALYSIS CAPABILITIES OF THE JAVA MISSION-PLANNING AND ANALYSIS FOR REMOTE SENSING (JMARS) APPLICATION P. F. Wren[1] S. Dickenshied[1] , S. Anwar[1], D. Noss[1], W. Hagee[1], S. Carter[1], K. Rios[1], M. Burris[1], [1]Mars Space Flight Facility, 201 E Orange Mall, Arizona State University, Tempe, AZ 85287 USA (pwren@mars.asu.edu)

Introduction: JMARS is a planetary GIS application developed by ASU's Mars Space Flight Facility to provide mission planning and data analysis tools for NASA missions, researchers, students of all ages, and the general public [1].

Originally written as a mission planning tool for the THEMIS instrument onboard Mars Odyssey, JMARS has since been released to the science community and the general public as a free tool to quickly locate and view planetary data for Mars, the Moon, Vesta, Ceres, Mercury, Earth, Pluto, Europa, Phobos, Deimos, and many of the outer planet moons and asteroids. We continue to expand our library as meaningful data become available.

The public version of JMARS offers quick access to thousands of maps and millions of individual images collected from planetary missions. These images can be easily located by geographic area or filtered based on any number of scientific parameters, then viewed in situ without excessively large downloads or extensive knowledge of planetary data formats.

JMARS provides a number of capabilities that impact crater researchers would find useful.

Crater Counting Layer: JMARS provides a native layer for crater counting (Figure 1). It allows the user to mark craters, label them with a user-defined color scheme, and export the crater data (location, diameter, notes) to a CSV file.

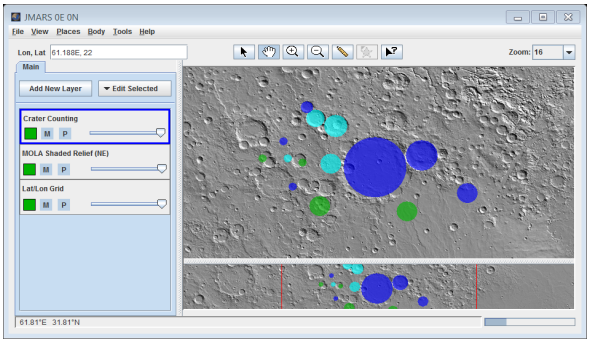

Figure 1: JMARS Crater Counting Layer

Counting tools. This layer supports identifying craters using two different methods. The first tool is a circular outline can that follows your cursor can be placed over the rim of a crater, and its size can be adjusted using the scroll wheel on your mouse. The Settings page can be used to customize the default diameter of this tool, the step size, and the color with which craters are highlighted.

The second tool, called "3-point Mode", allows the user to select any three points along the rim of a crater with the mouse. Once the third point has been selected, JMARS will draw a circular outline that passes through the three points.

Crater data table. At ant time, you can view the craters you have marked in a table (see Figure 2). This table can be filtered by lat/lon boundaries, or by crater diameter. The contents of the table can be exported to a CSV file for use in a spreadsheet, to create a table for publication, or to be read by a separate program for further analysis.

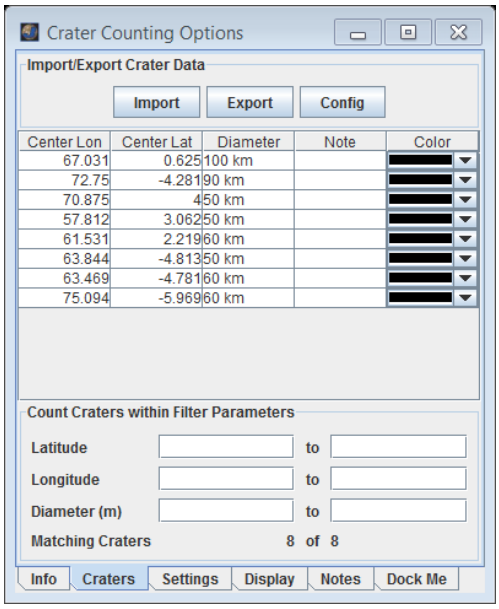

Figure 2: Crater Counting Options dialog box

Craterstats Compatibility: Users of Craterstats 2.0 can directly import the CSV created by JMARS into the tool [2]. Older versions may require the user to re-format the JMARS-created CSV into the Craterstats `.diam` file format.

Measuring the Areas of Craters: Users can export the contents of a Crater Counting layer as a .csv file that can then be imported into a Custom Shape

layer. The user must tell the Custom Shape layer how to interpret the Circle shapes it just read in by: a) telling it the radius field is derived from the Diameter column inthe file, and b) that it is specified in meters. A custom column can then be added to your shape layer data table that computes the area of the enclosed region of each crater in kilometers.

More Crater Analysis: The JMARS Custom Shape layer provides the ability to create custom columns in the layer's data table which can contain functions that manipulate data from other columns. JMARS provides a number of ready-to-use functions, or custom functions that you can build on the fly. Built-in functions include Enclosed Area, Perimeter, and even the ability to sample numeric map data "under" a user-defined shape.

A JMARS user recently used these capabilities of the Custom Shape layer to compute shape compactness measurements of impact craters (Figure 3). The user drew a detailed polygon shape that traced the entire rim of a crater, and then used the custom columns/formulas to compute both the Circularity Ratio and the Form Ratio [3] for the crater. Who knows what you could do with this tool?

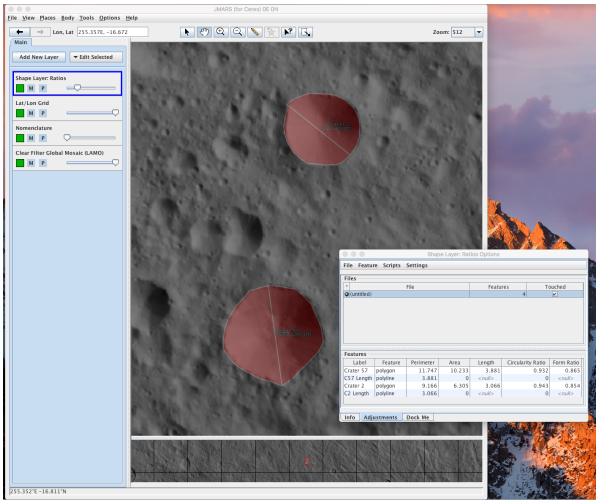

Figure 3: Custom Analysis in Custom Shape Layer

Future Crater Capabilities: We have already begun implementing a 5-point Mode for selecting elliptical craters, and hope to have it available before the end of the year. We are also looking at exporting the contents of a Crater Counting layer directly into a Craterstats `.diam` file. If you have ideas for new features you would like to see in JMARS, please tell us!

Conclusion: If you have not used JMARS, or perhaps it's been a long time since you have, perhaps you should download it from our website and give it a try: `http://jmars.mars.asu.edu`. We provide user assistance via a forum on our website, via email, or you can report bugs easily from within the tool itself.

References: [1] Christensen P. R. et al. (2009) *Eos Trans. AGU, 90(52), Fall Meet. Suppl., Abstract #IN22A-06.* [2] Michael, G. G. (2010) *Craterstats application.* [3] Selkirk, K. (1982) *Pattern and Place*, 53-55.

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