**IMPACT CRATER ANALYSIS USING THE JAVA MISSION-PLANNING AND ANALYSIS FOR REMOTE SENSING (JMARS) APPLICATION**

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**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.

**Long-standing JMARS capabilities:** For several years, JMARS has provided features that support impact crater research.

*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 (longitude, latitude, diameter, notes) to a CSV file. As with any other layer in JMARS, you can save the crater counting layer (or your entire session) and load it again at another time.

*Vertical profile tool.* When using a numeric map that includes elevation data, a profile line can be drawn across a crater, and a graph of the crater's profile can be viewed and exported.

*3D visualization.* The 3D Layer in JMARS allows the user to specify an elevation data source (e.g. MOLA elevation, regional DEM) and then visualize the contents of the main viewer in a rotatable 3D image. This image can be exported to an STL file for 3D printing.

*Customizable analysis capabilities.* The Custom Shape Layer in JMARS is a general purpose tool for creating various types of shapes and then performing computations upon them. For example, one could use the free-form draw tool to outline a crater rim, and add columns to the layer table to compute the crater's perimeter, its area, or something else using available data combined with your own formulas. Such drawn shapes can also be exported, along with data from an underlying numeric map (e.g. elevation, slope, temperature) for each exported pixel.
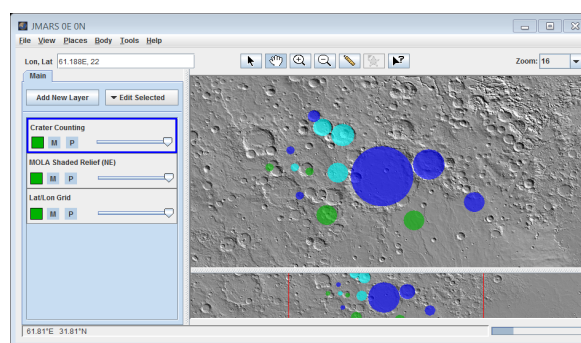


**Figure 1:** JMARS Crater Counting Layer

**New features in JMARS:** In the last year or so, we have introduced new functions and capabilities to JMARS intended to support the crater community.

*Direct support for CraterStats.* Within the Crater Counting Layer, users can now export their crater data to a `.DIAM` file for direct use with CraterStats [2].

*Click-and-drag crater selection.* In addition to the two existing tools for selecting craters in the Crater Counting Layer (a resizable outline that moves with the cursor, and 3-point selection to define the circle), we have added a click and drag selection tool that is a faster way to select many craters in a session.

**Coming Soon:** We are working on a new advanced crater counting layer that will provide the ability to mark the rims of elliptical craters using a 5-point method. Any elliptical craters in your layer will be described by a center point, a major axis, a minor axis, and the azimuthal of the major axis. This new advanced crater layer will be built on the custom shape layer, so you can add custom computed columns to your crater data directly (and export it all, of course).

**What tools do you need?** We have received some suggestions for additional tools to be added into JMARS

specifically to support impact crater research. For example:

- Automatically fitting a custom shape outline to the rim of an indicated crater

- Creating multiple profile lines through the center of a crater to measure depth and other aspects of its morphology

If you have ideas for new features you would like to see in JMARS, please tell us! There will be space on the poster where you can record your wishes.

**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.*