Mars Crater Density Tools: New Project Report

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Introduction: Crater density plots provide researchers the means to interpret the age and geologic history of planetary surfaces. We recently started a project to provide a set of Mars crater density tools for the planetary community. Here we provide a brief progress report for the project.

The crater density tools will be built as a plug-in for the GIS application ArcMap and ArcMap Server by Environmental Systems Research, Inc (ESRI). Fortunately, any tools built for ArcMap can then be transitioned to ArcMap Server, which allows anyone with a web browser to access the tools. Over the last couple of months, we have made progress learning how to interact with the ArcMap Server 9.1 software. We plan to beta-test the next generation of ArcMap Server, version 9.2, in early 2006, which gives us access to a suite of new geoprocessing tools. Geoprocessing tools enable the assembly of a simple chain of processing tasks to build a very high-level functional tool.

We built a prototype crater density viewer using these tools. Next, we will construct the web application, which will look something like Fig. 1. In the interface, we have an MDIM base image for context [1], the Mars 1:15,000,000-scale global geologic map [2], and the first version of Nadine Barlow's crater catalog [3, 4]. We plan to update the interface with more base images, an updated and correctly registered 1:15M global geologic map, additional geologic maps [e.g., 5], and Barlow's revised crater catalog updated using MOLA, THEMIS, and MOC data. Thus far, we have added three specialized functions, the "Crater Count E", "Crater Count U", and "Selection" tools. Using the "Crater Count E" (existing) tool, the user can select an existing polygon from the 1:15M Mars geologic base, which in turn selects the intersecting craters and returns the N(5) and N(16) crater density values [6, 7]. We will add a sorted crater table and create a crater density chart. For the "Crater Count U" (user-defined) tool, the same information can be returned via interactively digitizing a polygonal area. For the "Select" tool, the user can simply select craters by digitizing an area and returning a sorted table for the user to copy and plot. Other functions to be added will allow the user to select geologic units by age (i.e., Noachian, Hesperian, or Amazonian), by unit type, or by building their own query. Once the revised crater catalog is completed and added, craters also will be selectable by their preservation states.

This tool will help the planetary community to generate crater density values and plots from a common crater database for previously recognized or user-defined surfaces of geologic significance. In addition, as feedback is elicited from the user community, we intend to upgrade the tools to meet science- and mission-driven needs.

References:

[1] Archinal, B. A., Kirk, et al, Mars Digital Image Model (MDIM) 2.1 control network, ISPRS Working Group IV/9 Workshop "Advances in Planetary Mapping 2003", 2003.

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[3] Barlow, N. G., et all, Standardizing the nomenclature of Martian impact crater ejecta morphologies, J. Geophys. Res., 105, 26733-26738, 2000.

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[6] Crater Analysis Techniques Working Group, Standard techniques for presentation and analysis of crater size-frequency data, NASA Technical Memorandum 79730, 20 pp., 1978
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Related links:

Crater Counting on Mars, Gregg Herres and William K. Hartmann, (accessed Oct 3, 2005), http://www.mtholyoke.edu/courses/mdyar/ast223/mars_a/mars_hw_a.htm
Introduction to Cratering Studies, Darby Dyar, (accessed Oct 3, 2005), http://www.psi.edu/projects/mgs/cratering.html

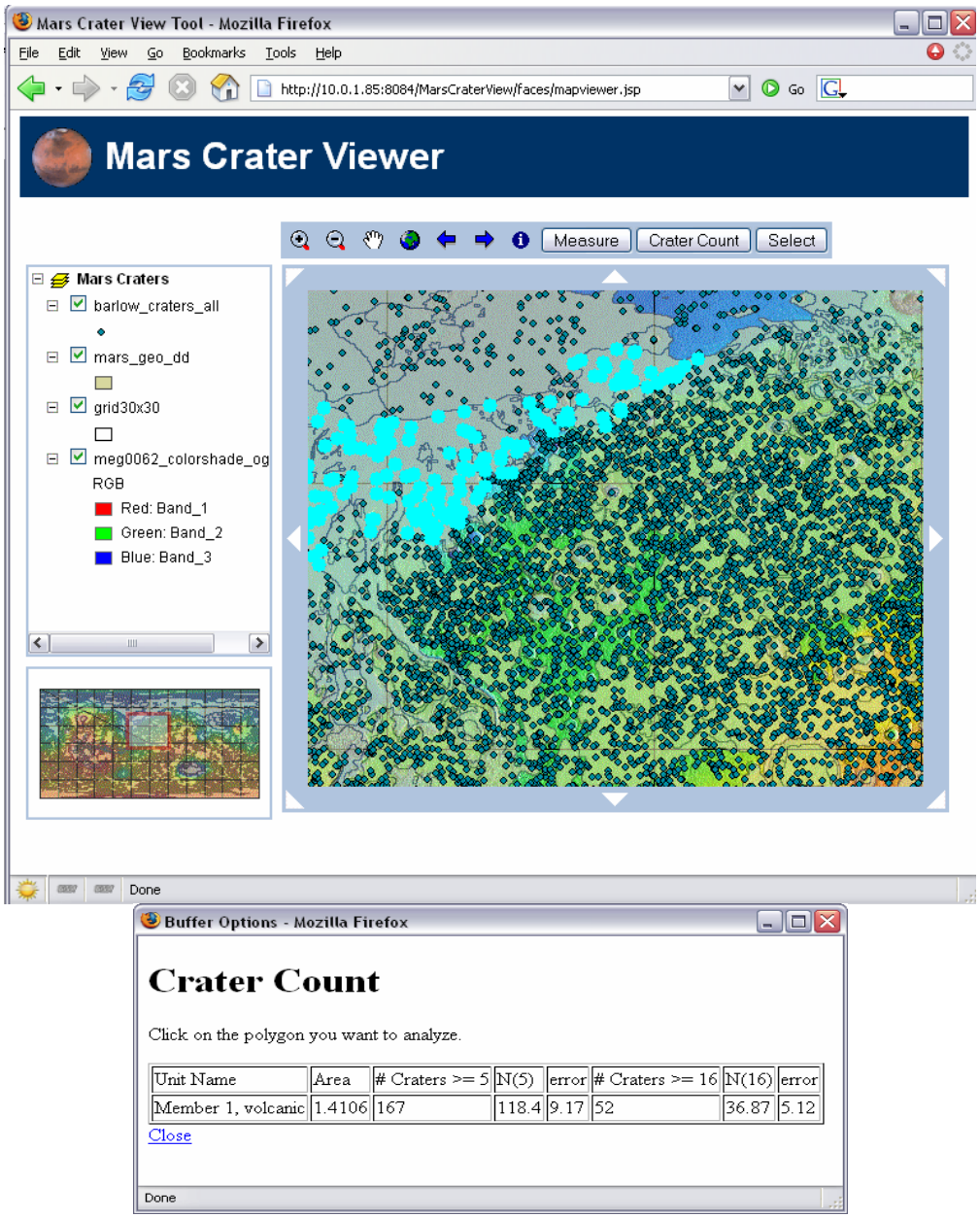

Figure 1. Prototype viewer showing the “Crater Count” tool and the resultant crater count table with N(5) and N(16) values.