

Getting Started with JMARS for the Moon

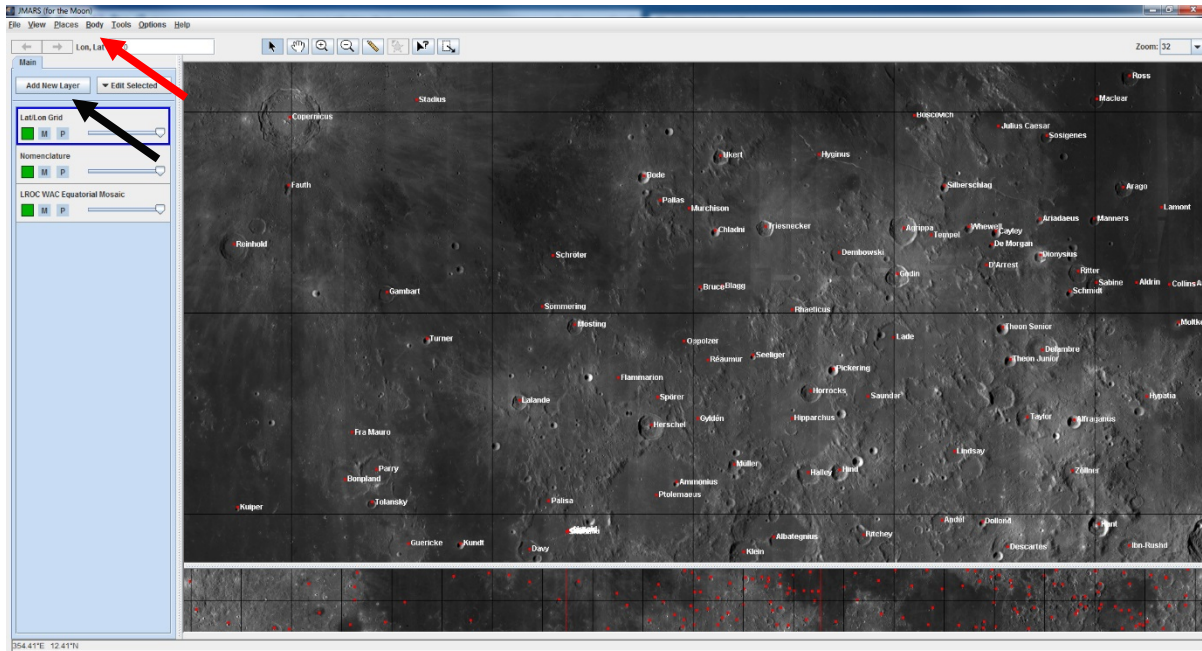
One program you might choose to access lunar data sets is JMARS (for the Moon). It's freeware available online and it will allow you to look at LROC WAC and NAC images as zoomed in as you'd like, as well as take topographic profiles if you want and to measure crater diameters, etc. This will be a good place to start, and then if you want to find higher resolution images of certain areas we can look into that as well. You can also use GoogleEarth...there's a planet tab on the menu at the top and you can choose to go to the Moon (or Mars!). GoogleEarth is much easier to use in the sense of measuring lengths and navigating, but JMARS has more updated, higher resolution data available so I'd recommend using JMARS as your primary tool and using GoogleEarth to supplement as needed.

To download JMARS, go to this website: <http://jmars.asu.edu/>

On the right side of the page (red arrow above) you'll see a link for downloading JMARS for multiple planetary bodies including Mars, Earth, Earth's Moon, Mercury, Venus, and more. You'll have to set up an account (it's just your email address, and they send you a link so you can change your password), and you'll use that every time you open JMARS (or just login as Guest). The benefit of registering an account is that when you use it to open JMARS, you can save your progress each time you use JMARS and that setup and your work can be auto-loaded the next time you log in.

Upon opening JMARS for the first time, select the planetary body you wish to investigate by selecting the correct name in the "Body" menu at the top of the window (red arrow below). For Earth's Moon, select Luna. The program will automatically load three layers: a Lat/Lon Grid, Nomenclature, and the LROC WAC Equatorial Mosaic.

To move to a different part of the planet, click on the reference window in the bottom of



the screen, or use the arrow keys on your keyboard. For more information on the navigation shortcuts, go to View, Navigation...that will tell you how to zoom in/out too. Also there is a "zoom" draw down menu in the upper right of the main window that you can use to zoom in/out a lot at once.

You can make simple distance measurements on the map by clicking the Measure tool (a ruler icon) at the top of the window. Click and hold on the map and, while holding the mouse button down, draw a line across the surface and look at the bottom left of the window for a distance and azimuth reading. Take care to consider map projections when using this data for scientific purposes, especially for large areas. Unfortunately, this measurement technique does not get recorded by JMARS, so be sure to make note of any measurements you make before releasing the cursor.

You can add as many new layers (black arrow above) as you'd like (within the memory limits allocated to the program), and feel free to play around with what is available. To start, I'd recommend adding the LOLA 512ppd Topography layer (Add New Layer, Select Instrument category, Select LOLA subcategory, select Elevation, 512ppd). The default setting will add a gray-scale stretch. To change this to a color stretch, right click on the layer and select "open" to see options (click "Dock Me" to keep the window visible while working on the map). Select the "Input" tab at the bottom of the pop-up window, then, under "Grayscale" click the "+" key and select "Color Stretcher" from the drop down menu. Right click on the grayscale bar, place the mouse cursor over "Built-in colors" and select from the list. I'd recommend using "Color Scale (7)" or "VX Color Stretch" for a familiar color pallet. If the stretch changes from the original, click "Reset min/max" in the "Grayscale" section to return to the original stretch. Another option under this tool is to create contours: click the "+" button under "Grayscale" again and select "Contour" from the drop down menu. Then select the contour interval you'd like (default is 100 m) and the line color. Note that only one option, Color Stretcher or Contour, can be displayed at a time. If you'd like to remove the contours, click the "-"

button under “Contour.” You can change the opacity of this layer (and any other layer) by moving the slider bar from right to left.

You can also use the Topography layer in JMARS/Moon to create a profile. Put the Topography layer at the top of your layer menu, then click the “Chart” tab at the bottom of the Topography menu (double click the Topography layer to re-open the options menu, or click on the tab if it’s still open from before). Move your mouse over the main map window and you’ll see topography values following your cursor. To draw a profile, click on the map – a line will appear. Move your mouse along the area of interest on the map and click once to draw a line segment or double click to end the profile. The profile should appear in the chart window. You can run your mouse cursor along the chart and the associated position will appear on the profile on the map. Right click on the chart for options and to export the data. To clear a profile, double click on the map.

Other layers of interest might include Composition, Gravity Anomaly maps, and Rock Abundance maps. Explore the different categories and subcategories available in the “Add New Layer” menu to find these layers and more. Once you have the layers on the map, you can change the opacity by adjusting the slide-bar on the lower right of each layer, and you can move your layers around by clicking and dragging them up or down in the Layer Manager window (this will change which layer you can see). You can remove a layer by right-clicking on the layer in the Layer Manager bar and clicking delete.

Also, consider adding LROC NAC Stamps to the map to a small area of the map (this layer can use a lot of data and can take a while to load). Zoom into a preferred portion of the map, click “Add New Layer,” select “Imagery” and “Equatorial” (for example). Select LROC Stamps, then click “Set Lon/Lat to bounds of View (or to preferred lat/lon coordinates, if known). Select the instruments (for NAC, select NACL and NACR), then “OK.” If the region is small enough, you will see the bounds of NAC images available for that region. To see what the image numbers are, click on the “Investigate” button at the top of the window (an arrow with a question mark), then move your mouse cursor over the image. To load a NAC image, right click on the screen, scroll over “View LROC Stamps” and select which NAC image you’d like to see (whether rendered into JMARS or online). Keep in mind that every layer you add on JMARS uses up some of the memory allocated to the program, so the program might start struggling if you have too many layers open at once.

How you continue to utilize JMARS for the Moon depends on your individual research project, so the rest is up to you! Have fun exploring with JMARS for the Moon! For additional assistance using the program, go to the Help menu at the top of the screen. The video tutorials are helpful for making numerical (e.g., topographic) profiles, conducting crater counting, exporting data, and more, and the forums facilitate conversations with other users. If you notice any bugs in the program or have a question that is not answered on the JMARS website (and that your advisor or mentor cannot answer), submit a question through the website and someone from the JMARS group will respond to your query.

For another resource specific to lunar data, use the QuickMap tool generated by the LROC team: <http://target.lroc.asu.edu/q3/>. (Note that unlike JMARS, you cannot save measurements or export images from QuickMap, nonetheless QuickMap is a valuable resource!)

Click the layer button under the “+/-“ zoom bar in the upper left corner for projection (the globe on the upper right of that layers menu) and layer options. The wrench on the right side of the screen (above the word “Share”) will allow you to make measurements and define regions to look up available NAC image data. The “Share” button allows you to copy a link to the current specific view so that you can send it to your teammates or save it for later browsing.