

MoonKAM

Moon Knowledge Acquired by Middle Schools



Student Mission Operations Center (SMOC)
User Guide

Version: 2.1

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Welcome to GRAIL MoonKAM!

NASA's Gravity Recovery And Interior Laboratory (GRAIL) mission will place twin satellites in tandem orbits around the Moon to measure its gravity in unprecedented detail.

While the GRAIL satellites gather information that will unlock the mysteries of the Moon's origin and development, your class will be in command of the MoonKAM cameras on board the GRAIL spacecraft.

Use this guide as a reference throughout your mission to ensure a smooth and successful journey to the Moon!

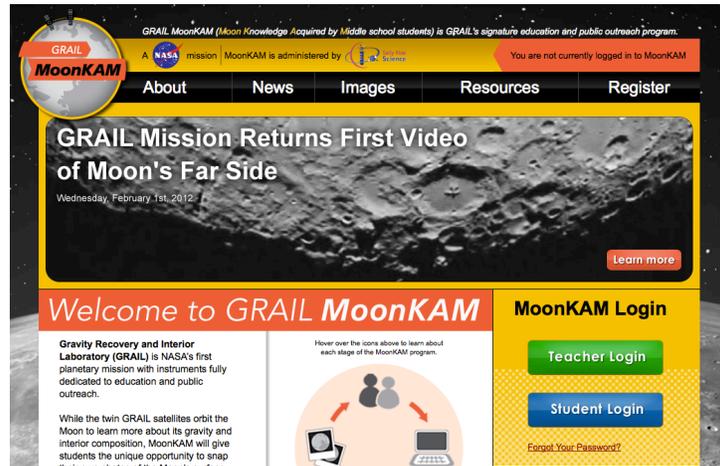


Sally Ride Science



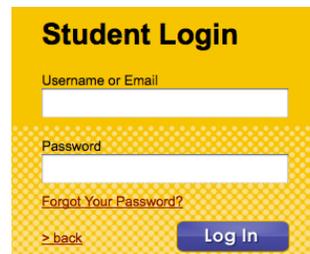
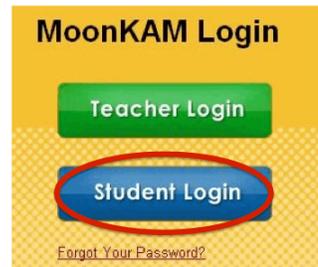
University of California, San Diego

Log In to Student Mission Operations Center (SMOC)



Steps:

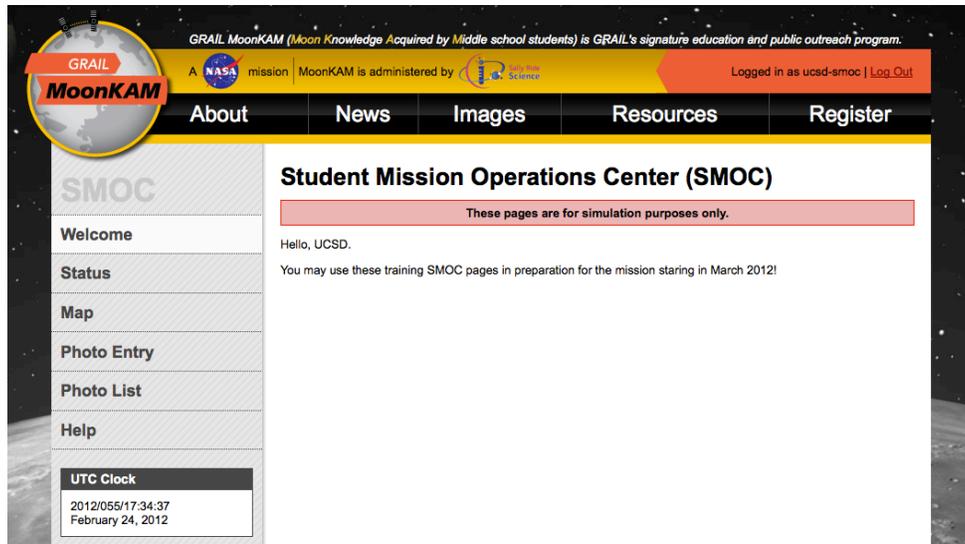
1. Visit our home page at <https://moonkam.ucsd.edu>
2. Click on the "Student Login" button located on the right column.
3. Enter the "SMOC Username" and "SMOC Password" that you received in your registration confirmation email.
4. Click on the "Log In" button.
5. After you have successfully logged in, click on the "SMOC" button.



Note: Please remember that the password is **case sensitive** and should be entered exactly as shown in your confirmation email. If you have trouble logging in, please contact us at:

mk-help@moonkam.ucsd.edu

Student Mission Operations Center: Quick Overview



The Student Mission Operations Center Page is the main interface that you and your students will use to make and track your photo requests of the Moon from the GRAIL spacecraft.

It is separated into six main sections:

- Welcome – General information about the current status of the MoonKAM mission
- Status – Information on upcoming deadlines for photo requests and orbits
- Map – 2D interactive map of the Moon’s surface used to gather information for photo requests
- Photo Entry – Form used to manually enter in a photo request
- Photo List – Search engine for the current status of photo requests
- Help – General help guides

Image Requests: An Overview

MoonKAM offers two options for making image requests from the “Map” tab:

Simple Mode:

In the **Simple Mode** option, students can request a photo of any location on the Moon’s surface using an interactive 2D Map.

The wait period for viewing the requested photos could be anywhere between one to four weeks. The wait period will depend on the current location of the GRAIL spacecraft and when it is expected to pass over the requested location.

Advanced Mode:

In the **Advanced Mode** option, students can request photos based on upcoming orbits of Ebb or Flow. This option is time sensitive and photo requests must be made before the deadlines that appear on the “Status” Tab for each orbit available.

Students should be able to view their photo within a week after the orbit deadline for the request.

Simple Mode

To make image requests in Simple Mode, students can use either the “Map” tab or “Photo Entry” tab.

Using the “Map” Tab (Simple Mode):

1. Click on the “Map” tab on the left menu.
2. Select the “Simple Mode” tab above the Moon map.

SMOC

Welcome

Status

Map

Photo Entry

Photo List

Help

UTC Clock

2012/054/19:51:43
February 23, 2012

Current Orbits

There is no current orbit.
Upcoming Deadline
2012/066/15:00:00
There is no current orbit.
Upcoming Deadline
none

Help

Simple Mode
Click on the map to set a point.

Advanced Mode
Choose a spacecraft and an orbit with an active deadline (found from the Status section).
Click on the map to set a point on an orbit track.

Student Mission Operations Center (SMOC)

Map

Simple Mode Advanced Mode

Request a photo of any location on the moon's surface.

[Reset map]

visible elevation

500 mi
1000 km

Google NASA/USGS

Current Position 19.17° N, 108.63° E

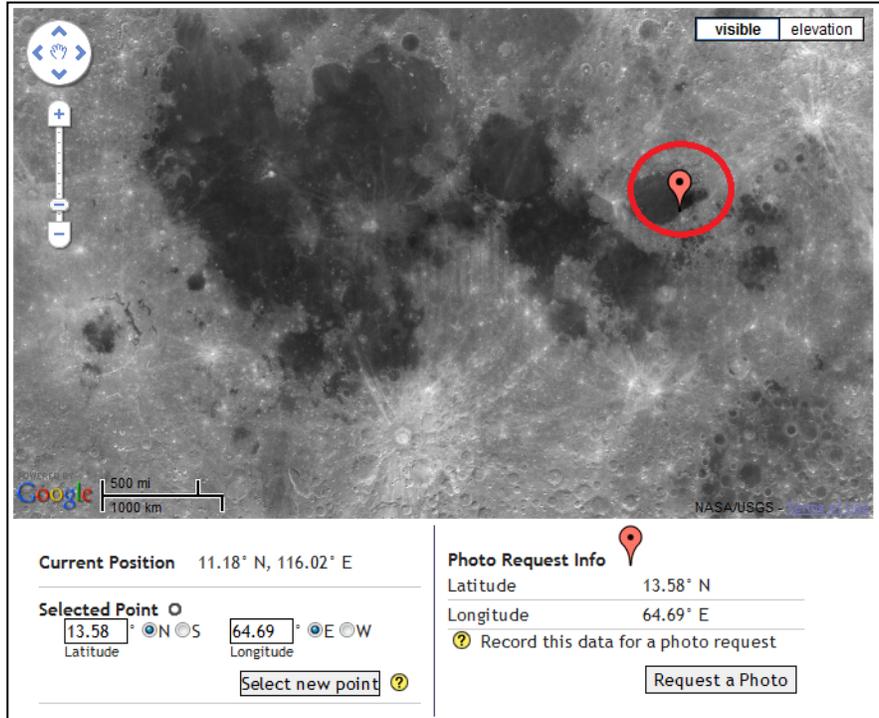
Selected Point

8.26 • ON OS Latitude Longitude
36.56 • OE OW
Select new point ?

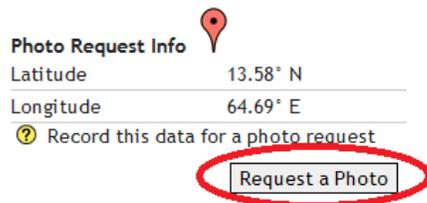
Photo Request Info

Latitude 8.26° N
Longitude 36.56° E
Record this data for a photo request
Request a Photo

3. Click on any area on the Moon that you wish to take a photo of. Feel free to explore the map and zoom in for more details.



- After a location has been selected, click on the “Request a Photo” button on the bottom right corner of the screen. A Photo Entry window should pop up.



Note: Please make note of the **latitude and longitude coordinates**. You will need this information later to successfully make an image request.

- Enter in one of the codewords you have received by email.



Note: Each codeword may only be used **ONCE** and is **case sensitive**.

- Click "Submit."
- Enter in the coordinates of the selected location.

Note: Make sure to specify **North/South** and **East/West**.

- Click "Submit" once more to finalize the image request. You will receive a confirmation message once your photo request has been accepted.

Success! Photo request accepted. You may continue to request photos.

If your photo request is not successful, double check to make sure the coordinates have been entered correctly.

Using the "Photo Entry" Tab (Simple Mode):

- Alternatively, you may enter your photo request by clicking on the "Photo Entry" tab and enter your valid codeword. We recommend opening the photo entry page in a new browser tab or window to provide you easier access to the page. Right click on the tab to access these options.

2. Enter the “Latitude,” and “Longitude” information you recorded from the “Nearest Photo Opportunity” section in the “Map” tab. Before clicking submit, double check that you’ve entered the correct information.

Advanced Mode

To begin making image requests with Advanced Mode, first refer to the “Status” tab.

SMOC

Welcome

Status

Map

Photo Entry

Photo List

Help

UTC Clock

2012/05/19:52:34
February 24, 2012

Student Mission Operations Center (SMOC)

These pages are for simulation purposes only.

Status

Status updates
No status updates yet

Deadlines
Orbits 701 to 725(Ebb) are due at 082/15:00:00

Orbits for Ebb

Current and Future

KEY ? Current orbit Next orbit deadline ? Orbits with the same deadline

Orbit	Longitude Day	UTC Day	Longitude Night	UTC Night	Deadline	Camera
701	20.851° E	084/00:47:30	134.043° E	084/01:43:13	082/15:00:00	1 (nadir)
702	20.833° W	084/02:41:04	1212.099° W	084/03:36:48	082/15:00:00	2 (backward)

Status Tab

The “Status” tab provides information about available orbits for photo requests.

1. Click on the “Status” tab on the left of the SMOC pages.
2. Observe the two windows on the top of the page for mission updates.

Status updates

No status updates yet

Deadlines

Orbit 5701 (Flow) is due at 083/22:45:38
Orbit 701 (Ebb) is due at 083/22:47:30
Orbit 5702 (Flow) is due at 084/00:39:12
Orbit 702 (Ebb) is due at 084/00:41:04

This window provides general updates about the mission.

These deadlines are given in UTC. You must submit your photo requests for each orbit by the deadlines shown in this window.

3. Under the “Current and Future Orbits” section you will find a table listing all available orbits for this mission, the longitude and time when day and night begins for each orbit, and the deadline for submitting photo requests for each orbit.

Current and Future

KEY						
	Current orbit ?		Next orbit deadline ?		Orbits with the same deadline	
Orbit	Longitude Day	UTC Day	Longitude Night	UTC Night	Deadline	Camera
701	20.851° E	084/00:47:30	134.043° E	084/01:43:13	082/15:00:00	1 (nadir)
702	20.833° W	084/02:41:04	1212.099° W	084/03:36:48	082/15:00:00	2 (backward)
703	23.836° W	084/04:34:39	134.341° E	084/05:30:23	082/15:00:00	3 (forward)
704	18.048° W	084/06:28:13	119.459° W	084/07:23:58	082/15:00:00	4 (nadir)
705	703.872° E	084/08:21:48	133.949° E	084/09:17:33	082/15:00:00	1 (nadir)
706	16.241° W	084/10:15:23	131.384° E	084/11:11:08	082/15:00:00	2 (backward)
707	70.931° E	084/12:08:57	1073.018° W	084/13:04:42	082/15:00:00	3 (forward)

KEY		
? Current orbit	? Next orbit deadline	Orbits with the same deadline

The orbit for which GRAIL is currently traveling and taking daytime photos for is highlighted in yellow.

The next deadline for which you can request photos is highlighted in orange. You may request photos from this orbit and beyond.

All photo requests for all orbits highlighted in green must be submitted by this

- Find the row for "Next orbit deadline" and take note of that orbit number and the UTC deadline.

IMPORTANT: You must submit photo requests for specific orbits **before** the listed deadlines have passed. You can make photo requests for the orange highlighted orbit and the later orbits below. Orbits listed above the orbit highlighted in orange have already passed the submission deadline (refer to image below).

Current and Future Orbits						
KEY						
	Current orbit ?		Next orbit deadline ?		Orbits with the same deadline	
Orbit	Descending Node	Longitude Day	GMT Day	Longitude Night	GMT Night	Deadline
201	*	98.35° E	032/00:20:21	94.249° W	032/01:05:41	031/22:20:21
202	*	75.601° E	032/01:51:51	117.008° W	032/02:37:11	031/23:51:51
203	*	52.859° E	032/03:23:21	139.279° W	032/04:08:51	032/01:23:21
204	*	30.122° E	032/04:54:51	162.02° W	032/05:40:21	032/02:54:51
205	*	7.392° E	032/06:26:21	175.246° E	032/07:11:51	032/04:26:21
206	*	15.329° W	032/07:57:51	152.517° E	032/08:43:21	032/05:57:51
207	*	38.047° W	032/09:29:21	129.793° E	032/10:14:51	032/07:29:21
208	*	60.764° W	032/11:00:51	107.07° E	032/11:46:21	032/09:00:51

no requests

NO

can make requests

YES

5. Refer to the UTC Clock on the left hand column to assist you with the listed deadlines.

UTC Clock
2012/055/01:08:50 February 24, 2012

Current Orbits
Ebb: 104 Day
UTC Day 2012/068/06:18:05
UTC Night 2012/068/07:13:16
Upcoming Deadline 2012/068/08:08:13
Flow: 5104 Day
UTC Day 2012/068/06:18:05
UTC Night 2012/068/07:13:16
Upcoming Deadline 2012/068/08:08:13

Displays the current UTC (or Coordinated Universal Time) time in this format: [year]/[day of the year]/[hour]:[minute]:[seconds]

Current Orbit

The Current Orbit is where GRAIL satellites are currently traveling. Its day and night start times are also shown.

Upcoming Deadline

You have until this time to make photo requests for the next available orbit (check "Status" section).

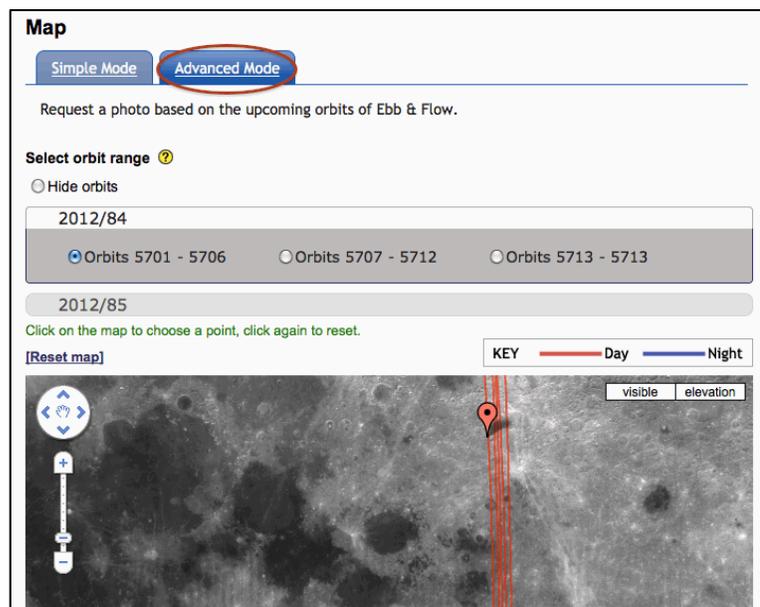
Making Image Requests in Advanced Mode

After you have reviewed the “Status” tab, refer to the “Map” tab. This page will assist you with locating photo opportunities by displaying the ground tracks of Ebb and Flow projected on a map of the Moon.

To make image requests in the Advanced Mode option, students can use the “Map” Section or “Photo Entry” section.

Using the “Map” Tab (Advanced Mode):

1. Click on the “Map” tab in the left menu.
2. Select the “Advanced Mode” tab.



3. Select the desired orbit range by clicking on the buttons at the top of the Map page.
4. Select your desired location near the red ground tracks by clicking on the map. Feel free to zoom in for more detail. Keep in mind that the bottom left section of the map page gives the latitude and longitude of your “Selected Point” and its distance from the GRAIL ground track.

Note: A good rule of thumb is to make sure your selected point is **less than 50 miles** from the ground track in order to get sufficient coverage of the area.

Map

[Simple Mode](#) [Advanced Mode](#)

Request a photo based on the upcoming orbits of Ebb & Flow.

Select orbit range

Hide orbits

2012/84

Orbits 5701 - 5706 Orbits 5707 - 5712 Orbits 5713 - 5713

2012/85

Click on the map to choose a point, click again to reset.

[Reset map](#) KEY Day Night

visible elevation

200 m
200 km

NASA/USGS [Terms of Use](#)

Current Position 23.73° N, 83.94° E

Selected Point

13.08° N 89.21° E

Latitude Longitude

[Select new point](#)

Distance from Groundtrack

285.18 mi (458.96 km)

Photo Request Info

Spacecraft	Flow
Orbit	5706
UTC	2012/084/10:38:09
Latitude	13.08° N
Longitude	89.44° E

Camera Alt Fore

3 1 4 2

Record this data for a photo request

[Request a Photo](#)

Note: The **RED** portion of the ground track corresponds to **day time**, when the camera can take images. The **BLUE** portion corresponds to **night time**, when the camera can NOT capture images.

- You may also locate your desired location choice by manually entering the latitude and longitude in the boxes under “Selected Point” and clicking “Select new point.”

Current Position 38.52° N, 39.42° E

Selected Point ○

13.08 ° N S 89.21 ° E W
Latitude Longitude

Select new point ?

Distance from Groundtrack ——— ?

285.18 mi (458.96 km)

- Once you have selected your desired location, make sure to take note of the orbit, latitude, longitude, and UTC information listed under the “Photo Request Info” section on the bottom right side of the page. You will need this information in order to submit your photo requests.

Photo Request Info 📍

Spacecraft	Flow
Orbit	5706
UTC	2012/084/10:38:09
Latitude	13.08° N
Longitude	93.44° E

Camera Aft Fore

3 1 4 2

? Record this data for a photo request

Request a Photo

- To make photo requests, click on the “Request a Photo” button on the bottom right corner of the page under “Nearest Photo Opportunity.”
- In the pop-up window titled “Photo Entry,” select the current mission in the drop down menu and enter one of the codewords you have received by email.

Note: Each codeword may only be used *ONCE* and is *case sensitive*.

Photo Entry

Simple Mode **Advanced Mode**

Request a photo based on the upcoming orbits of Ebb & Flow.

Codeword*

9. Click on the "Submit" button.

10. Once your codeword is accepted, you will be asked to enter the "Orbit," "UTC," "Latitude," and "Longitude" information, which can be found in the "Nearest Photo Opportunity" section right under the map of the Moon.

Photo Entry

Simple Mode **Advanced Mode**

Request a photo based on the upcoming orbits of Ebb & Flow.

Codeword accepted, please make your request.

Spacecraft **Flow**

Orbit*

UTC* (format: yyyy/dd/hh:mm:ss)

Latitude* North South

Longitude* East West

11. Check that the information is correct and click the "Submit" button to finalize the image request.
12. You will receive a confirmation message once your photo request has been accepted.

Success! Photo request accepted. You may continue to request photos.

If the orbit deadline has passed for your photo request, you will receive the following message:

The deadline for this orbit has passed! Please try another orbit.

If you encounter this error, go back to the "Status" tab and check the current orbit and the next orbit deadline. Use the UTC clock on the right column to assist you. Select a new location from orbits with valid deadlines.

You may also encounter this error:

That codeword doesn't exist.

This might be because the codeword was not entered in correctly. Remember that codewords are case sensitive.

If a codeword has been used, you will see:

That codeword has already been used. Here's its request.

Your Request	
Codeword	uc50001
Orbit	1044
Latitude	18.98°S
Longitude	92.99°W
UTC	2012/071/10:34:28
<hr/>	
Request ID	129854
Status	SUBMITTED
Photo URL	- not yet available -

Using the “Photo Entry” Tab (Advanced Mode):

1. Alternatively, you may enter your photo request by clicking on the “Photo Entry” tab and entering your valid codeword. We recommend opening the “Photo Entry” tab in a new browser tab or window to provide you easier access to this section. Right click on the tab to access these options.

The screenshot shows the SMOC interface. On the left is a navigation menu with the following items: Welcome, Status, Map, Photo Entry (circled in red), Photo List, and Help. The main content area is titled "Student Mission Operations Center (SMOC)" and includes a red warning banner that reads "These pages are for simulation purposes only." Below the banner is the "Photo Entry" section, which has two tabs: "Simple Mode" and "Advanced Mode" (which is selected). Under the "Advanced Mode" tab, there is a heading "Request a photo based on the upcoming orbits of Ebb & Flow." followed by a "Codeword*" label and an empty text input field. A "Submit" button is located below the input field.

2. Enter the “Orbit,” “UTC,” “Latitude,” and “Longitude” information you recorded from the “Photo Request Info” section of the page. Before clicking submit, double check that you’ve entered the correct information.

Photo List

The “Photo List” tab allows you to find existing photo requests and their statuses, as well as view photos that have already been taken.

Steps:

1. Click on the “Photo List” tab.

The screenshot shows the SMOC interface. On the left is a navigation menu with links for Welcome, Status, Map, Photo Entry, Photo List (highlighted), and Help. Below the menu is a UTC Clock showing the date and time: 2012/05/20:59:10, February 24, 2012. The main content area is titled "Student Mission Operations Center (SMOC)" and includes a red banner stating "These pages are for simulation purposes only." Below this is the "Photo List" section, which has two search options: "Search by codeword" and "Search by school". The "Search by codeword" section has a text input field for the codeword and a "Search" button. The "Search by school" section has a "School" input field, a "Search all schools" checkbox, radio buttons for "Ebb" (selected) and "Flow", "Orbits" dropdown menus set to "701" to "701", a "Status" dropdown menu set to "Any", and a "Search" button. Below the search options is a "Show" button for "All requests for ucisd-smoc".

2. To generate a list of your submitted photo requests, enter your SMOC login under “School.”
3. Input the range of orbit numbers you wish to view by selecting numbers from the “Orbits” drop down menus.
4. You can sort your results by specific statuses of your photo requests using the “Status” drop down menu (see pg.22 for list of statuses).
5. Alternatively, you may view a single photo request by searching by a specific codeword. Input a used codeword that you wish to view under “Search by codeword” and click “Search.”

6. Once you've submitted your information for the Photo List, requests that fit your search criteria will show up. If none appear, try changing your search or choosing a larger orbit range.

School	RID	Status	Latitude	Longitude	Orbit	UTC	Spacecraft
ucsd-smoc	129994	Submitted	21.29° N	88.95° W	1039	2012/071/00:53:50	Ebb
ucsd-smoc	129993	Submitted	38.48° S	91.75° W	1043	2012/071/08:46:30	Ebb
ucsd-smoc	129992	Submitted	18.98° S	92.99° W	1044	2012/071/10:34:28	Ebb
ucsd-smoc	129998	Locked CCFed	22.59° S	101.6° W	1052	2012/072/01:44:50	Ebb
ucsd-smoc	129995	Locked CCFed	29.35° N	103.93° W	1053	2012/072/03:21:04	Ebb
ucsd-smoc	130000	Locked CCFed	4.04° N	103.89° W	1054	2012/072/05:23:02	Ebb
ucsd-smoc	130005	Locked CCFed	81.24° S	99.34° W	1055	2012/072/07:42:14	Ebb
ucsd-smoc	130002	Locked CCFed	73.45° S	101.7° W	1056	2012/072/09:34:04	Ebb
ucsd-smoc	130018	Locked CCFed	73.84° N	112.53° W	1057	2012/072/10:41:04	Ebb
ucsd-smoc	129996	Locked CCFed	19.64° S	106.88° W	1057	2012/072/11:10:33	Ebb
ucsd-smoc	130017	Locked CCFed	79.07° N	118.33° W	1059	2012/072/14:26:27	Ebb
ucsd-smoc	130019	Locked CCFed	6° S	156° W	1103	2012/076/02:09:29	Ebb
ucsd-smoc	149930	Locked CCFed	6.28° S	156.45° W	1104	2012/076/04:03:50	Ebb

7. If your photo has been taken, you may view the image by clicking the "Taken" link under the status column.

Orbit	Status
301	Taken
301	Taken

Photo request statuses are summarized in the following table.

Status	Description
Submitted	UCSD has received this photo request
Locked CCFed	This photo request has been included in the camera control files
Locked Uplinked	The camera control file that includes the photo request has been uplinked to the GRAIL Spacecraft
Taken	This photo has been taken and available for viewing
Rejected	This photo selection contained incorrect information (i.e. UTC did not match Lat/Long or it was during night time)
Missing	This photo selection is missing due to one of the following reasons: camera malfunction, software malfunction, uplink delayed, or spacecraft conflict

HELP!

If you forget how to navigate through the SMOC pages and submit image requests, click on the “Help” tab for assistance.

SMOC	Student Mission Operations Center (SMOC)
Welcome	Help
Status	Problems?
Map	<ul style="list-style-type: none">◦ If you run into any website issues, please try refreshing the page.◦ While all modern browsers are compatible with SMOC, for best performance we recommend using the latest versions of the following browsers:<ul style="list-style-type: none">◦ Mozilla Firefox◦ Google Chrome◦ Apple Safari◦ For any other questions or problems, please contact SMOC Help.
Photo Entry	<hr/>
Photo List	Make a Photo Request with Simple Mode (geography-based)
Help	Make a Photo Request with Advanced Mode (time-based)
	Check on Photo Requests
	UTC Clock and Current Orbits

Simple instructions are also provided under the “Help” section on the left column of each section.

If at any point you have trouble using specific features in the SMOC pages, you may also hover over the  icon for assistance.

If you wish to contact us, click on “contact us” link at the bottom of the page, or email us at:

mk-help@moonkam.ucsd.edu

We will be happy to assist you.

We hope you have a successful mission! Thank you for participating in MoonKAM!