



# MARS STUDENT IMAGING PROJECT

## ASU MARS EDUCATION PROGRAM



## MARS STUDENT IMAGING PROJECT (MSIP) Suggested 3-Week Archived Schedule

This schedule is intended to provide a set of activities to be implemented in your classroom as a three-week MSIP archived format. Each meeting is intended to fit a classroom period of about 45 minutes. This schedule can also be used as a 'primer' for your students to put together a formal proposal and project for use of the THEMIS camera.

Here is an overview of each meeting:

### Week 1: Meetings 1 - 5

MEETING 1: Earth / Mars Comparisons and an Introduction to MSIP and THEMIS Images

MEETINGS 2 and 3: Mars Uncovered

MEETINGS 4: Mars Image Analysis Activity

MEETING 5: Question Mars Activity

### Week 2: Meeting 6 – 10

MEETING 6: Question Mars Activity (continued)

MEETING 7: Question Mars – Refining Your Experiment and Data Collection Methods

MEETING 8: Data Analysis Practice

MEETINGS 9 and 10: Proposal Outline

### Week 3: Meetings 11 - 15

MEETINGS 11 – 12: Gathering Additional Data

MEETINGS 13: Graphing and Data Analysis

MEETINGS 14: Drawing Conclusions

MEETINGS 15: Writing up your Final Conclusions

RESOURCES THAT CORRESPOND TO EACH MEETING ARE AVAILABLE AT  
[http://marsed.asu.edu/upload/MSIP\\_3WeekArchivedResources](http://marsed.asu.edu/upload/MSIP_3WeekArchivedResources)

This includes the MSIP ARCHIVED STUDENT MANUAL. (This manual is a compilation of all the materials and activities. If possible, it is recommended that each student have their own manual.)



# MARS STUDENT IMAGING PROJECT

## ASU MARS EDUCATION PROGRAM



### MEETING 1: *EARTH / MARS COMPARISONS AND AN INTRODUCTION TO MSIP AND THEMIS IMAGES*

Having your students become familiar with similarities and differences between geologic features found on both Earth and Mars can allow them to begin thinking about what may be interesting for them to research.

1. Show MSIP Intro Video: A video link to this presentation is available at <http://breeze2.is.asu.edu/p93588777/> (Note for Cassie: I think I may want to do a taping of this presentation as it will apply to the MSIP Archived groups. A new link will be provided before the fall of 2007 – the content will not change, just the whole idea of doing an archived format of MSIP will be better included and explained.)
2. Have students follow along and take notes using the Earth/Mars comparison outline.

**Homework Recommendation:** Assign Chapter 1 (pp. 13-18) as reading from the MSIP Resource Manual. (Students can read other parts of the Resource Manual, but Chapter 1 is the highly recommended.)

This would provide students with additional background information allowing them to potentially narrow down their interest in a particular topic. The MSIP Resource Manual is available at

- <http://msip.asu.edu/pages/pdfs/MSIPResourceManualv200.pdf> OR
- [http://marsed.asu.edu/upload/MSIP\\_3WeekArchivedResources](http://marsed.asu.edu/upload/MSIP_3WeekArchivedResources) (Look for Meeting 1 folder)

### MEETINGS 2 AND 3: *MARS UNCOVERED: Reveling the Geologic History Through Mapping*

This activity will guide students through an inquiry-based and critical thinking approach of studying the surface of Mars in a similar way scientists do. This lesson will teach students to create a geologic feature map of a planetary surface and use relative age dating techniques to analyze the information and interpret the geologic history of that region.

You will find the Teacher Guide, Student Guide and three possible images to map at the following link:

- <http://marsed.asu.edu/upload/MarsUncovered> OR
- [http://marsed.asu.edu/upload/MSIP\\_3WeekArchivedResources](http://marsed.asu.edu/upload/MSIP_3WeekArchivedResources) (Look for Meetings 2 and 3 folder)

Students can simply follow the guide with the teacher leading necessary discussions as recommended in the Teacher Guide. If students are going to map one image, the Chryse Planitia image is recommended.



# MARS STUDENT IMAGING PROJECT

## ASU MARS EDUCATION PROGRAM



### MEETING 4: *MARS IMAGE ANALYSIS ACTIVITY*

This lesson allows students to use a hands-on approach to get familiar with THEMIS visible images. The lesson allows for students to identify features seen in images, make measurements and/or come up with the "story" of what happened to the area of Mars they are observing. (Lendable materials are available for this activity.)

- This activity is available at [http://marsed.asu.edu/upload/MSIP\\_3WeekArchivedResources](http://marsed.asu.edu/upload/MSIP_3WeekArchivedResources) (Look for Meeting 4 folder. Folder includes lesson plan, Feature ID Charts and a video clip of how to incorporate this lesson into your classroom)

The lesson can be implemented without asking the students to write down any information as they go through the activity. The activity provides experience with what can be seen/resolved in THEMIS images and is recommended to be conducted somewhat informally. The format recommended to facilitate this activity is to:

Give students the following materials:

- One THEMIS Visible image per group of 3-4 students
  - The accompanying context image
  - An "11 X 17" MOLA map
  - Feature ID Charts
  - Erasable markers
1. Have students locate the general area of where their THEMIS image is located on the MOLA map.
  2. Have students label and identify features on their THEMIS visible image and the context image. They should use the Feature ID Charts for assistance in naming the features.
  3. Think about the history of the area using the relative age dating techniques they learned in the Mars Uncovered activity (Relative age dating of features in the image, classification of craters, what happened to make this area look the way it does today.)
  4. Make measurements

You may want to play the video clip to explain each part of the activity with the students.

5. After students have had a chance to label features and make measurements on their initial image, have them rotate from image to image adding additional information and observations to each image they observe. Students should not erase anyone else's observations, but should add additional observations or measurements as they wish.

**Homework Recommendation:** Assign the background reading (page 1 only) of the Question Mars Activity as reading.



# MARS STUDENT IMAGING PROJECT

## ASU MARS EDUCATION PROGRAM



### MEETINGS 5: *QUESTION MARS ACTIVITY*

This activity is especially useful to help students create a research question that can be answered using THEMIS visible images of Mars. Students should have read page 1 of this activity as homework so you can discuss it during the first part of class.

You will find the Teacher Guide, Student Guide, and feature identification charts (these are the same ID Charts that were used with the Mars Image Analysis activity) that go along with this activity at the following link:

- <http://marsed.asu.edu/upload/QuestionMars>
- [http://marsed.asu.edu/upload/MSIP\\_3WeekArchivedResources](http://marsed.asu.edu/upload/MSIP_3WeekArchivedResources) (Look for Meetings 5, 6 and 7 folder)

Once you have discussed the background information (page 1), have the students work with the groups they will conduct their research with. Discuss Student Worksheet I, questions 1 and 2 with the class and then within their small groups, have them decide what topic their group wants to study. Have them spend approximately 5 minutes brainstorming questions they may have about their topic. Students can do this individually and they do not need to write down 5 questions. They should write down whatever comes to mind within 5 minutes.

Part II of the activity has students look at THEMIS images related to their topic and has them start making observations. Students should make observations of at least 4 images. Students should ideally work in pairs on the computer, although if necessary, each group can have one computer to work with.

**Homework Recommendation:** Have students make 4 additional observations of images for homework. (Note: If students do not have a computer at home, you can ask them to either try doing this in the library or media center or provide some extra credit for those who can make additional observations outside of class.)



# MARS STUDENT IMAGING PROJECT

## ASU MARS EDUCATION PROGRAM



### MEETINGS 6: *QUESTION MARS ACTIVITY (continued)*

Students should now have at least 4 observations (but hopefully more!) of THEMIS images related to their topic of interest. They should get back into their research groups and work on Student Worksheet III. As they get into refining their question, students should discuss the features they have been able to make observations of and focus their question on those features. Students can brainstorm up to three refined questions.

Student Worksheet IV asks the students to focus on one question they feel is best answered by using THEMIS visible images. This part of the activity helps students start thinking about how they would go about answering their question - the experiment design. Once they have answered the questions on Student worksheet IV, have them begin Student Worksheet V together. This Worksheet gives them a pre-made starting list of a step-by-step plan of how they will go about gathering data for their research. This will enable them to think about their experiment design in a more detailed fashion.

**Homework Recommendation:** Have students write down additional information on Student Worksheet V to the list of what observations they would need to make of every image in order to make their experiment repeatable and be able to come to a conclusion about their question.

### MEETING 7: *QUESTION MARS – EXPERIMENT DESIGN REFINING AND DATA COLLECTION METHODS*

Within their research groups, students should discuss the details of what information they need to collect from every image they observe in their step-by-step plan or experiment design. Students should discuss the Question Mars Student Worksheet V, which provides a structure to this plan, and they should come to a decision on what data they will collect.

As they discuss the data they should collect as part of their Experiment design, they should fill out the Experiment Design (Data Collection Methods) sheet available at:

- [http://marsed.asu.edu/upload/MSIP\\_3WeekArchivedResources](http://marsed.asu.edu/upload/MSIP_3WeekArchivedResources) (Look for Meetings 5, 6, and 7 folder)

Filling out this sheet will allow them to see what information they need to collect, where they will find that information and why that information is important for their project.



# MARS STUDENT IMAGING PROJECT

## ASU MARS EDUCATION PROGRAM



### MEETING 8: *DATA ANALYSIS*

Once students have an idea as to the data they need to collect in order to answer their question and support or refute their hypotheses, they need to have an idea as to how they will be able to analyze their data. Students will need access to a computer that has Microsoft Excel on it.

Provide students with access to the Graphing and Data Analysis Practice Guide. This guide and the MOLA map that goes along with it is available at:

- [http://marsed.asu.edu/upload/MSIP\\_3WeekArchivedResources](http://marsed.asu.edu/upload/MSIP_3WeekArchivedResources) (Look for Meeting 8 folder)

### MEETING 9 AND 10: *MSIP PROPOSAL OVERVIEW*

Proposals are required for On-Site and Distance Learning teams interested in taking their own image of Mars. For archived teams and especially for this 3-week structure, it is still useful for them to be familiar with this format, although they are not required, nor is it recommended for them to submit a proposal.

The proposal outline should be used in order to have students create an outline of their work to see if they are lacking any information for their project.

- This outline is available at [http://marsed.asu.edu/upload/MSIP\\_3WeekArchivedResources](http://marsed.asu.edu/upload/MSIP_3WeekArchivedResources) (Look for Meetings 9 and 10 folder)

Some important aspects of their project that they will most likely need to work on will be:

1. Gathering background information from books and / or websites and other sources about what is known about the feature(s) they are studying.

- This information can include definitions of the features they are studying, specific knowledge and hypotheses other scientists have about these features. Students should write down information and keep track of references in order to cite sources appropriately in their proposal.

2. Gathering specific information from archived THEMIS images (available at <http://themis.asu.edu>) that relate to their project.

- Students should already have at least 4 “data points” that they acquired based on their observations made during the Question Mars activity. They should make sure they have logged all the information for each image according to what they established with their data collection methods. They should create their own data table that they can fill in by hand (prior to inputting it into an excel spreadsheet) for their collection of data. They can relocate any image previously observed by going to the <http://themis-data.asu.edu> website and typing in the Image ID number.

3. For the Analysis Plan section, they should create their data table and think about what graphs they will make. Students should use the activities they completed with the Graphing and Data Analysis activity to think about how they will want to display their data.



# MARS STUDENT IMAGING PROJECT

## ASU MARS EDUCATION PROGRAM



**Homework Recommendation:** Have students fill out each section of the proposal outline starting in class, but anything they don't get to finish in class, they should work on as homework.

A few suggested resources students can use as they conduct their research are:

- MSIP Resource Manual: This is included in their Student Manual
- Feature ID Charts: This is also included in their Student Manual
- THEMIS website: <http://themis.asu.edu>

### MEETINGS 11 AND 12: *GATHERING ADDITIONAL DATA*

Students should continue to gather data for their project as well as background information they may still need to investigate. Depending on what information they need to gather for their project, all students within a research group should have a data table they are filling out for each of the images they make observations of. If students are making measurements, they can make estimated measurements (knowing the image is 18km across) or print out images to work with and determining the scale of the image, similar to what they did with the Mars Image Analysis activity. (The printing option depends on your ability to print images.)

By the end of Meeting 12, students should compile all of the data collected into an excel spreadsheet.

This can be continued for homework as well as throughout the project. The more data students collect, the more confident they will be when formulating conclusions and answering their question.

### MEETINGS 13: *GRAPHING AND DATA ANALYSIS*

Based on the students project and analysis plan from their MSIP proposal outline, teams should make graphs, tables, and plot out on a map(s) information from all the images they have looked at and analyzed. They can refer to the Graphing and Data Analysis activity for assistance in making their graphs. If necessary, they can make graphs using the computer or "by hand".

Once graphs are made, students should use the Data Analysis sheets to write down the observations and interpretations of each graph. The sheets are available at

- [http://marsed.asu.edu/upload/MSIP\\_3WeekArchivedResources](http://marsed.asu.edu/upload/MSIP_3WeekArchivedResources) (Look for Meeting 13 folder)

**Homework Recommendation:** Provide students with a print out of any or all the graphs they have made and have them write complete the Data Analysis sheet at home.



# MARS STUDENT IMAGING PROJECT

## ASU MARS EDUCATION PROGRAM



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### MEETING 14: *DRAWING CONCLUSIONS*

Students should discuss what these data and graphs mean as they relate to their science question. They should compile their Data Analysis sheets to record the most pertinent information for their project.

### MEETING 15: *WRITING UP YOUR FINAL CONCLUSIONS*

Using the information and data acquired during the project, students should be able to compile their information into the Final Report outline.

- An outline to use as a guide for the final report is available at:  
<http://marsed.asu.edu/upload/MSIPArchivedFinalReportOutlinev1.doc>

OPTIONAL: If students wish to potentially publish their results on the MSIP website, they can do so by filling out the MSIP Archived Team Results Form.

- This outline is available at: [http://marsed.asu.edu/upload/MSIPArchivedTeamResults\\_web.doc](http://marsed.asu.edu/upload/MSIPArchivedTeamResults_web.doc)