



MARS STUDENT IMAGING PROJECT

ASU MARS EDUCATION PROGRAM



MSIP Proposal Outline

I. Introduction

The purpose of the introduction section is to introduce your project and science question. It should include the following information:

1. What is your science question?
 - This question should have a specific focus on a geologic feature(s) and you should be able to answer it by analyzing THEMIS images.

2. Why is your science question important and interesting?
 - Why is this question and topic interesting to your team?
 - How will answering this question be important in understanding Mars better?

3. List any hypothesis(es) you may have of what the answer(s) might be to your science question.
 - You may not formulate any hypotheses right away. It is best to look at images related to your question and formulate your hypothesis(es) based on the trends or patterns you have seen in those preliminary observations and data.
 - Hypotheses may change as you gather more data and make additional observations.



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II. Background

The purpose of the background section is to provide background information about the specific feature you are studying.

- Any facts you mention should be followed by the source where you found that information. For example: *Mars has the largest volcanoes in the Solar System. One theory why this is true is that Mars seems to have a much thicker crust than Earth, and so it doesn't have floating, moving crustal plates* (MSIP Resource Manual, p.16). It is important to cite your sources as it gives readers a way to verify your information.
- A few suggested resources you can use as you conduct your research are:
 - MSIP Resource Manual: <http://msip.asu.edu/curriculum.html>
 - Feature ID Charts: <http://marsed.asu.edu/upload/FeatureIDCharts.pdf>
 - THEMIS website: <http://themis.asu.edu>
 - Other reliable internet sources
 - Books, magazines or science journals

The background section should include the following information: (Don't forget to cite the source of piece of information including any image you include!)

1. List definitions of the geologic feature(s) on Mars you are studying as part of your science question.
2. Show how the geologic feature(s) you are studying are thought to form (the geologic process) on Mars in a sketch.



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3. Describe how the geologic feature(s) you are studying are thought to form? If you created a sketch describe the process your sketch is illustrating.

4. Show what the geologic feature(s) you are studying look like on Mars.

- Draw sketches.
- Show THEMIS images that show good examples of your geologic feature(s).
- Describe the defining characteristics or criteria for identifying the geologic feature(s) you are studying.

(For example: Let's say you are studying the relationship between sand dunes in different types of craters. If this is the case, you should describe what criteria or defining characteristics let you know you are looking at the different types of craters (preserved, modified or destroyed) as well as what criteria or defining characteristics you look for to identify sand dunes.)

- (Optional) Select an image that best illustrates each of the defining characteristics of the geologic feature(s) you are studying to use as a "control". (For example: If you described the criteria or defining characteristics of each type of crater and sand dunes, you could label those specific characteristics in a THEMIS image and use that as an exemplary example (a "control") to base your classifications throughout your project.)



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5. List any hypotheses or information about the formation of the geologic feature(s) you are studying from other scientists.
6. **PRELIMINARY OBSERVATIONS:** All proposals should provide information about the preliminary observations or data you have already collected. During the initial stages of your research you should have looked at THEMIS visible images. To illustrate this, you should consider including the following in your proposal:
- How many images you have looked at up to the time you are putting together the proposal. (It is important for you to keep a log of all your data and observations.)
 - Include a written description of what trends or patterns you are noticing with the images you have observed so far. (This is related to the hypothesis(es) you included in the Introduction section of the proposal. In this section of the background you would provide details and elaborate on the trends and patterns you are observing.)
 - Plot points on a map of Mars that represent the location of each image you have observed. If you do this, you should consider:
 - Showing the map with the plotted data points.
 - Describing what geographic regions you observed these features on Mars?
For example, “*During our preliminary research, as we have looked at THEMIS images on the <http://themis.asu.edu> website and plotted them on a map, we have noticed that most of the images of _____ seem to be found... (you would explain what you are noticing).*”



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III. Experiment Design

The purpose of the experiment design section is to show how you plan to design your experiment so that other scientists will be able to repeat it. This section includes a detailed step-by-step process explaining exactly what and how you will collect your data to answer your science question.

This section can include the following:

(Note: Some of this information may not apply to all projects.)

1. What specific spacecraft and camera will you use to collect data for your research?
2. What specific geologic features will you focus on for your study and why?
3. What geographic regions will you focus on for your study?
 - Examples of this may be as follows: certain latitude bands (*from 30N to 60N*), certain regions (*northern or southern hemisphere*).
 - It is not recommended to focus one small or specific geographic feature on Mars.
4. How many THEMIS images you will use to gather your data in order to answer your science question?
5. As part of your experiment design, **list** the specific data (information) you plan to record in a table from each image you observe, and why?

For example:

- **Image identification # (V#):** This will allow us and other scientists to reexamine the images we observed to check our data.
- **Latitude and longitude:** This will allow us to map where each image we examine is located



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- Specific feature(s) (*You would name the specific features here*): We will look for _____ and _____ as those directly relate to our science question
- Other?

List what you will record from each image AND why it is important:

6. What measurements you will make, if any. Please describe **how** you will make these measurements and why they are important.
7. List and describe **what** website(s) and **how** you will use it/them to gather and record the data you listed above.
 - List each website.
 - Describe where you will look, once on that website, to find each piece of data you will record from each image. (This can be a step-by-step list. For example:
 - 1. Go to the <http://themis.asu.edu/topic> website;
 - 2. Click on the “craters” topic;
 - 3. To find the image ID #, click on the THEMIS Data Releases link
 - 4. To find the Latitude and Longitude look...



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IV. Analysis Plan

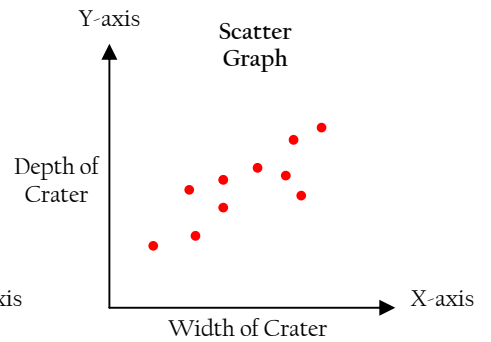
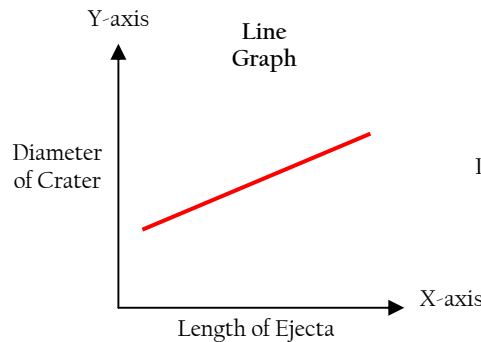
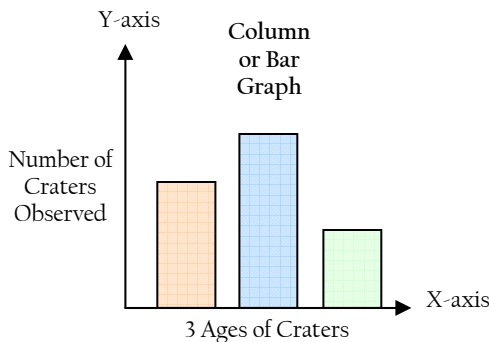
The purpose of the analysis plan section is to plan how to list and display your data in order to analyze it. This section may include:

1. **DATA TABLE:** This table lists the specific information (Image ID#, latitude, longitude, specific feature(s), measurements, etc.) you listed in the experiment design that you will record from each image you observe. [For your proposal, you should show how your data table will be set up (showing the column headers) for you to display your data.]

Image ID (V #)	Lat. (N)	Long. (E)			
EXAMPLE					

- Show what will your table look like?

2. **GRAPHS:** Describe what specific pairs of information will you graph (including what type of graph you may use: bar, line, scatter, etc.; see examples shown below) and what will each graph tell you?



- Use the table below to list the details of what you plan to graph.

Pair of data you will graph _____ vs. _____	Type of graph you will create	What that graph will tell you?
1.		
2.		
3.		

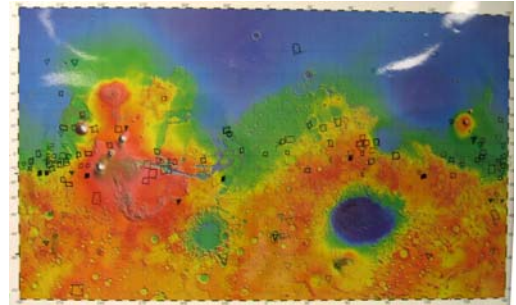
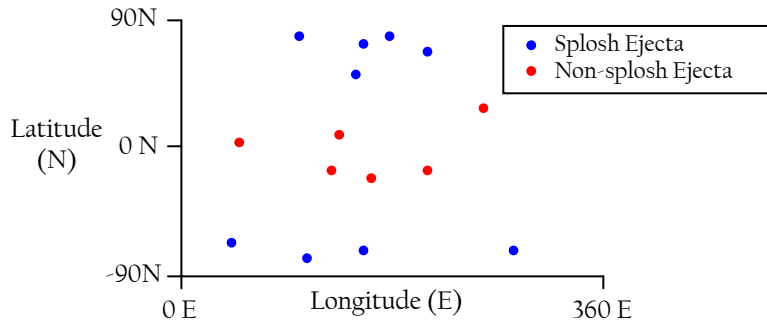


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3. **MAP:** Scientists often plot their data on a map to look for patterns and trends. Here are two examples of data plotted. These graphs are looking at latitude versus longitude.



MOLA map with plotted dust devil data

- Will you plot your images on a map? If yes, please explain what you will plot and why? (What will this map of data show you?)

4. **OTHER:** Are there any other ways you will display your results?
- Labeled THEMIS images showing important descriptive or qualitative information about the geologic feature(s) you are studying.
 - Context image sketches or images that provide descriptive or qualitative information important for understanding how the surrounding area (the context) may play a role in the process or formation of the geologic feature(s) you are studying.



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V. Conclusion

The purpose of the conclusion section is to summarize what your team is proposing to study. You should:

1. Restate your science question.
2. Restate your hypotheses (if you had any).
3. Restate why it is important to answer your science question and why your proposal should be accepted for your team to use the THEMIS visible camera.

VI. References

The purpose of the references section is to list all sources of information used to create your science proposal. It includes a list of sources such as:

- Books
- Websites
- People
- Equipment

Note: Each reference you list in this section should be cited within the body of your proposal. There is a specific way to do this. For example:

- Within the body of your proposal after a written statement(s): (*MSIP Resource Manual, p. 16*)
- Listed in your reference section at the end of your proposal:

Watt, K. (2002). *Mars Student Imaging Project: Resource Manual*. Retrieved June 29, 2006, (the date you downloaded) from Arizona State University, Mars Student Imaging Project Web site: <http://msip.asu.edu/curriculum.html>.

You can go to www.apastyle.org for additional information.