

## **DATA ANALYSIS (Cont'd) and MSIP PROPOSAL OVERVIEW**

Minimum materials required:

- *Data Analysis Practice Guide*: 1 per student recommended (students should already have this handout)
- 1 Internet-connected computer per team:
  - Computer needs to have Microsoft Excel
  - Electronic copy of MOLA Mars elevation map (provided) needs to be on each computer
- *MSIP Proposal Outline*: 1 per student

### *Data Analysis*

If students are still working on the *Data Analysis Practice Guide*, provide them time during the beginning of this meeting to complete the activities. Bring this activity to a close by reviewing the summary points at the end of the practice guide. Discuss any of the individual activities as you feel necessary.

The majority of this Meeting should focus on the *MSIP Proposal Outline*.

### *MSIP Proposal Overview*

The proposal outline should be used to have students create an outline of their work to see if they are lacking any information for their project. It can be considered somewhat of a progress report. It is also a guide to assist them with their project. Most of the information for the proposal has already been completed by students in the previous activities. The proposal outline allows students to compile all their previously completed information in one place. It also helps to ensure they are all on the same page and consistent with their research plan. As they progress with their research, some of the information they include in this proposal outline will most likely change. This is a natural part of the process of science.

Download the [\*\*\*MSIP Proposal Outline\*\*\*](#).

The recommended strategy for filling out the *MSIP Proposal Outline* is as follows:

- Small Research Teams: Working as a team, students should discuss and debate the information they feel should be included in each section of the proposal.

Here is an overview of each of the sections for the *MSIP Proposal Outline*:

### **I. Introduction**

There are three main questions students should address in this section:

1. *What is your science question?* This is self-explanatory.
2. *Why is this question important and interesting?* Students should think about why this topic interests them but ALSO why this question is important in understanding Mars better. For many, understanding why what they are studying is important can be difficult. It requires students to think more globally

and critically about the geologic processes at work on Mars. They need to relate what they understand about how a process may work on Mars with what they are studying. Encourage students to think about how their study may help in the understanding of the past or present conditions on Mars and why that would be important. They may also want to consider what effect this better understanding may have for future human or robotic exploration of Mars.

3. *List any hypotheses you may have of what the answer(s) might be to your science question.* For this, students should think back to what they did with the *Question Mars* activity, *Student Worksheet*

4. Students should base any hypothesis (and they can have more than one hypothesis) on observed trends rather than just an unsupported guess.

## **II. Background**

Gathering background information from books and/or websites and other sources about what is known about the geologic feature(s) they are studying is a very important part of their research. This section should be continually worked on as students go through their research. Student teams may assign different portions of this section to individuals within their research team to be responsible for. This information can include:

1. *List definitions of the geologic feature(s) on Mars you are studying as part of your science question.* Some of this information can be found in the Feature Identification Charts.

2. *Show how the geologic feature(s) you are studying are thought to form (the geologic process) on Mars in a sketch.* This can be done in a student drawn sketch or diagrams they have found in a resource.

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.* This can be a written explanation of their sketch or diagram.

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

- *Draw sketches.* Students can draw or sketch the feature(s) they are studying.
- *Show THEMIS images that show good examples of your geologic feature(s).* These can be images from the **THEMIS** website.
- *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 the criteria or defining characteristics are for the different types of craters (preserved, modified or destroyed) as well as what criteria or defining characteristics you look for to identify sand dunes.)* Students should describe defining characteristics or criteria for identifying the geologic feature(s) they are studying.
- *(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.) In some cases students may have a "control" image that is an exemplary example of the specific characteristics or criteria of the geologic feature(s) they are studying. This may be considered their "control". The use of a "control" is not absolutely necessary, however, defining characteristics or criteria is important for students to establish.

5. List any hypotheses or information about the formation of the geologic features(s) you are studying from other scientists: Different sources may provide different information about the geologic features students are studying or thoughts on how those features may form.

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:

- a. How many images you have looked at up to the time you are putting together the proposal. Students MUST have made observations of THEMIS images in order to write a quality proposal.
- b. Include a written description of what trends or patterns you are noticing with the images you have observed so far. Students should provide details and elaborate on the hypotheses they mentioned in the Introduction section of the proposal.
- c. Plot points on a map of Mars that represent the location of each image you have observed. Students may want to actually show a map with their plotted preliminary data points. Alternatively, they can plot their points on a map and for the proposal only include a description of what geographic regions they observed the features they are studying on Mars.
- d. Students should keep track of ALL references used in order to cite sources appropriately. This includes citing images from the THEMIS website as well. It is important for students to know they need to cite all their sources from the very beginning of their research.

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

- MSIP Resource Manual: This is included in their Student Manual
- Feature Identification Charts: This is also included in their Student Manual
- [THEMIS](#) website
- Other reliable internet sources or books, magazines or science journals

### **III. Experiment Design**

This section includes a number of questions/information that are self-explanatory. Students should describe, in as much detail as possible, the information they include as the "answers" to the questions. Students should

discuss their answers with each other to be sure they are all on the same page, as a team, with the intentions of their experiment and plan. Students have already worked on and discussed a lot of this information in the *Question Mars activity Student Worksheets 4 and 5*.

Here are some important details for questions/information #5, 6, and 7 suggested in this section:

5. *As part of part of your experiment design, list the specific data (information) you plan to record in a table from each image you observe and why?"* These details have also already been completed by the students from their *Experiment Design (Data Collection Methods)* handout. They should include a list of the information they will gather from each image and why that information is important. Asking students to rewrite and include this information as part of their proposal, helps reinforce the importance and consistency of what and how they are conducting their research.

6. *What measurements will you make, if any. Please describe how you will make these measurements and why they are important.* If students are going to make measurements as part of their research, they have one of a few options to make their measurements:

- Make measurements by using the techniques (determining the scale of the image) they learned with the *Mars Image Analysis* activity. For this technique students would need a print out of images.
- Make estimated measurements knowing that every THEMIS visible image is 18 km across. By knowing this, they can make estimated measurements without having a print out images.
- Use Adobe Photoshop to make measurements (This would require having Adobe Photoshop on your computers and time or knowledge to learn how to make measurements. MSIP Image Processing Curricular guides for using Adobe Photoshop are available upon request.)

Students should describe in detail, how they are going to make their measurements and why these measurements are important for their research.

7. *List and describe what website(s) and how you will use it/them to gather and record the data you listed above.* Students should list out exactly what they will do at each website in order to gather their data. This should include descriptions of where they will go once on the website in order to gather each piece of data they state they will log. This can be done as a list of steps. Some of this information was included on the *Experiment Design (Data Collection Methods)* handout.

#### **IV. Analysis Plan**

For the Analysis Plan section, students should focus on how they will list and display their data in order to analyze it. These main items are as follows:

1. *Data Table (THEMIS Image Data Gathering data table):* Students should show the headings of their data table (without the actual data included). At this time they should look at their individual *THEMIS Image Data Gathering* table and

make sure they all agree on its set-up. The team should also be thinking about if they are filling out their data table in a consistent fashion. Each member of the research team should have a data table that is consistent in every way, including any abbreviations being used. They should also make sure they include (or do not include) units of measurement in each logged observation. For example, if students have a header for *Longitudes*, it is recommended that they have *Longitudes (E)* in the header section. Therefore, for each logged observation, they will not need to include the E after each longitude recorded. This will be inferred from the header. They should think about how the headers should be labeled and exactly how they are going to log the information they want to collect from every image. At this point, it is recommended that they review and ensure consistent table header information. Only AFTER they are finished with the proposal outline should they review the consistency of the recorded information. Students should have recorded information in their data tables with previously recorded data (from the Question Mars activity) that they completed for homework. Again, it is not recommended that they review the recorded data until they are finished discussing the entire proposal outline.

2. *Graphs and Maps (listed separately as #2 and #3 in the MSIP Proposal Outline):* Students should use the activities they completed with the Data Analysis Practice Guide to think about what graphs they may want to create to display their data, including their information on a MOLA elevation map of Mars (which is a graph comparing latitudes versus longitudes). Students should include which pairs of data they plan to graph, the type of graph they will create and what that graph will tell them.

3. *Other:* Students may consider showing labeled images (sketches or actual images) to show important descriptive or qualitative information about the geologic feature(s) they are studying. They may also include context images (sketches or actual images) that also provide qualitative information important for understanding the context area where they are observing these features.

## **V. Conclusion**

This section is used to summarize what the team is proposing to do and is almost a reiteration of their Introduction section. This section has three main questions:

1. *Restate your science question.* This is self-explanatory.
2. *Restate your hypotheses (if you had any).* Students can restate any hypotheses they may have.
3. *Restate why it is important to answer your question and why your proposal should be accepted for your team to use the THEMIS visible camera.* For students conducting an archived project, they do not need to address the last part of this regarding why their proposal should be accepted. Their main focus should be on why it is important to answer their question.

## **VI. References**

This section should include a list of all (and ONLY) sources of information actually used to create their science proposal. Any fact, image or piece of information that they read in a book, website, journal or magazine should be referenced within their proposal outline. Only sources referenced within the *MSIP Proposal* (students should learn how to reference properly) should be included in their references section.

### **HOMEWORK RECOMMENDATION:**

1. Fill out the remaining sections of the *MSIP Proposal Outline* that were not completed in class.