Kingswood 5th Grade MSIP Proposal

Are Dust Storms on Mars Cyclical?

Developing the Next Generation of Explorers!

Science Question

Are the global dust storms on Mars cyclical?

- It is important to understand and possibly predict the global dust storms for all current and future missions, especially those with astronauts. Research shows the storms seem to originate in the Southern Hemisphere during the summer months but go every other year or so. By looking at various Southern Hemisphere sites, we can check the sand levels and surface temperature to look for patterns to find precursors which will perpetuate the global dust storms.

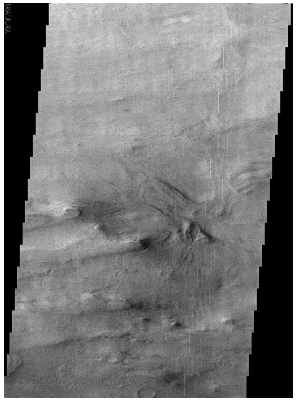
Hypothesis

- Global dust storms on Mars are cyclical due to the movement of sand which will affect heat levels in the Southern Hemisphere. There is a cyclical pattern of winds which caused by uneven heating and cooling of the surface which then results in the movement of dust perpetuating the cycle.

Background Research

- Everyone is curious and very interested in finding out more information about Mars and WHEN astronauts will finally get there. During our research, we kept coming back to the Mars Southern Hemisphere and the strange weather found on Mars. We initiated our research by watching the BBC film production of "The Wonders of the Solar System" with Bryan Cox and it showed him in the Mojave desert and mirroring the conditions found on Mars. This seemed to guide the direction of our research. We also kept looking at the dust devil tracks found on Mars using the THEMIS images. An example is THEMIS **Image ID: V03394003** found at http://themis.asu.edu/zoom-20020927a. We compared the sand to our sand here on Earth and looked for similarities. Being from Florida, we have sand but not at all similar to that in a hot desert. We looked at our Florida sand and the properties it had and then compared and contrasted it to Martian sand.

THEMIS Image



Florida Sand

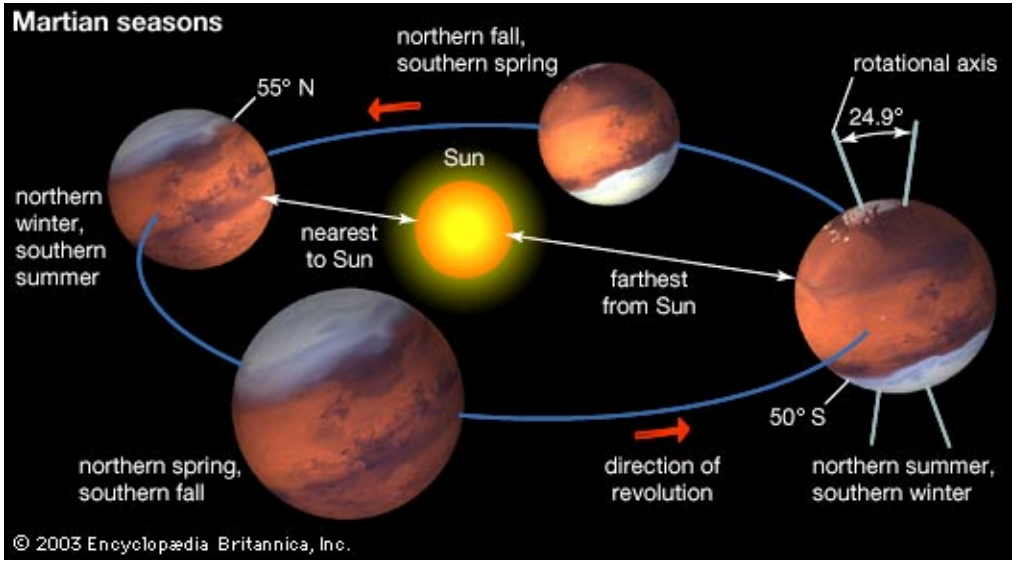
Mojave Desert Sand

Further Research

- The Hellas Planitia or Hellas Impact Basin, was one place that we kept coming back to as we could not believe the size of it. With a diameter of 2,300 km, or 231,000 of our classrooms! Craters caught the eye of everyone but this we just couldn't take our eye off of it. http://en.wikipedia.org/wiki/Hellas_Planitia
- We also examined explored the sites that Curiosity did not choose and the Gale Crater it did land in. The other sites we looked at were the Holden Crater and the Eberswalde Crater. The website address was http://mars.jpl.nasa.gov.
- During our research, we saw an article on Global Dust Storms which tied the Hellas Planita back to the "The Wonders of the Solar System" clip we saw. The article titled, "THEMIS keeps an eye on Mars for dust". It was from THEMIS website itself, http://themis.asu.edu/dust_activity_monitor. After we read this article, we knew we had our project. If the Jet Propulsion Lab did not know the answer, then we wanted to help!

Narrowing the Field

- After agreeing on a subject, we went looking for research and found that it basically all came back to a few sites. An article from BrightSurf.com, http://www.brightsurf.com/news/headlines/31507/Arizona_State_scientists_keep_an_eye_on_Martian_dust_storm.html was from 2007 and it gave good background information and a chance to see in the past. We learned that the dust storms do start in the summer months and in the Southern Hemisphere as it is hotter there due to the tilt of Mars and its relationship to the sun. We noted that the Mars orbit is different than that of Earth and saw how it can get much hotter in the Southern Hemisphere.



Narrowing the Field, continued…

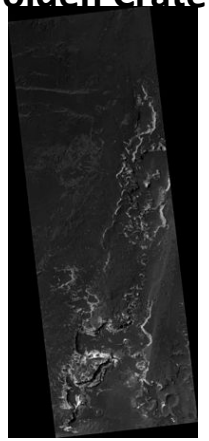
- The Lunar and Planetary Institute provided some more information as well at http://www.lpi.usra.edu/education/explore/mars/background/. It seemed like it the space version of Wikipedia.

- The European Space Agency provided a wealth of information, particularly the article from 2007 explaining the global dust storm. http://www.esa.int/esaSC/SEMPWD361AF_index_0.html It explained how the dust absorbs the solar radiation which directly heats the atmosphere and blocks 20% of the sun from the surface, thus cooling the planet down. It stated that the storms start in the Southern Hemisphere based on the tilt of Mars and that the Hellas Basin plays a very important role. They have the same question as JPL does, why do the global storms happen some years and not others?

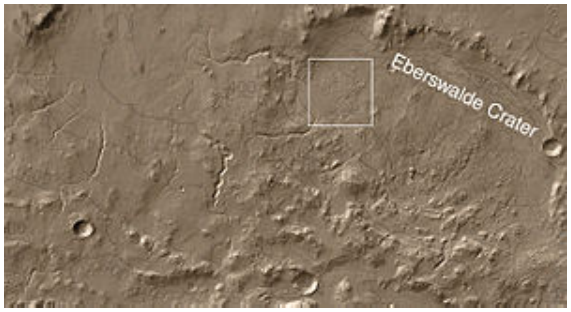
- Finally, the NASA website proved to be invaluable as well. The numerous articles, pictures and videos, such as http://www.nasa.gov/mission_pages/MRO/multimedia/20070717-1.html gave us images and explanations that we could better understand and how dust devils tied into the equation. We started to examine the dirt devils found on the MSIP subject site to be able to recognize and better understand them on Mars.

Images of Interest

Holden Crater

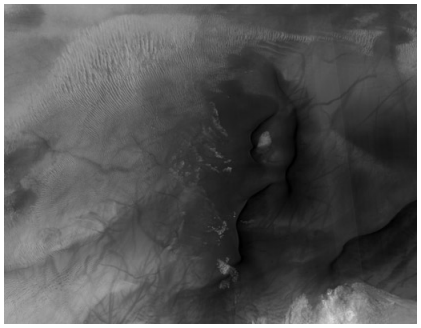


Eberswalde Crater

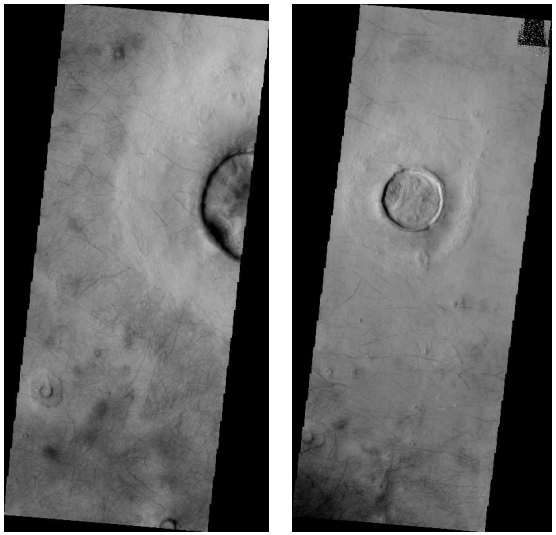


Hellas Plaitia

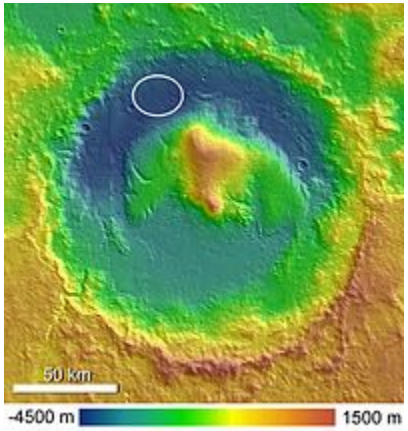
Crater with Dune Field

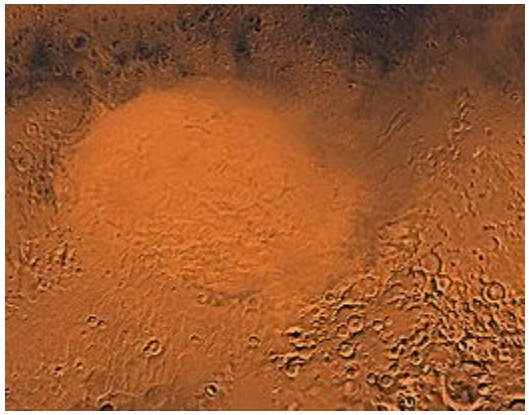


Dust Devil Tracks



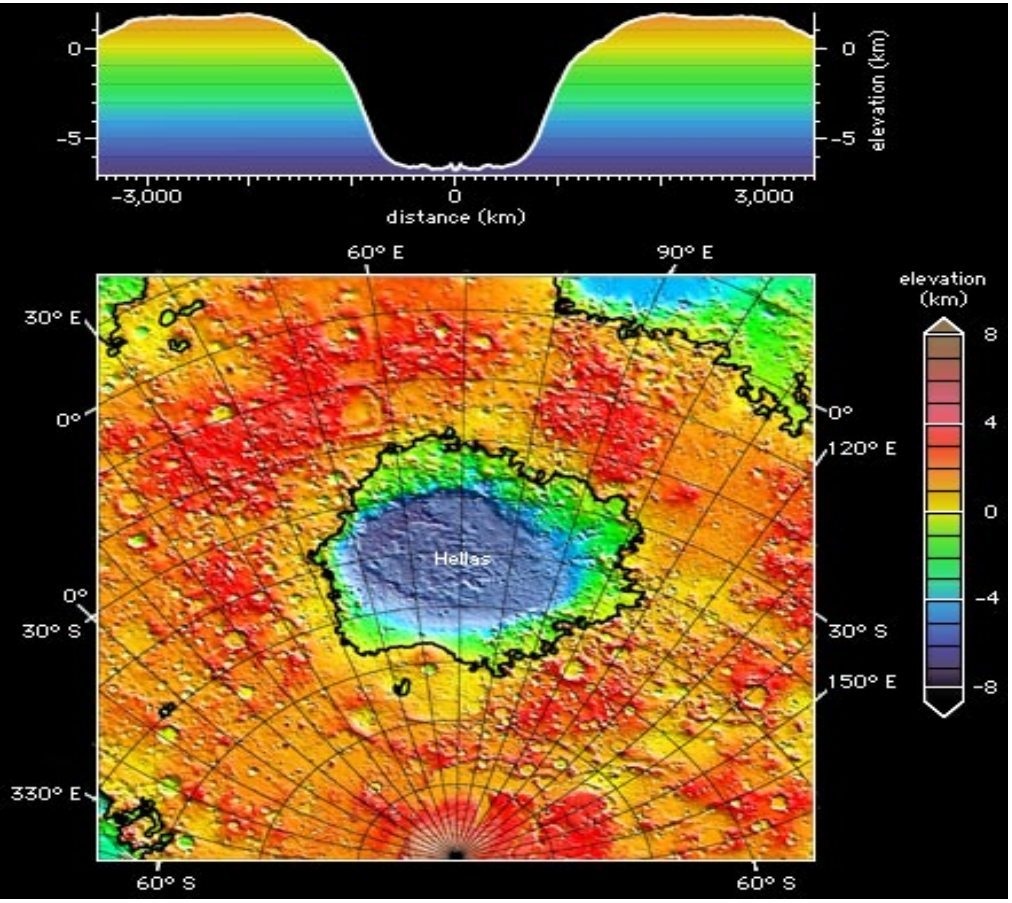
Gale Crater

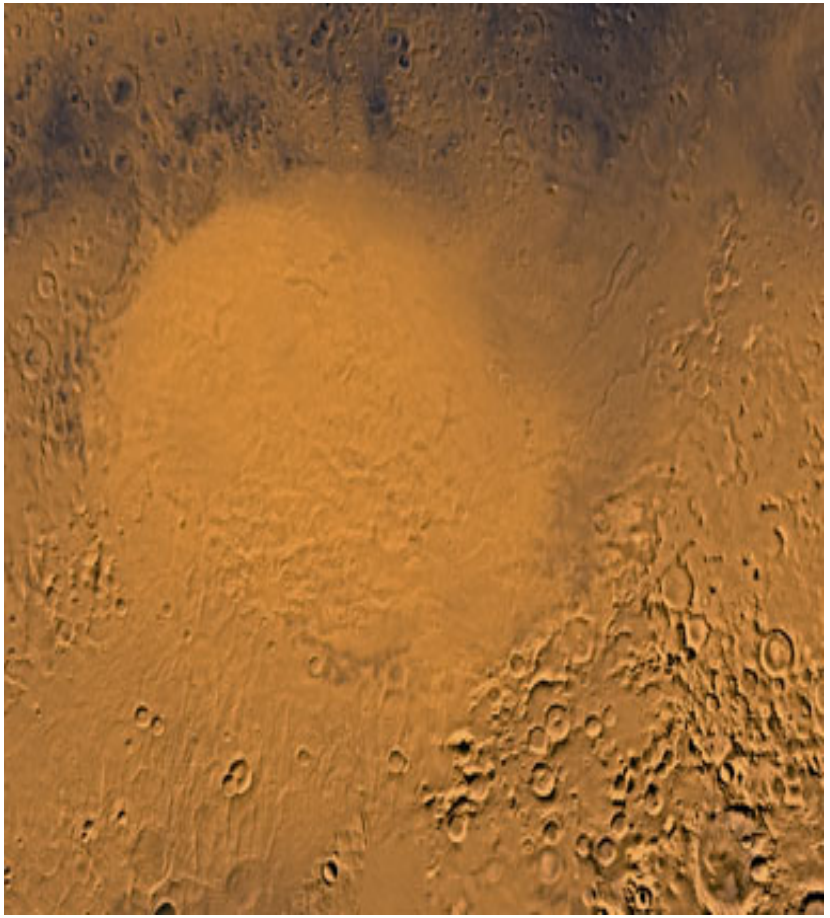




Images continued…

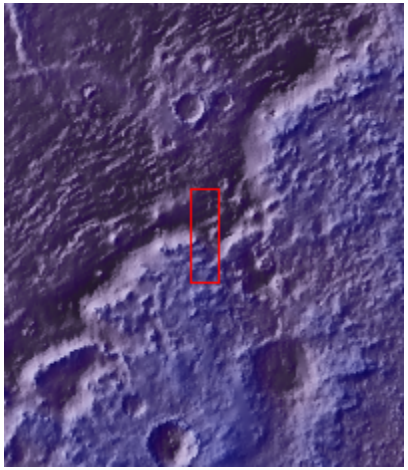
Hellas Crater





Themis Images of Interest

Image ID: V03394003 **of Hellas Basin**



THEMIS Image of the Gale Crater

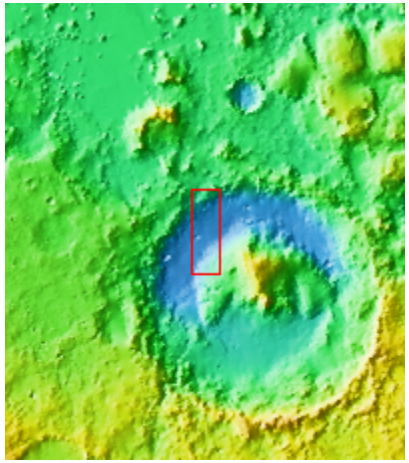
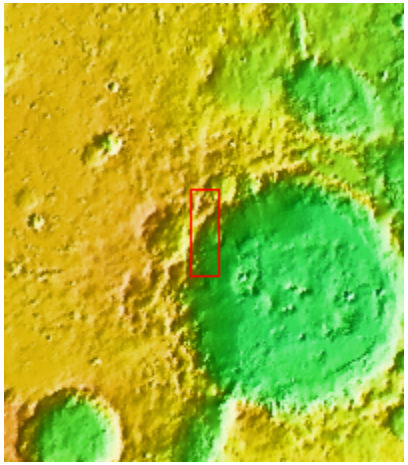
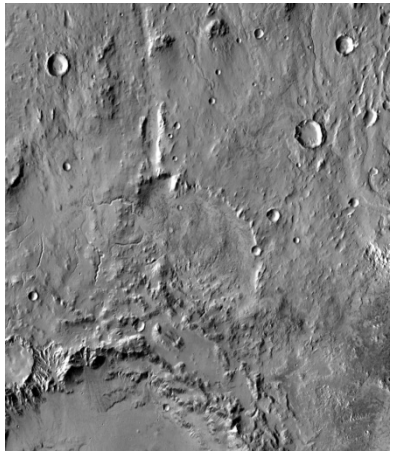


Image ID: V4170900 **of Holden Crater**



THEMIS Image of Eberswalde Crater



All Images were found on the THEMIS website: http://themis.asu.edu

The features are craters and were formed by meteors. All locations are in the Southern Hemisphere. The exact features we are looking for is the dust itself as found by dust devils or sand dunes. We would focus on the floor of the craters. We would also like to use the thermal imaging and record the surface temperature and chart over the years. We know on Earth that sand dunes are created by wind and the uneven heating of Earth. We would like to prove that this is the case on Mars and patterns will emerge over time showing the possibility of predicting global dust storms.

Experiment Design

- We will be using the THEMIS camera on the Mars Odyssey satellite to collect and record all of our data.
- We will be focusing on the four craters found in the Southern Hemisphere of Mars: Hellas Basin, Gale, Holden, and Eberswalde. In particular, the sand levels and the surface temperature.

  Eberswalde location: 23.86° S, 326.73° E

  Holden location: Latitude: -25.2309 Longitude: 324.993

  Gale location: Latitude: -4.53472 Longitude: 137.296

  Hellas Basin location: 5.4° S, 137.8° E
- We will be using the JPL website along with NASA and THEMIS to confirm and discuss the results of our findings. We are looking for the level of sand to decrease in each of the craters and an increase in surface temperature which will precede the global dust storm. We predict the levels will be consistent before the global dust storm. We also look for a consistent temperature rise preceding the storm.
- We would like to have a current image of the four craters if possible and then research the JMARS site to go back in time and track the sand level and storm occurrences.

Experiement Design continued…

- We will be listing the photos by their image identification number along with their latitude and longitude.
- We will examine the photos for dust devil tracks, sand dunes, and any other visible evidence of sand as those directly relate to our science question. We will record by number of tracks, dunes, and shifting of sand.
- We would also like to look at the thermal images of the same area to check for patterns over time as this also relates to our science question. We will record the surface temperature of the areas from the thermal images.

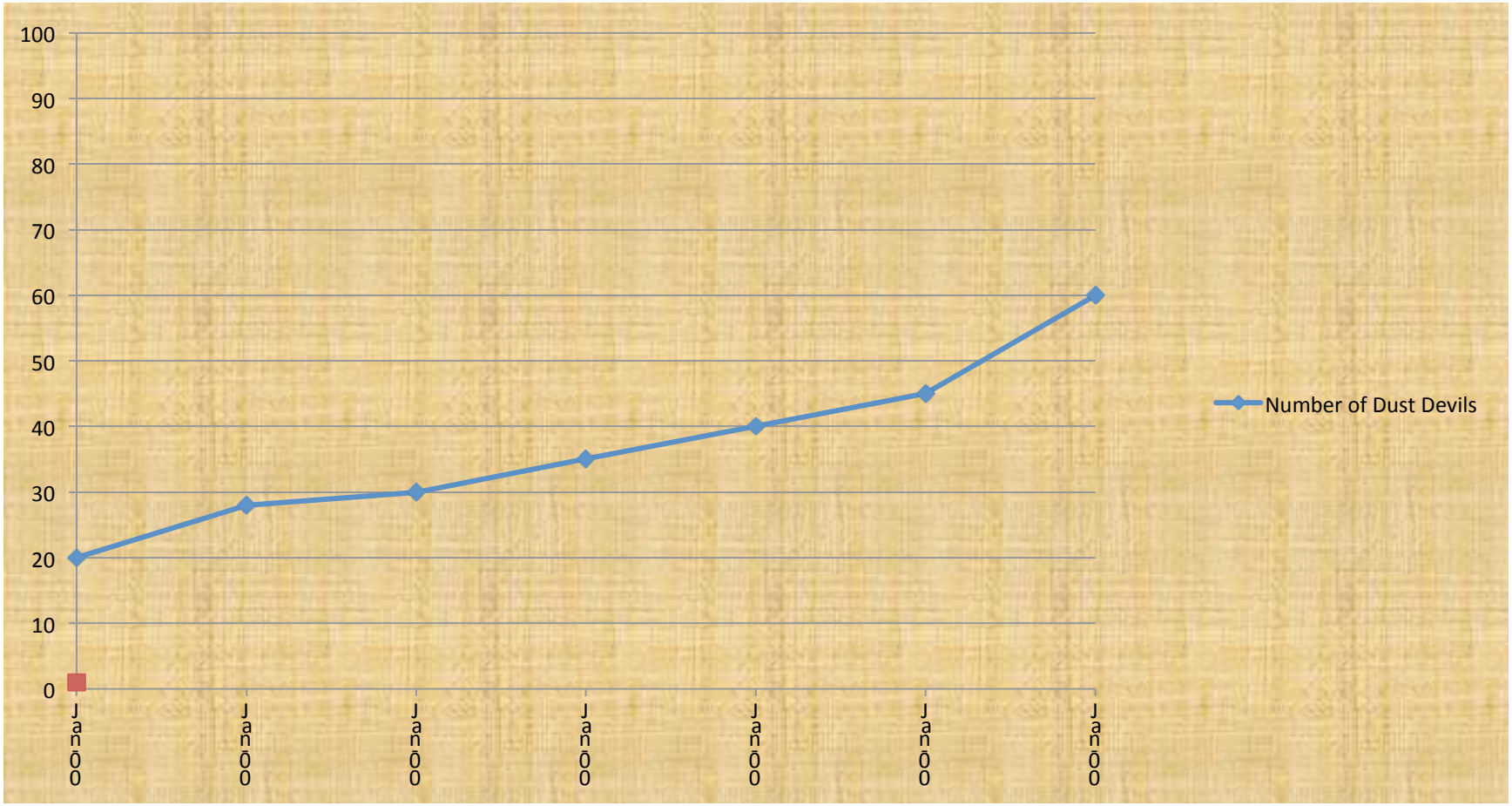
Analysis Plan

- In order to best display our findings, we will be using a variety of charts and graphs.
- ***Line Graph*** – Showing a change over time. The number of Dust Devils versus the time of year. The number of sand dunes versus the time of year. The surface temperature versus the time of year.
- ***Bar Graphs*** – comparing the differences between craters. One bar graph will be for dust devils, another for number of sand dunes, and another for surface temperature.
- We plan to ***plot our data on a MOLA map*** to show the direction the sand travels. This will show a consistency of direction and thus increase the ability to predict storms.

Examples of Planned Data Tables

Image ID (V#)	Latitude	Longitude	# of Dust Devils	# of Sand Bars	Surface Temp.

Examples of Planned Data Tables



Conclusion

- ***Science Question -*** By looking at various Southern Hemisphere sites, we can check the sand levels and surface temperature to look for patterns to find precursors which will perpetuate the global dust storms.
- ***Hypothesis -*** There is a cyclical pattern of winds which caused by uneven heating and cooling of the surface which then results in the movement of dust perpetuating the cycle.
- ***Project Importance –*** This project is crucial for the better understanding of global dust storm development. These storms can cause tremendous damage and even death to the future astronauts is not properly prepared. We feel that we can track the data and be able to see a pattern in the global dust storm development.

References

- Floor of the Helen Basin, THEMIS **Image ID: V03394003** Retrieved 9/21/12, from the Arizona State university, Mars Student Imaging Project web site: http://themis.asu.edu/zoom-20020927a.
- Image of Florida sand was retrieved on 9/28/12 from a Bing web search at: http://www.city-data.com/picfilesc/picc20092.php
- Image of Mojave sand dunes was retrieved on 9/28/12 from a Bing web search at: http://www.flickr.com/photos/sieren/5609982041/
- "Wonders of the Solar System" video from BBC, 2010. The clip on Mars was played for the students on 9/10/12 to trigger an interest into Mars and a chance to relate to something on Earth.
- The information on the Hellas Impact Basin came from several sources and found at the following websites: http://en.wikipedia.org/wiki/Hellas_Planitia, http://themis.asu.edu, http://themis.asu.edu/zoom-20020927a, http://www.britannica.com/EBchecked/topic/366330/Mars/54239/Southern-cratered-highlands http://www.esa.int/esaMI/Mars_Express/SEMWPNXLDMD_0.html, http://www.jpl.nasa.gov/ http://www.nasa.gov/multimedia/imagegallery/image_feature_1721.html. We used these sites throughout the weeks from 9/10/12 to 9/28/12.
- The information on the Holden Crater came from several sources and found at the following websites: http://www.nasa.gov/mission_pages/MRO/multimedia/pia10072-caption.html, http://themis.asu.edu/node/5493, http://themis.asu.edu/feature/25, http://www.jpl.nasa.gov/ http://en.wikipedia.org/wiki/Holden_(crater_on_Mars), http://themis.asu.edu, http://www.esa.int/esaMI/Mars_Express/SEM5O1TX55H_0.html. We used these sites throughout the weeks from 9/10/12 to 9/28/12.
- The information on the Gale Crater came from several sources and found at the following websites: http://www.esa.int/esaMI/Mars_Express/SEMNE8TX55H_0.html, http://themis.asu.edu, http://www.nasa.gov/multimedia/imagegallery/image_feature_2023.html, http://www.jpl.nasa.gov/ http://themis.asu.edu/node/5990, http://en.wikipedia.org/wiki/Gale_crater. We used these sites throughout the weeks from 9/10/12 to 9/28/12.

References continued…

- The information on the Eberswalde Crater came from several sources and found at the following websites: http://www.esa.int/esaMI/Mars_Express/SEM5O1TX55H_0.html, http://en.wikipedia.org/wiki/Eberswalde_(crater), http://www.jpl.nasa.gov/ http://www.britannica.com/EBchecked/topic/366330/Mars/54239/Southern-cratered-highlands, http://themis.asu.edu/node/5494, http://themis.asu.edu http://www.nasa.gov/mission_pages/MRO/news/mro20090924.html. We used these sites throughout the weeks from 9/10/12 to 9/28/12.
- The information on the global dust storms came from several sources and found at the following websites: http://www.nasa.gov/mission_pages/msl/multimedia/vasavada-4.html, http://www.nasa.gov/home/hqnews/2007/jul/HQ_07162_Rover_Dust_Storm.html, http://themis.asu.edu, http://themis.asu.edu/search/node/dust%20storm, http://www.britannica.com/EBchecked/topic/366330/Mars/54239/Southern-cratered-highlands, http://mars.jpl.nasa.gov/gallery/duststorms/PIA02807.html, http://en.wikipedia.org/wiki/Dust_storm, http://www.esa.int/esaSC/SEMPWD361AF_index_0.html, http://www.jpl.nasa.gov/