WIND STREAKS IN THARSIS AND SYRTIS MAJOR REGIONS. A. Kaczmarowski, K. Burleigh, A. Precie, N. Hunt, K. Adler, R. Birch, N. Gordon, H. Miller, J. Carpenter and L. Rawlings, (Astronomy Club, Gilbert High School, 1101 E. Elliot Rd, Gilbert, AZ, 85234, leon_rawlings@gilbert.k12.az.us).

Introduction: The Thermal Emission Imaging System infrared camera, band 9, of the Mars Odyssey Spacecraft was used to compare day and night infrared images of the Tharsis and Syrtis Major Regions of Mars. The exact locations of these images were selected based on their wind streaks. The features of each image pair, which consisted of day and night infrared images of similar longitude and latitude, were compared in order to study the heat signature of wind streaks in the context of their surrounding terrain. Then, using background data, a model was determined for how the wind streaks were formed in each area. By determining the characteristics for how the wind streaks were formed, further understanding into these formations can be acquired. The traits of wind streaks can then be used in later experimentation to determine different characteristics in each region of Mars.

Background: Wind streaks are the result of continuous wind flow over an obstruction, which can be any surface feature, in this case a crater. The obstructions cause a disturbance in wind flow leading to bright or dark streaks in their lee. Scouring and depositing wind streaks are the two major categories, but for the purposes of this study the differences between their effects are negligible [1].

Tharsis Region. The Tharsis Region is a bulge on the Martian surface containing many shield volcanoes and valleys. It is an area of high dust content including a dust layer several meters thick [2].

Syrtis Major Region. The Syrtis Major Region is an old shield volcano noted for its basaltic rock composition and extremely low dust levels [3].

Data: The day infrared images possessed three major factors that influenced the heat signature of their wind streaks: shadows (lighting affects), albedo and thermal inertia [1]. In both regions, shadows had minimal affect because of their constantly changing nature and were, therefore, not accounted for [1]. However, in the night infrared images, only thermal inertia was a factor. It was discovered that the Syrtis Major Region featured wind streaks that were both cool during the day and cool at night relative to their surroundings. On the other hand, the Tharsis Region contained wind streaks that were both warm during the day and warm at night with respect to the surrounding area.

Discussion: An analysis of the data revealed the following explanation of wind streak formation.

Tharsis Region. The albedo of the region is relatively constant. This can be seen through the Thermal Emission Spectrometer data. The very thick dust layer in the region causes some degree of induration across the entire area [4]. Wind streaks in the region cause a greater amount of dust to build up in the lee of craters. This build-up of wind-blown dust allows for a lower thermal inertia than that of the surrounding area. This effect makes wind streaks warmer during the day. Likewise, this build-up eventually leads to a greater degree of induration behind craters than in the surrounding area. This causes an increase in thermal inertia relative to the surrounding area and, therefore, makes the wind streaks warmer at night. Daytime infrared readings, which depend more on surface features than underlying features, would be more affected by the fresh layer of dust rather than the area of increased indurated dust.

Syrtis Major Region. The albedo of the region is low because of its basaltic rock composition. Wind streaks in this region are composed of a thin dust layer that has a higher albedo relative to the surrounding area. Since albedo has a greater affect on heat signatures than thermal inertia in the daytime, this makes wind streaks appear cooler in the day infrared images. With regards to the night infrared images, the porous basaltic rock, which possesses low thermal inertia, coupled with a thin dust layer, also with low thermal inertia, causes wind streaks to be cooler at night than their surrounding areas.

Conclusion: Since the characteristics of each region seemed to dictate the properties of a surface feature, such as a wind streak, it can be inferred that general characteristics of the regions of Mars can be used to determine the properties of other mysterious surface features.

References:

[1] Personal Communication, Dr. Joshua Bandfield, 22-23 Oct. 2007. [2] http://crism.jhuapl.edu /gallery/featuredImage/image.php?image_id=82, 3 Jan. 2008. [3] http://www.marstoday.com/viewsr.html?pid= 5688, 3 Dec. 2007. [4] http://tes.asu.edu/TESworkshop /Mellon.pdf, 3 Jan. 2008.