**\*\*disclaimer for peer reviewer: I had some difficulty with Overleaf and choose to just do a pdf instead. This is also just a skeleton of what the paper should look like as I don’t have any significant results yet. Anything in parenthesis and all caps is a note about what should be included there but I either don’t have the results for or haven’t finished the background research.**

**Working Title:** Setting Our Sights on Mars: Using InSight to Take a Closer Look at the Seismicity of The Red Planet

**Abstract:**

Two years ago, NASA’s Insight mission team successfully installed the first seismometer on the surface of Mars capable of detecting seismic waves. By looking at the characteristics of these waveform signals, seismologists hope to gain a better understanding of the structural features and chemical composition below the visible surface of the planet. The mission's goal is to answer questions about the early formation processes of Mars as well as the ongoing processes affecting the planet today, either on the surface or deep within. We created a visual catalog of the waveform data and used it to identify common features among them. Based off of previously reported events, we analyzed these waveforms with the goal of constraining the location of the event and the possible processes contributing to these signals. (MAJOR FINDING)

**Introduction:**

On November 26, 2018, NASA’s Mars InSight mission team successfully installed the Interior Exploration using Seismic Investigations, Geodesy and Heat Transport (InSight) lander on the surface of Mars. The lander is outfitted with many instruments hoping to answer the major questions surrounding the formation and current structure of Earth’s most interesting neighbor. One of these instruments, the Seismic Experiment for Interior Structure (SEIS), is the first seismometer on the surface of Mars capable of detecting seismic signals. Using this data, seismologists can begin to investigate the early formation processes of the rocky planets of our inner solar system as well as gain a better understanding of the current processes shaping the red planet.

Characteristics of the seismic signals can aid in constraining the current models of the structure of the planet. For example, (GO INTO WHAT EACH THING CAN POSSIBLY TELL YOU) Unlike Earth, Mars’s crust is composed of a single tectonic plate and therefore intraplate tectonics (?), such as faulting, and impacts are expected to be the major contributors to the seismicity of the planet.

In this paper we will catalog and characterize the seismic events detected and reported by MQS in order to expand our understanding of Mars. By using events S0173a and S0235b as reference, we will attempt to constrain the location of other reported events through polarization analysis of the waveforms and calculated particle motion. Additionally, we will begin to hypothesize about the phenomena associated with these seismic signals by ~~comparing them to the characteristics of signals from the Moon and Earth~~.

**Observations & Data Reduction:**

This project took advantage of the waveform data in Mars Seismic Catalog provided by the Insight Marsquake Service (MQS). It was downloaded directly from the Incorporated Research Institutions for Seismology (IRIS) database using a function of the python package named ObsPy. The instrument of interest for this project is the very broadband (VBB) seismometer, which is a part of the seismometer package, Seismic Experiment for Internal Structure (SEIS). The Insight mission successfully installed the geophysical observatory on 26 November 2019 and the data used for this analysis extends from 1 January 2019 to 31 December 20. By taking advantage of the categorizations created by MQS, we developed a filtering process unique to each event type. After the initial filtering process, the events with stronger signals were then filtered over four different frequency ranges, 2-8Hz, 1-4Hz, 0.125-0.1Hz, and 0.03-0.125Hz which helped us to look more closely at the wavetrains before performing a polarization analysis. Because of the configuration of the seismometer, the different trace elements were then recombined using the azimuth and dip angles of the seismometer components reported by (???). This was done to properly orient the data in the north, east and vertical (Z) direction.

**Analysis & Results:**

**Discussion:**

**Conclusion:**

Using SEIS, we were able to create a catalog of seismic events occurring on Mars between 1 January 2019 and 31 December 20. We focused specifically on the low-frequency events in order to take a closer look at the tectonic processes occurring close to the landing site. (INCLUDE ACTUAL CONCLUSIONS)

For this project, the results can be improved upon by better constraining the maximum and minimum frequencies of the filters applied to the data streams. Additionally, as the mission continues more data will become available that can provide a more complete picture of the seismicity of Mars. By also gaining a better understanding of seismology using a single instrument, we can begin to develop better technology and data processing techniques that can be applied to InSight data as well as data from future missions. These updated methods can then be used to investigate the interior of other small bodies in our solar system, like Europa or Titan. Both(?) are hypothesized to be seismically active due to tidal forces from Jupiter and Saturn respectively.