SUMMARY

The aim of this graduation thesis entitled "Models of Apollo hardware based on photogrammetric analysis of the surface imagery" was to accurately create a three-dimensional model of the Apollo 14 Lunar Module vicinity.

The model is based on photogrammetric analysis of a total of 65 images made by the crew. As a result of the analysis, locations of the hardware elements and surface features were determined. Autodesk ImageModeler was used to find the coordinates of boulders and then the mean boulders' plane equation was derived. The equation of the mean boulders' plane was found to be 0.118x + 0.043y - z= 0.053. This was followed by the transformation of the coordinates of all the points of the Apollo 14 hardware elements to the topocentric frame. Vector algebra and matrices were used to transform the coordinates. The coordinates of hardware elements were transformed through a total of three rotations to match the XY plane of the model to the local horizontal plane. The solar azimuth was also determined using JPL HORIZONS.

The mean boulders' plane was then modeled using Blender. The coordinates of the points of the Apollo 14 hardware elements were then plotted on the mean boulders' plane, creating a rudimentary model of the Apollo 14 landing site. Hardware elements of the Apollo 14 were then sketched using Blender. These models were then aligned with the plane and the coordinates of the points. Angle of elevation of the Sun was calculated, and the Sun was placed in the model accordingly, creating an accurate three-dimensional model of the Apollo 14 landing site.

Comparing the results achieved with the images and the data provided by my supervisor, I am satisfied with the results and success of this work. I believe this is a very promising concept to continue my research on as extraterrestrial colonization is a key factor in the survival of human civilization. The ability to correctly model surfaces of celestial objects from photographs would be in high demand in the future.

In the future I would like to fully automate a lot of the processes that I performed manually here. An object detection algorithm would determine and track the location of objects and elements. The transformation of these coordinates would then be performed automatically by the algorithm. This would increase the efficiency and time spent in order to create the model.

I have thoroughly enjoyed working on this project. It has been a great learning experience and I could not have completed it without the mentoring and the guidance of Mr. Pustynski.