Commercial Crew Vehicle Ascent Abort Simulation and Analysis

SpaceX and Boeing have been selected to develop and operate crew vehicles to transport astronauts to and from the International Space Station. Their design work is to be analyzed to ensure that they are meeting all of the safety and operational requirements put forth by NASA. Throughout my time here, I worked familiarized myself with the SpaceX Dragon Abort system, as well as the NASA Human-Systems Integration Requirements (HSIR). This included understanding the different abort scenarios, and how each one could potentially impact the astronaut crew. In addition, I familiarized myself with the simulation developed my NASA to test and analyze the Guidance Navigation and Control (GN&C) systems developed by SpaceX and Boeing.

I was responsible for updating and working with the simulation using a UNIX system, and git for version control. I was responsible for running various monte-carlo simulations, with varying dispersion settings, and developing post processing scripts to allow analysis of the astronaut seat dynamics. I was also responsible for comparing NASA's simulated data with the data provided by SpaceX's own simulations, to further verify their own analysis and system designs.

I was able to successfully modify the simulation to allow for four astronaut seats to be simulated and tracked, and I was able to incorporate recent design changes to the seat location (made by SpaceX) into the simulation so that the current design can truly be simulated and analyzed. I was also able to develop post processing scripts to inspect the duration of forces/accelerations acting upon the astronauts throughout ascent abort scenarios, and verify that they fall within the requirements put forth by HSIR.

Throughout my time here at Johnson Space Center, I learned an extraordinary amount about using git and UNIX systems. In addition, I continued to grow my working knowledge of python and C++, as well as getting a better understanding on how to work with, maintain and operate large programs/simulations. But above all else, this internship experience exposed me to the real skills necessary to work in the field I plan on going into, and taught me an enormous amount about the types of things I need to learn and improve on to be successful.

I intend to get my PhD in Optimal Estimation, primarily focusing in spacecraft attitude filtering, so that I can work on developing the GN&C systems for future space exploration missions. While I have always appreciated a theoretical understanding of problems, this internship has taught me the importance of understanding the applications as well. It has shown me the importance of having an in-depth knowledge of computer programming, so that my theoretical understanding can be directly applied to real missions.