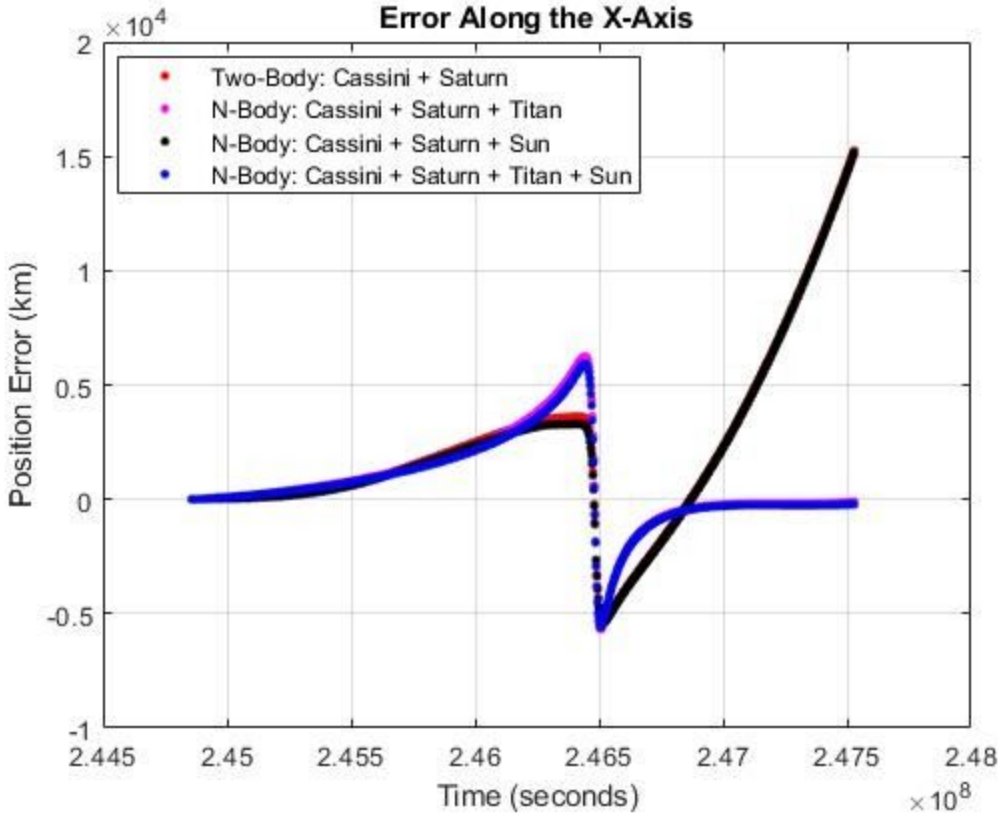
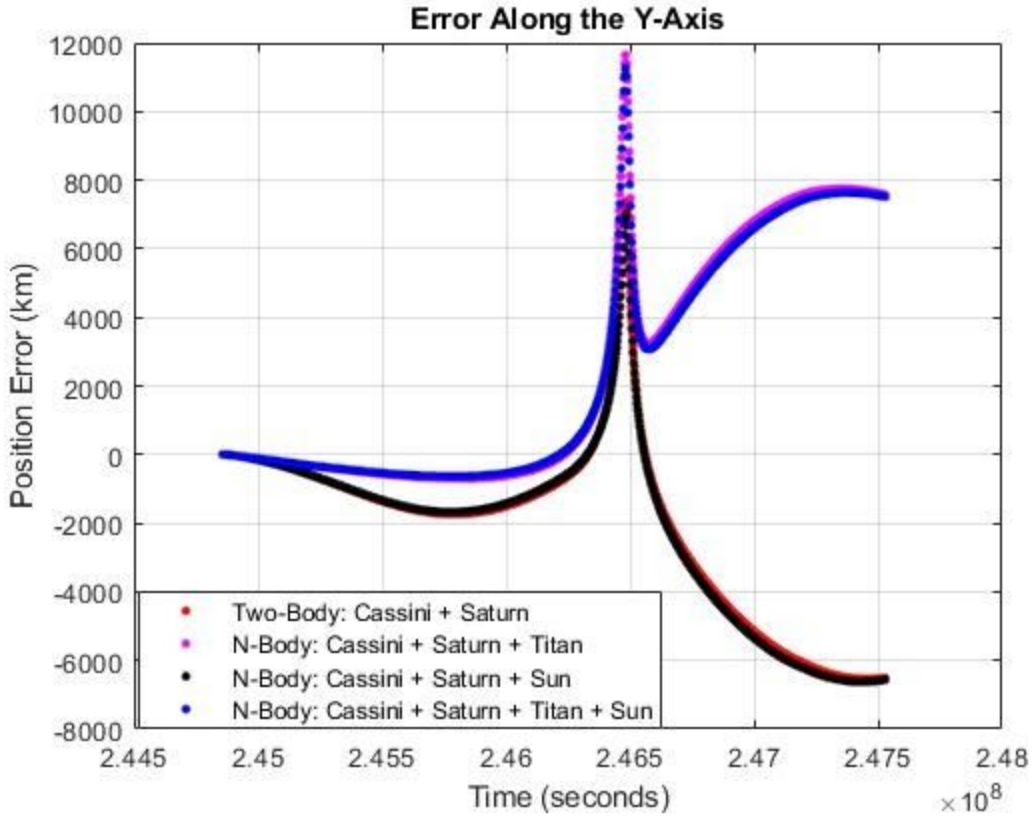
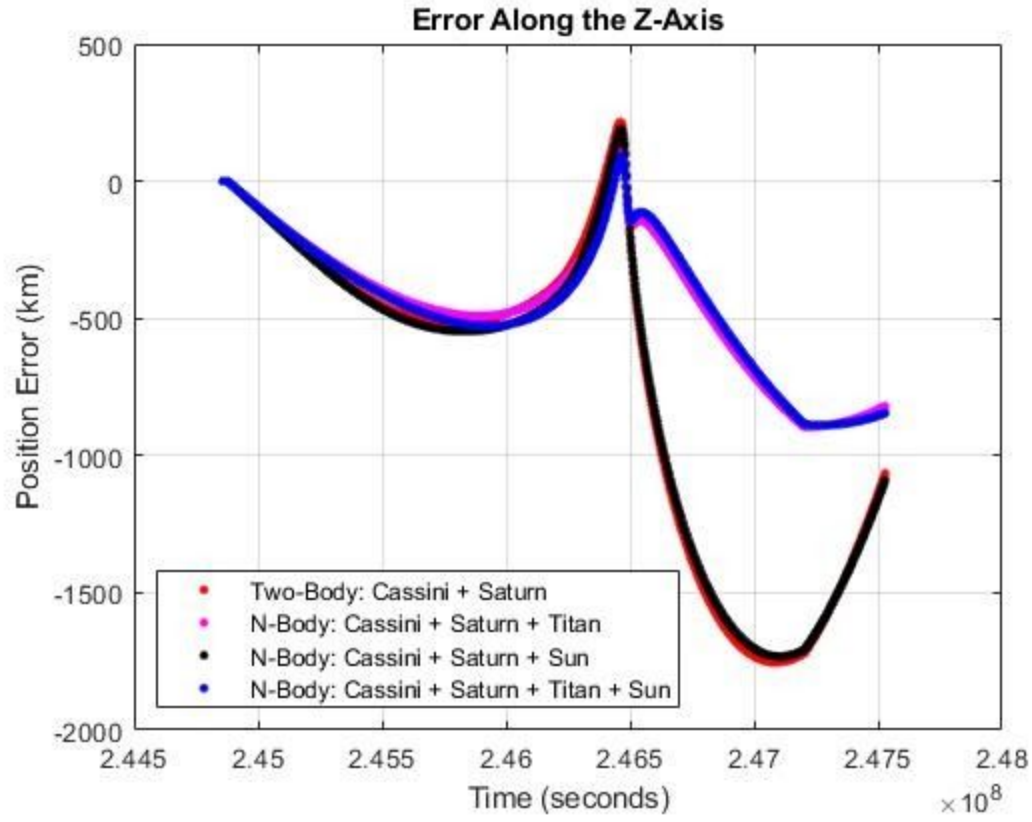
Computational Assignment #1 Discussion
MANE-4100 / Space Flight Mechanics

Part E

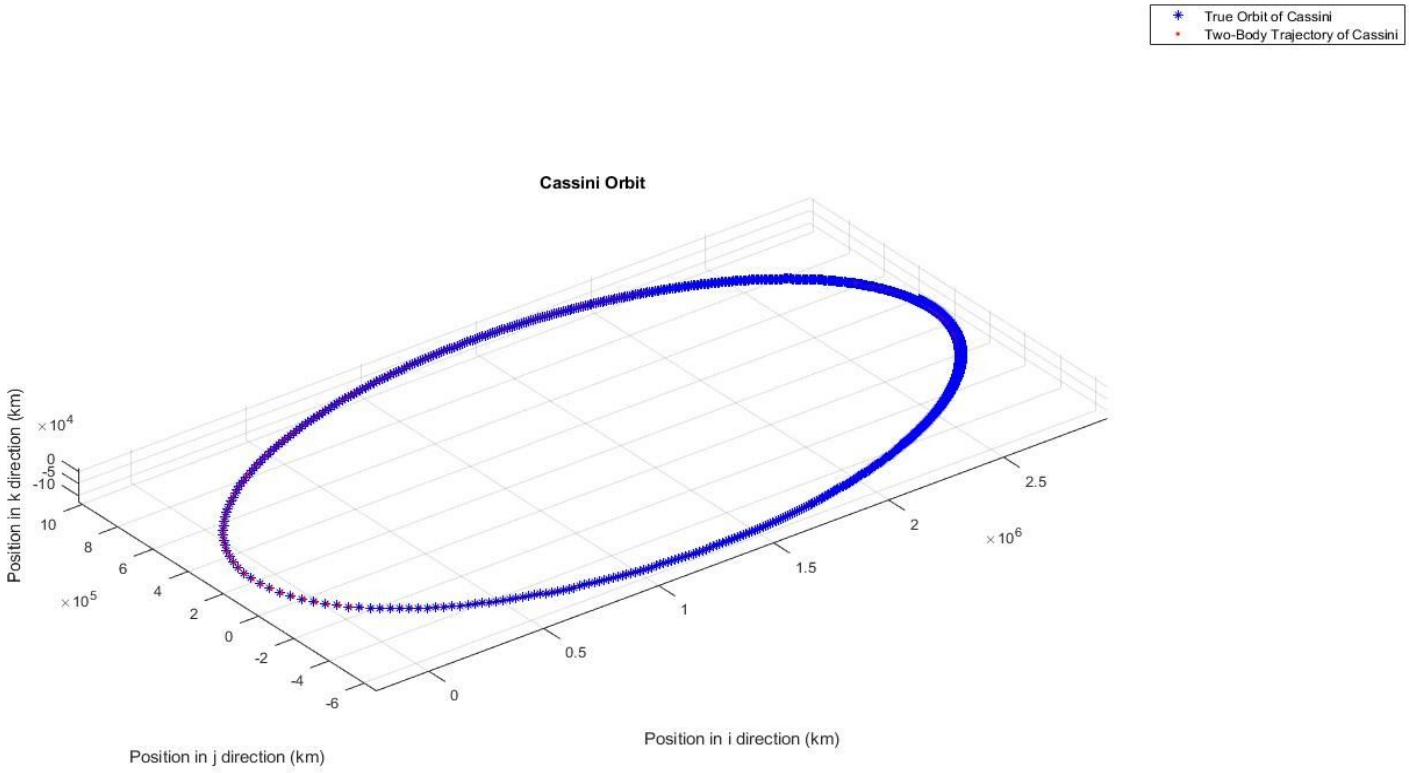



Error Along the Y-Axis
Position Error (km)
Time (seconds)
$\times 10^8$
Two-Body: Cassini + Saturn
N-Body: Cassini + Saturn + Titan
N-Body: Cassini + Saturn + Sun
N-Body: Cassini + Saturn + Titan + Sun


Error Along the Z-Axis
Position Error (km)
Time (seconds)
$\times 10^8$
Two-Body: Cassini + Saturn
N-Body: Cassini + Saturn + Titan
N-Body: Cassini + Saturn + Sun
N-Body: Cassini + Saturn + Titan + Sun

Based on the plotted position error for each case, it appears that the two-body trajectory displays the highest deviation from the true-trajectory. It can also be seen that the n-body case consisting of Cassini, Saturn, Titan, and the Sun displays the least amount of deviation from the true trajectory. The n-body system consisting of Cassini, Saturn, and Titan has a greater influence on the accuracy of the trajectory than the n-body system of Cassini, Saturn, and the Sun. Therefore, the planetary body that exerts the most influence on Cassini's trajectory, other than Saturn, is Titan.

Part F



Part G

The error between the integrated solution and the actual trajectory will persist because the n-body equation only takes into account the net perturbative acceleration from all sources other than the spherically symmetric gravitational attraction between the two bodies. It doesn't take into account additional common perturbations of two-body motion. Therefore, in order to improve the agreement between the integrated trajectory and the true trajectory, other perturbations of motion such as atmospheric drag, propulsive thrust,solar radiation pressure, electromagnetic forces, etc must be considered.