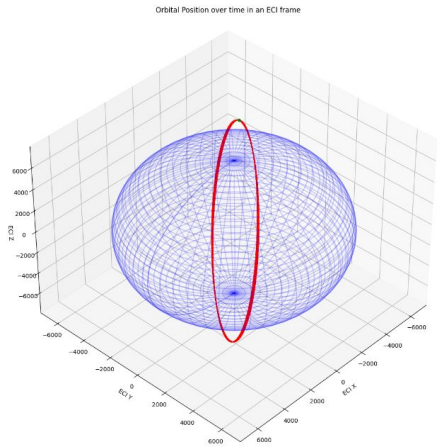
GNC Quad Chart

18 September 2024



Orbital position in ECI frame given initial keplerian orbital elements

External Tools Needed:

1. STK access - either on a lab PC / academic license
2. Pre-existing ground-truth simulation

Progress:

1. Developed a core dynamics model both on C++ & Python that does orbital dynamics and attitude dynamics simulations
    a. Incorporates Harris-Priester model (without attitude/solar flux) and J2
    b. Yet to be completely unit tested
2. Assigned subtask responsibilities to each member

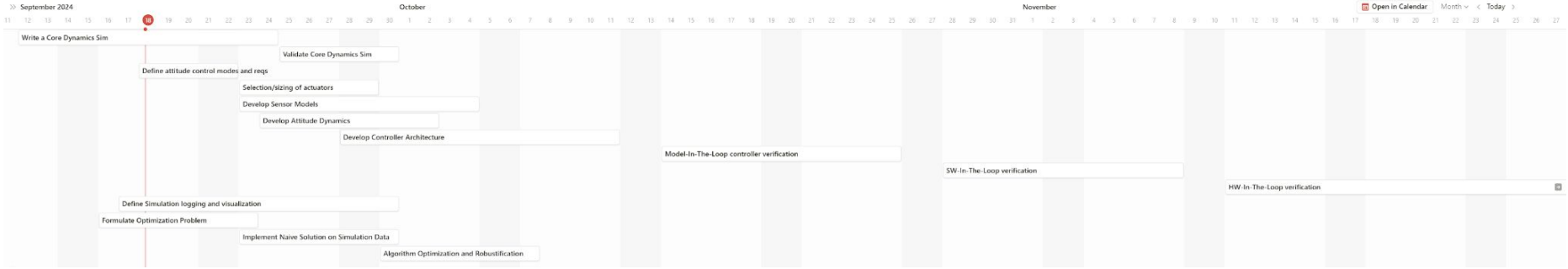
Plan for the Upcoming Week:

1. Finalize the core dynamics algorithm and plan for algorithm validation against ground truth (STK, argus-1 sim etc.)
2. Define attitude control method (spin stable, 3 axis pointing etc.) and define actuator & sensor specs
3. Formulate non-linear optimization for orbit determination

Interfaces:

1. Interface with Avionics & Mechanical for actuator and sensor specs for attitude control

Timeline



Name	Date	Sub-team
Implement GPS model in sim	October 12, 2024 → October 16, 2024	Simulation
Spec GPS	October 12, 2024 → October 16, 2024	Orbit Determination
Orbit Determination Ground Truth Alg (GPS)	September 23, 2024 → September 27, 2024	Orbit Determination
Spec AD sensors	October 7, 2024 → October 12, 2024	Attitude Determination
Implement AD sensor models in sim	October 7, 2024 → October 12, 2024	Attitude Determination, Simulation
Spec star tracker	September 28, 2024 → October 3, 2024	Attitude Determination
Star Tracker - Develop (find existing?) & test algorith	October 7, 2024 → October 12, 2024	Attitude Determination
Star Tracker - Develop Star Sim	September 28, 2024 → October 5, 2024	Attitude Determination, Simulation
Implement Attitude Determination Alg	October 7, 2024 → October 12, 2024	Attitude Determination
Derive & Formulate the Attitude Determination Alg	September 28, 2024 → October 5, 2024	Attitude Determination
Algorithm Optimization and Robustification	September 30, 2024 → October 7, 2024	Orbit Determination
Implement Naive Solution on Simulation Data	September 23, 2024 → September 30, 2024	Orbit Determination
Formulate Optimization Problem	September 16, 2024 → September 23, 2024	Orbit Determination
Selection/sizing of actuators	September 23, 2024 → September 29, 2024	Attitude Control, Attitude Dynamics
SW-In-The-Loop verification	October 28, 2024 → November 8, 2024	Entire Team
HW-In-The-Loop verification	November 11, 2024 → November 29, 2024	Entire Team
Model-In-The-Loop controller verification	October 14, 2024 → October 25, 2024	Entire Team
Define Simulation logging and visualization	September 17, 2024 → September 30, 2024	Simulation
Validate Core Dynamics Sim	September 25, 2024 → September 30, 2024	Simulation
Develop Actuator Models	September 23, 2024 → October 4, 2024	Simulation, Attitude Dynamics
Define attitude control modes and reqs	September 18, 2024 → September 22, 2024	Attitude Control, Mode Management
Develop Attitude Dynamics	September 24, 2024 → October 2, 2024	Attitude Dynamics
Write a Core Dynamics Sim	September 12, 2024 → September 24, 2024	Simulation, Attitude Determination
Develop Controller Architecture	September 28, 2024 → October 11, 2024	Simulation, Attitude Control

General Task Flow:

1. Problem Definition
2. Model-in-loop simulations - Mid October
3. Software-in-loop simulations - November
4. Hardware-in-loop simulations - Mid November