



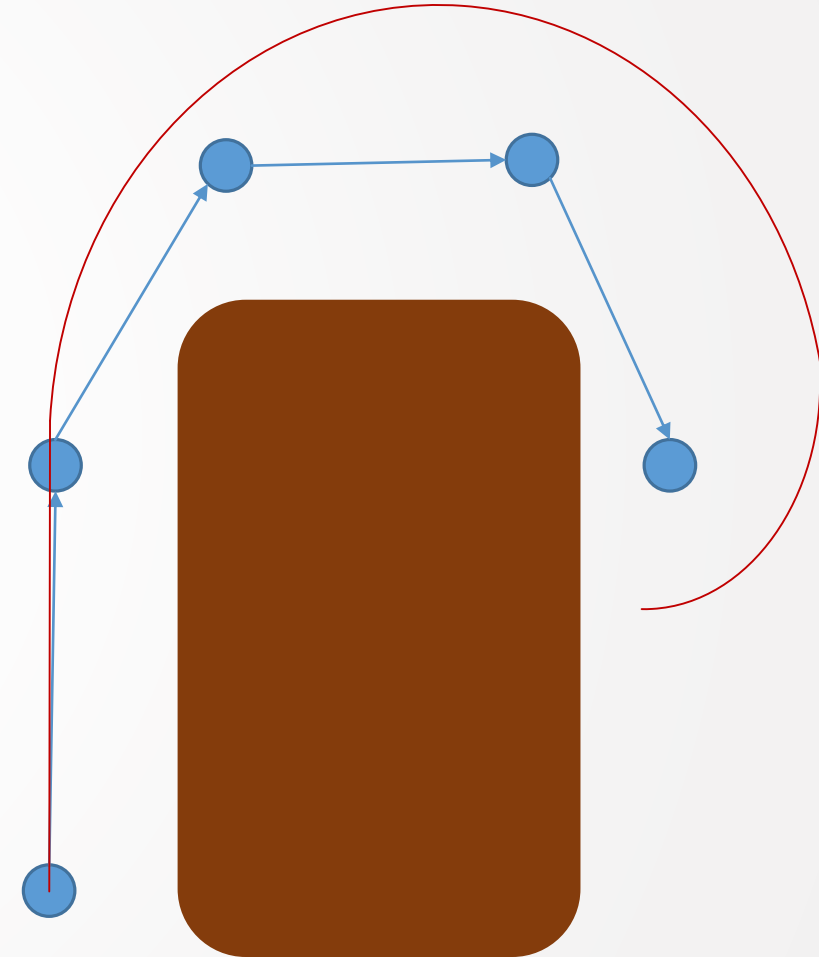
# CS491/691: Introduction to Aerial Robotics

## Hardware-in-the-Loop Fixed-Wing Control

TEAM 6

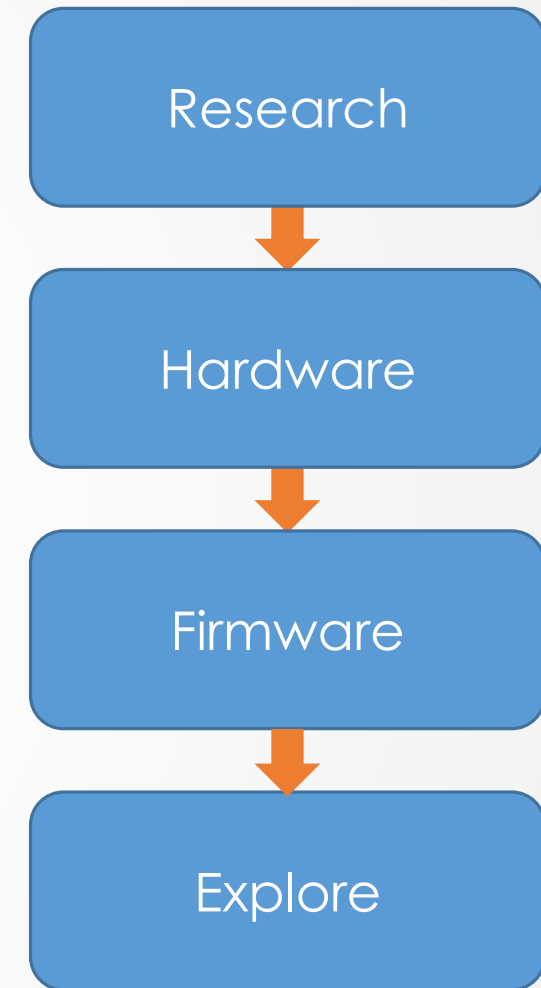
# Motivation and Problem Description

- Explore the behavior of fixed-wing flight by studying the effects of L1 and TECS controllers
- L1: Finding the optimal path to pass by or through way points
- TECS: Manage energy to maintain a constant speed or constant altitude
- Trade-offs:
  - Agility
  - Energy Conservation



# Proposed Approach

- Research the control schemes of L1 and TECS and figure out how they work
- Get flight control hardware for hardware-in-the-loop (HIL) simulation
- Compile and flash firmware to flight controller
- Use HIL simulation to verify the L1 and TECS control schemes for fixed wing flight.



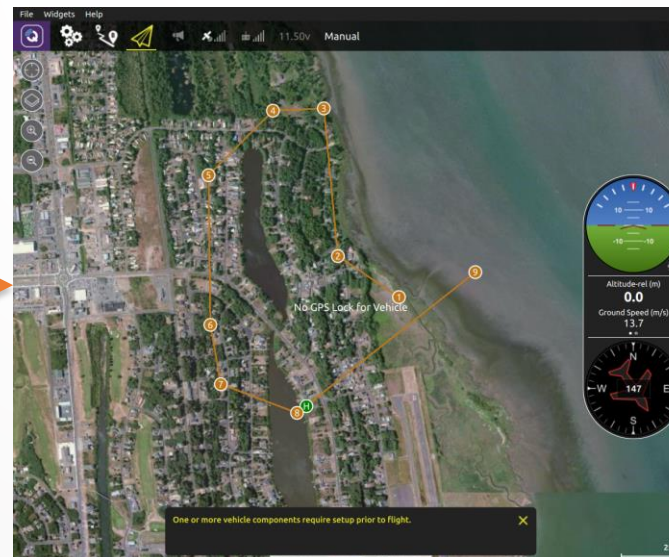
# System Description

- ▶ Telemetry from the flight simulator to the flight controller
- ▶ Control from the flight controller back to the flight simulator
- ▶ Pixhawk: flight controller
- ▶ QGroundControl: interface between Pixhawk and X-Plane
- ▶ X-Plane: flight simulator

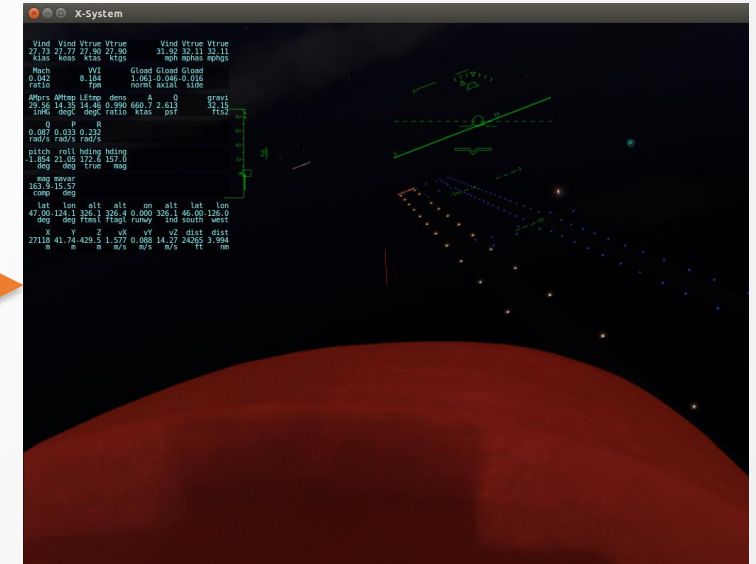
Pixhawk



QGroundControl



X-Plane



# Results

➔ L1 control behaves as we were expecting

High L1  
Distance

Low L1  
Distance



High  
Damping  
Coefficient

Low  
Damping  
Coefficient

# Results

- TECS displays the priority of potential energy and kinetic energy given a specific weight.

