State vector

State vector X is:

$$X = [x, y, z, v_x, v_y, v_z, \phi, \theta, \psi, p, q, r]^T$$

where:

- (x, y, z) is the position in the earth frame
- (v_x, v_y, v_z) is the linear velocities
- (ϕ, θ, ψ) is roll, pitch, yaw (Euler angles)
- -(p, q, r) is the angular velocities (body frame)

Control inputs

The control input U is:

$$U = [T, M_x, M_y, M_z]^T$$

where:

- T is the total thrust from all propellers
- M_x, M_y, M_z is the moments about the body axes

Measurement Model

Sensor measurements will be:

- IMU (Accelerometer, Gyroscope, Magnetometer)
- GPS
- Barometer