11/18/2024

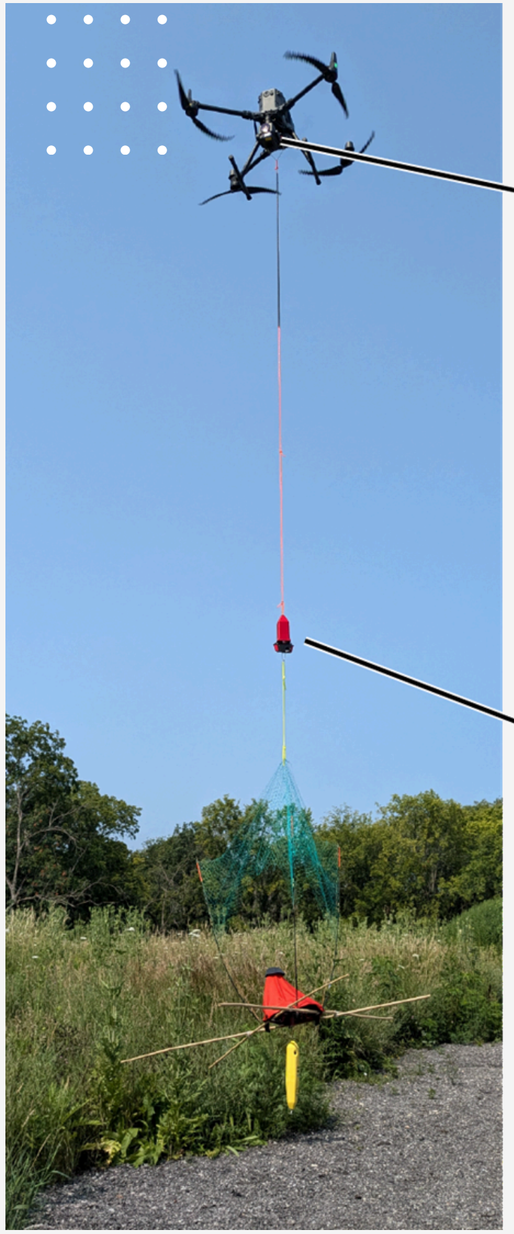
TETHERED DRONE USING PD CONTROL

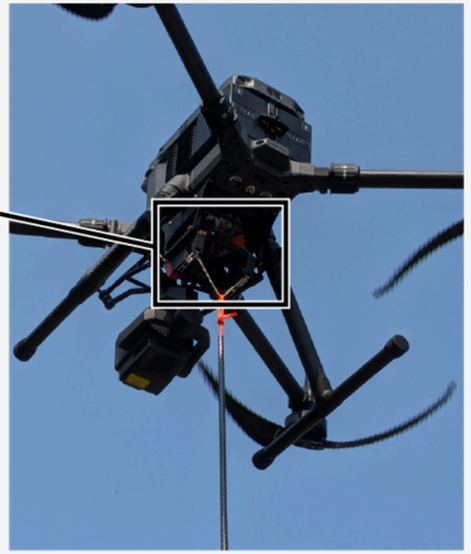
Khang Pham

01. Simulation

02. Control

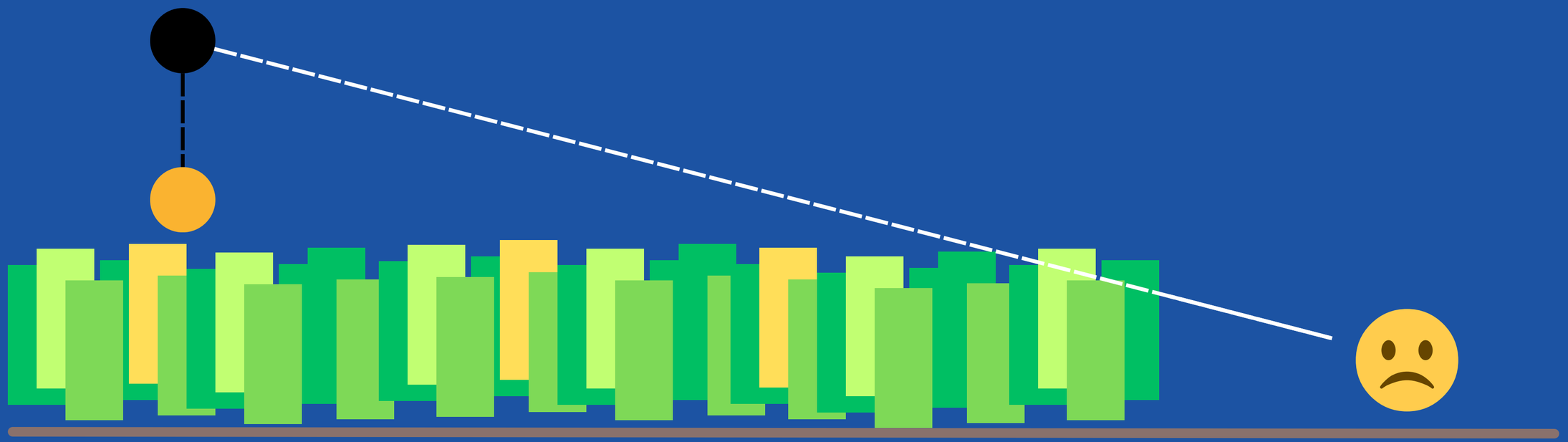
PROJECT OVERVIEW



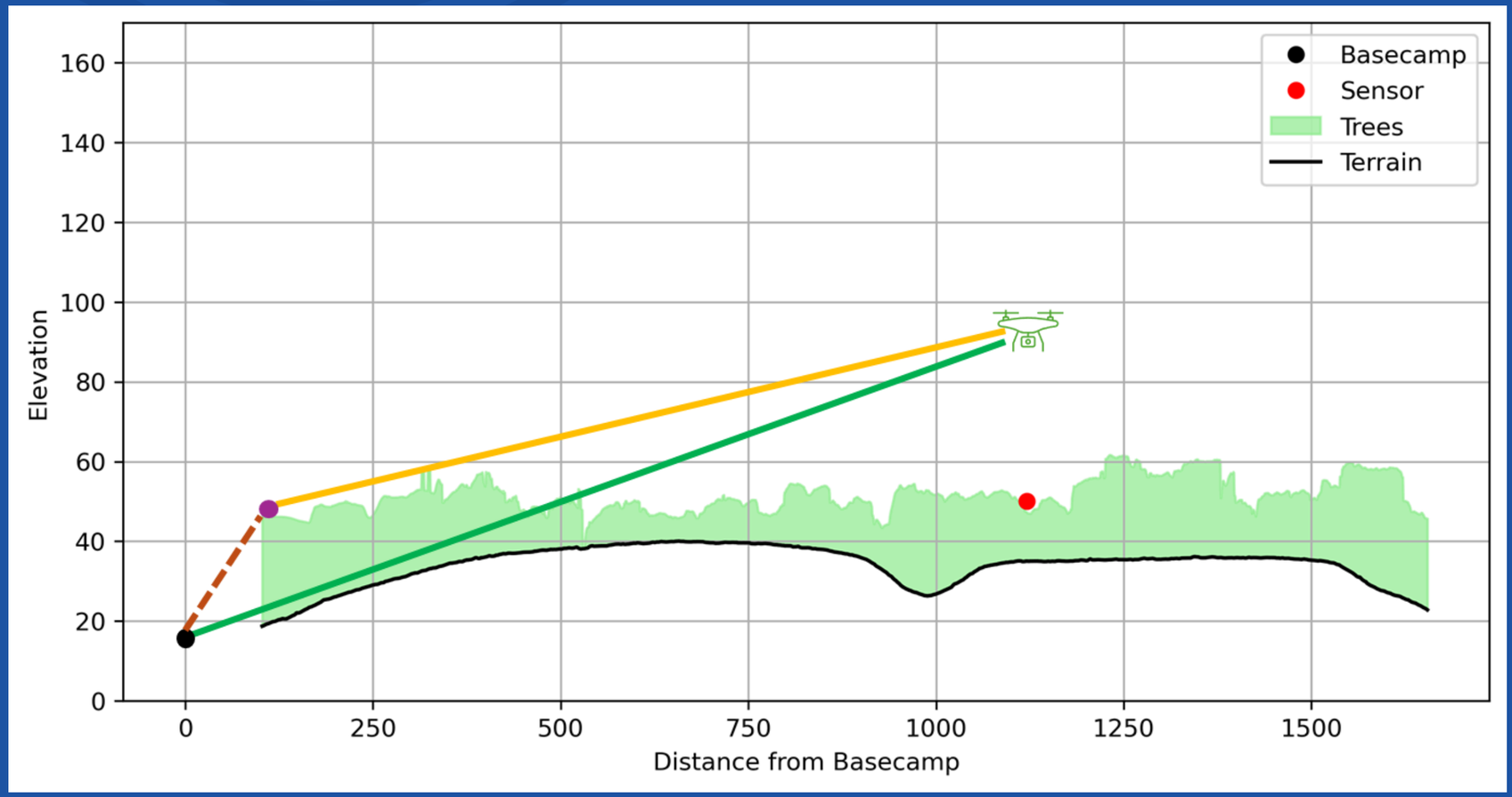


David Cañones Bonham - Comprehensive

WHY DO WE NEED THIS?

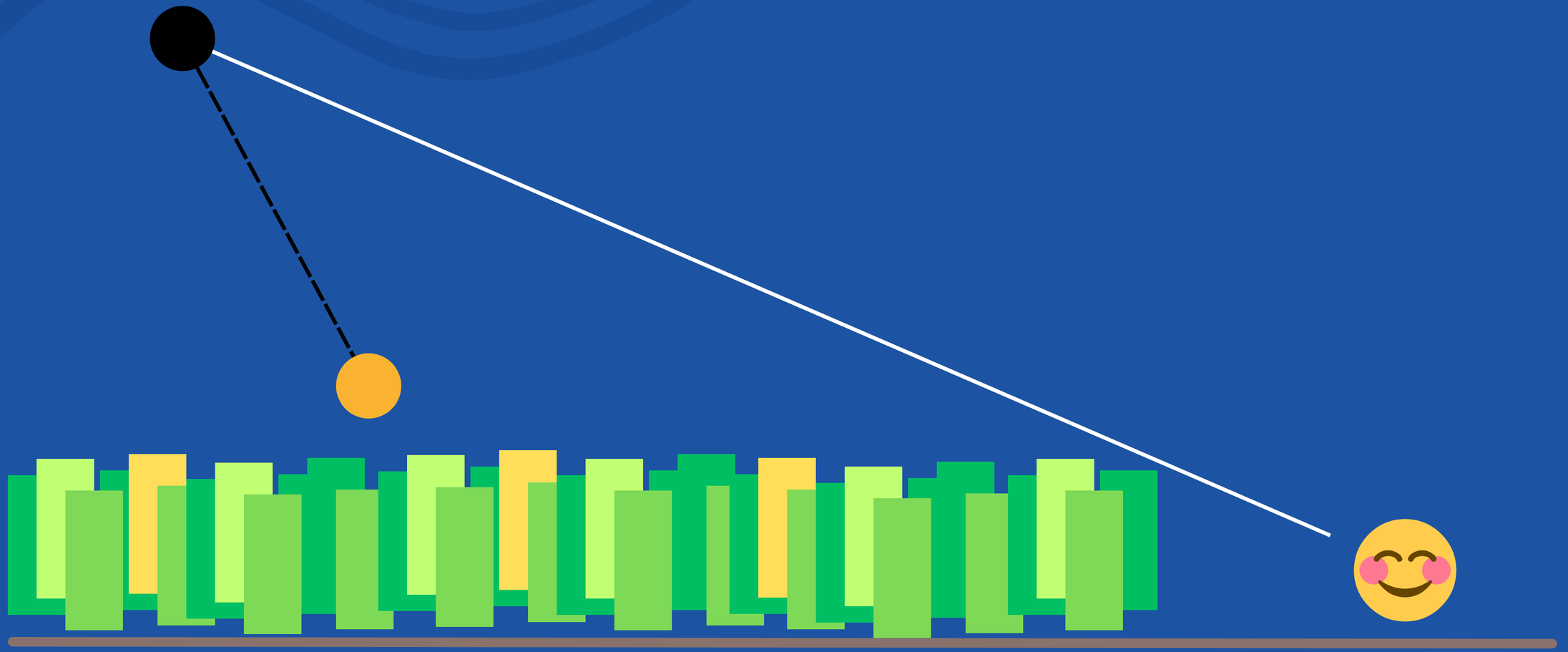


ONE SOLUTION



David Cañones Bonham - Comprehensive

ANOTHER SOLUTION + PROBLEM



SIMULATION
What NOT to do !

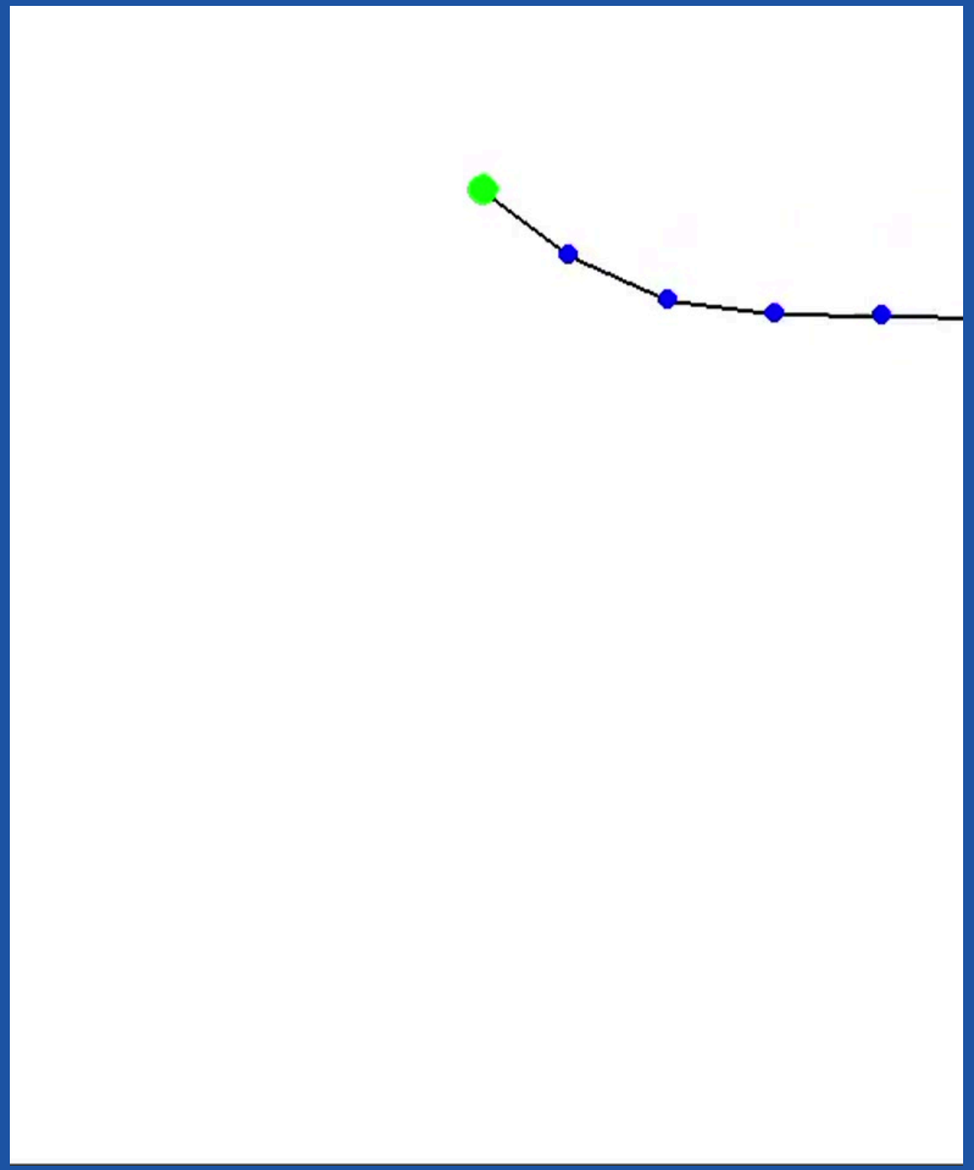
Jakobsen Method - Enforcing Contraints

(Figure 1.10) Particles need to be moved towards each other.

(Figure 1.11) Particles need to be moved away from each other.

Verlet Integration

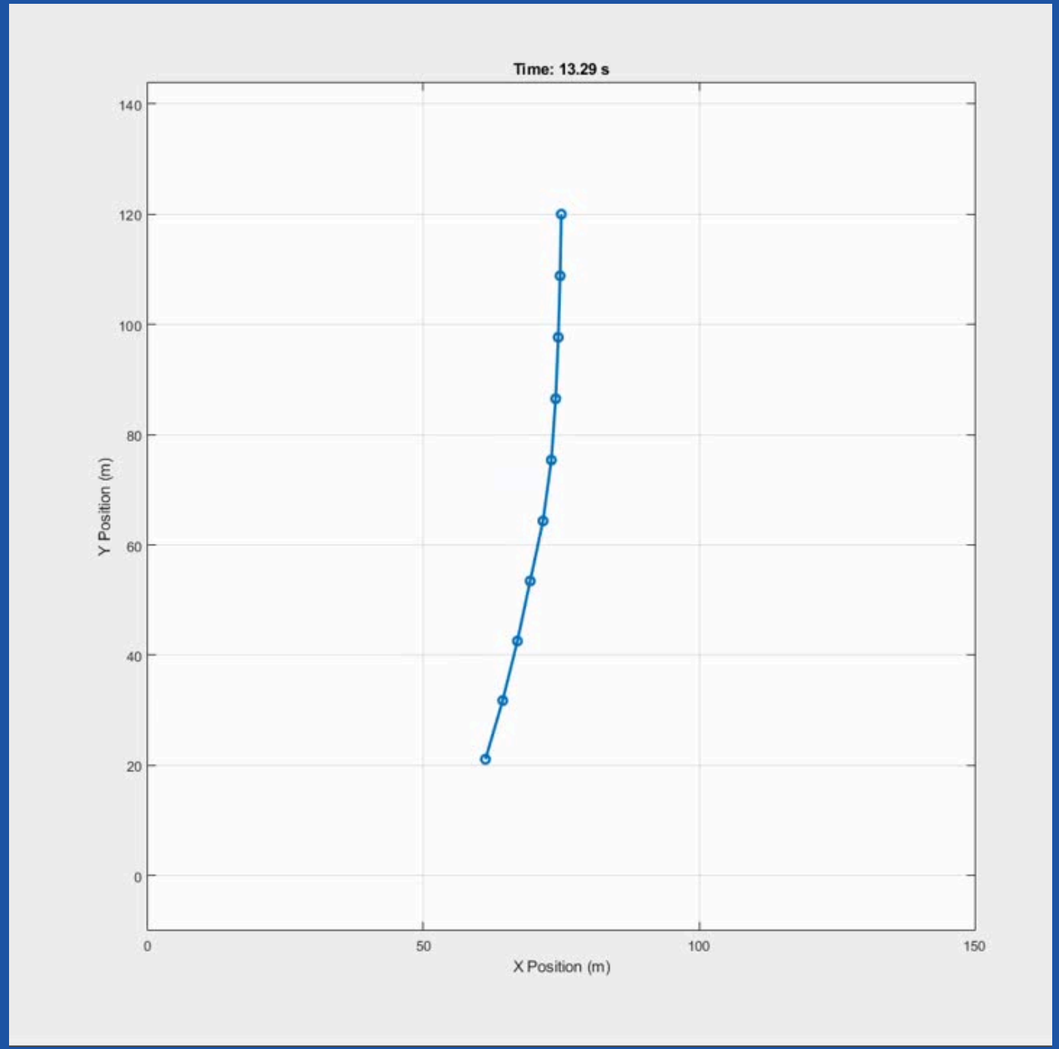
$$x_t = 2x_{t-1} - x_{t-2} + \Delta t^2 a$$



Owlree - Simulating a Rope

SIMULATION
SPRING - DAMPER

- Spring - Damper
- Point mass
- I tried to draw !

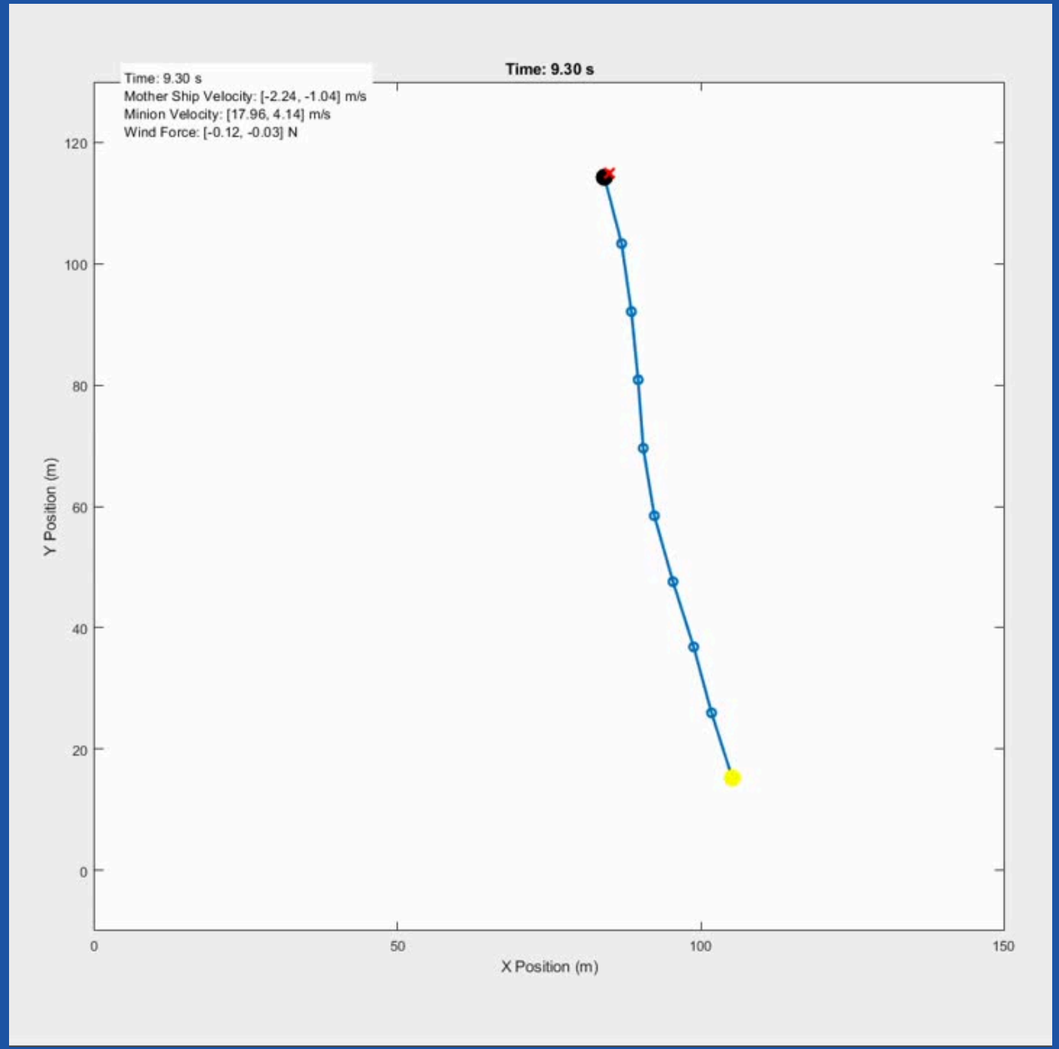


SIMULATION
MOTHERSHIP

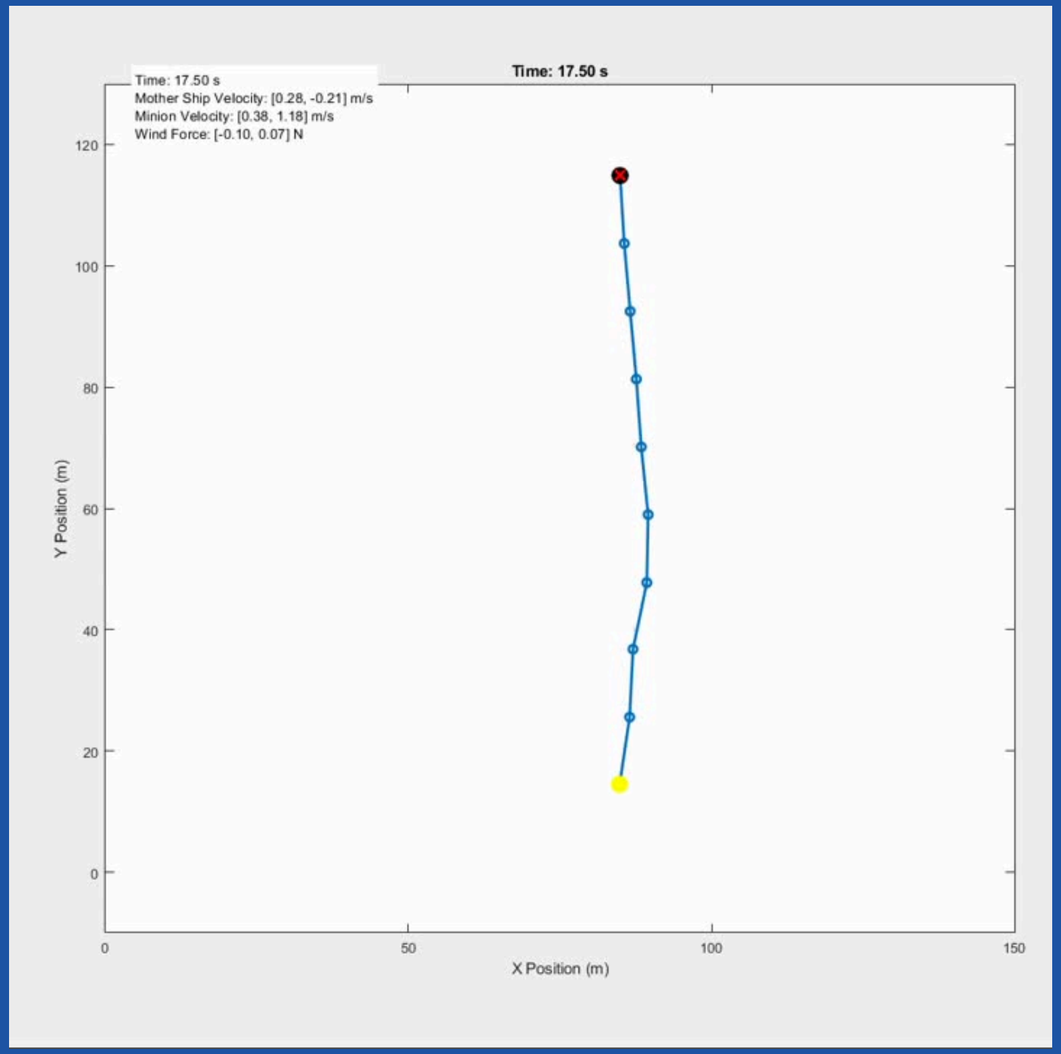
Mothership

- PD Control toward the **target**

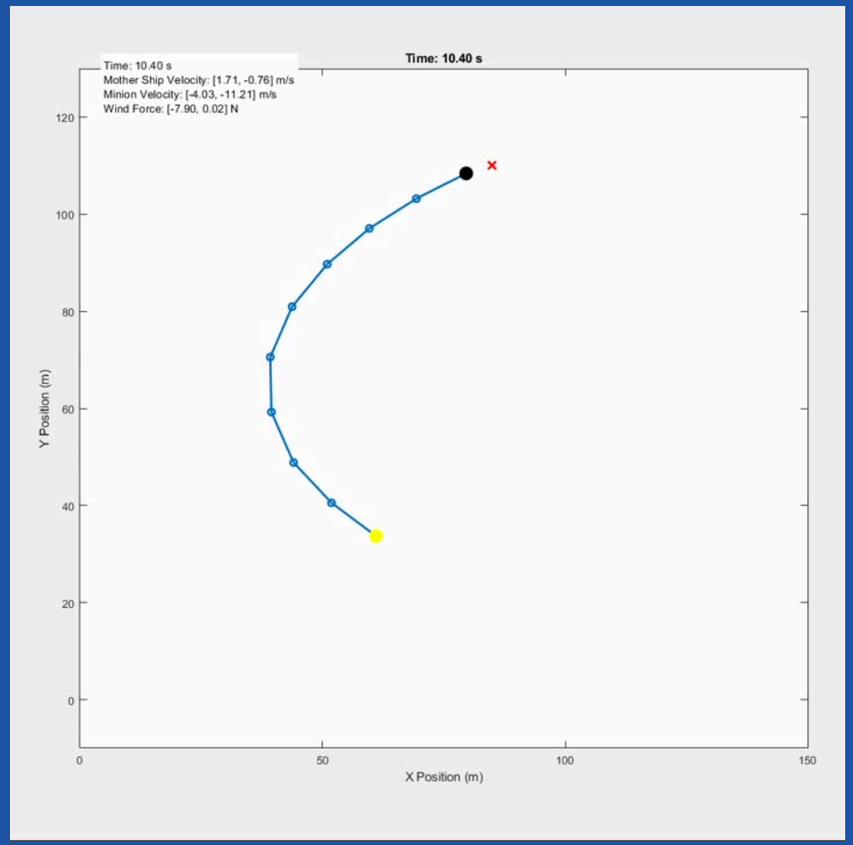
Minion

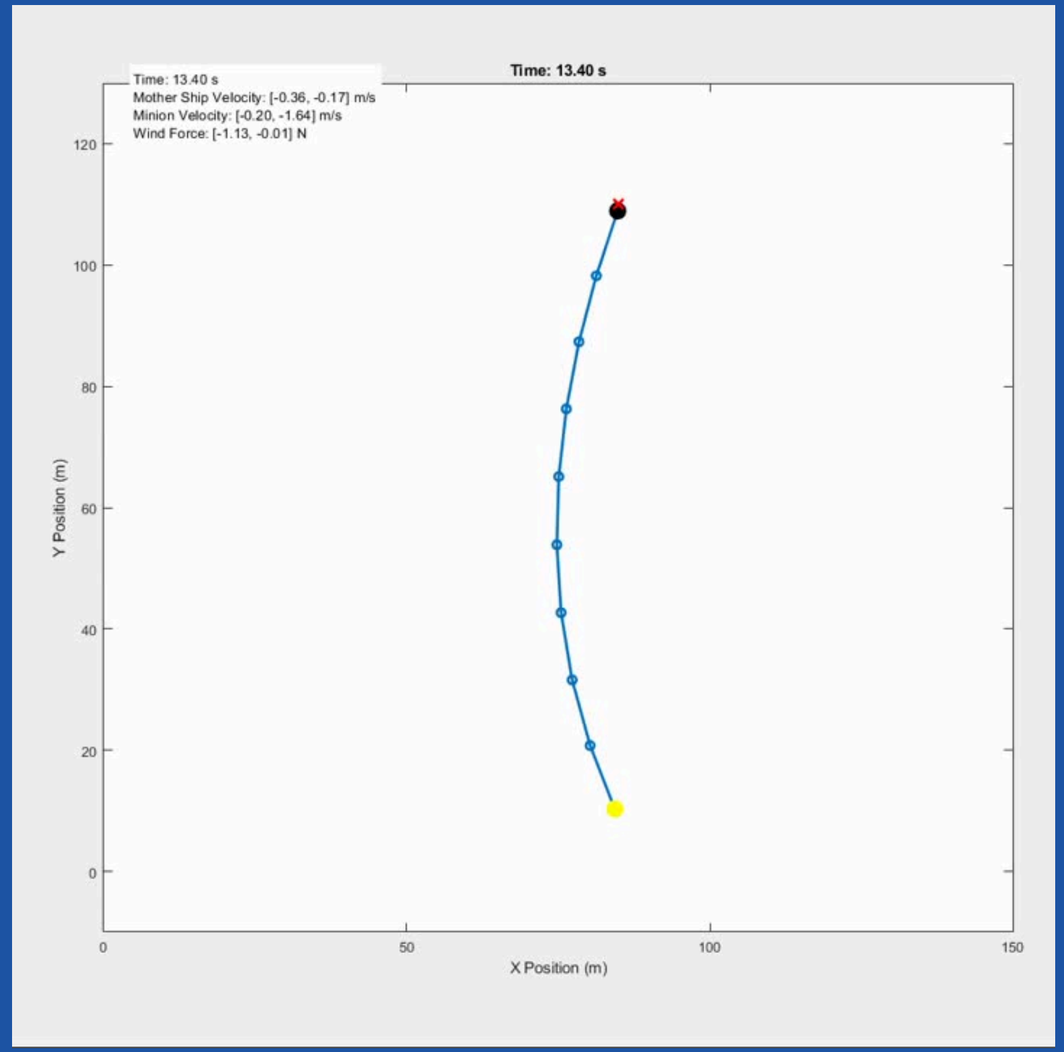


PD CONTROL
HORIZONTAL THRUST

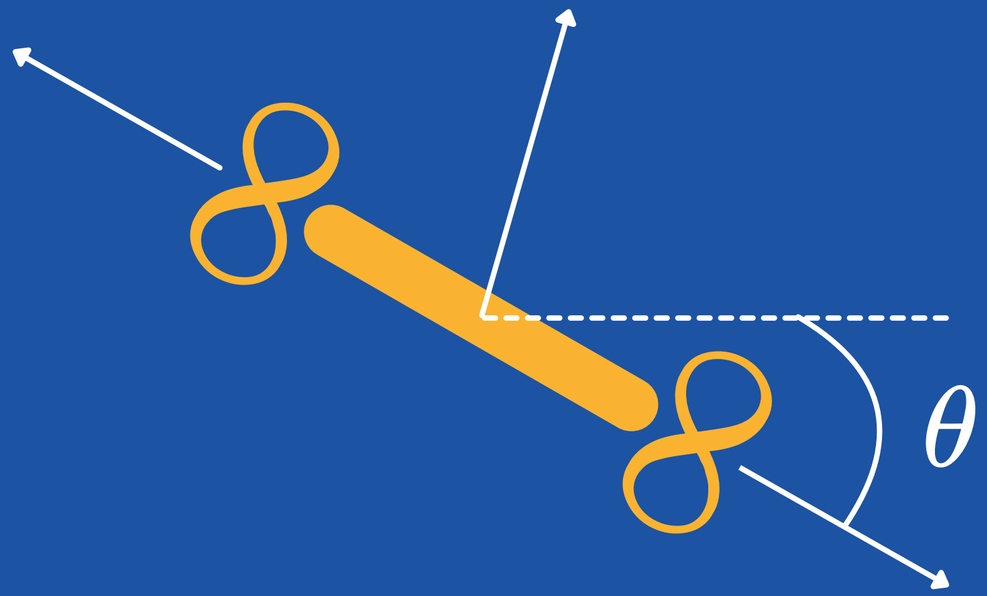


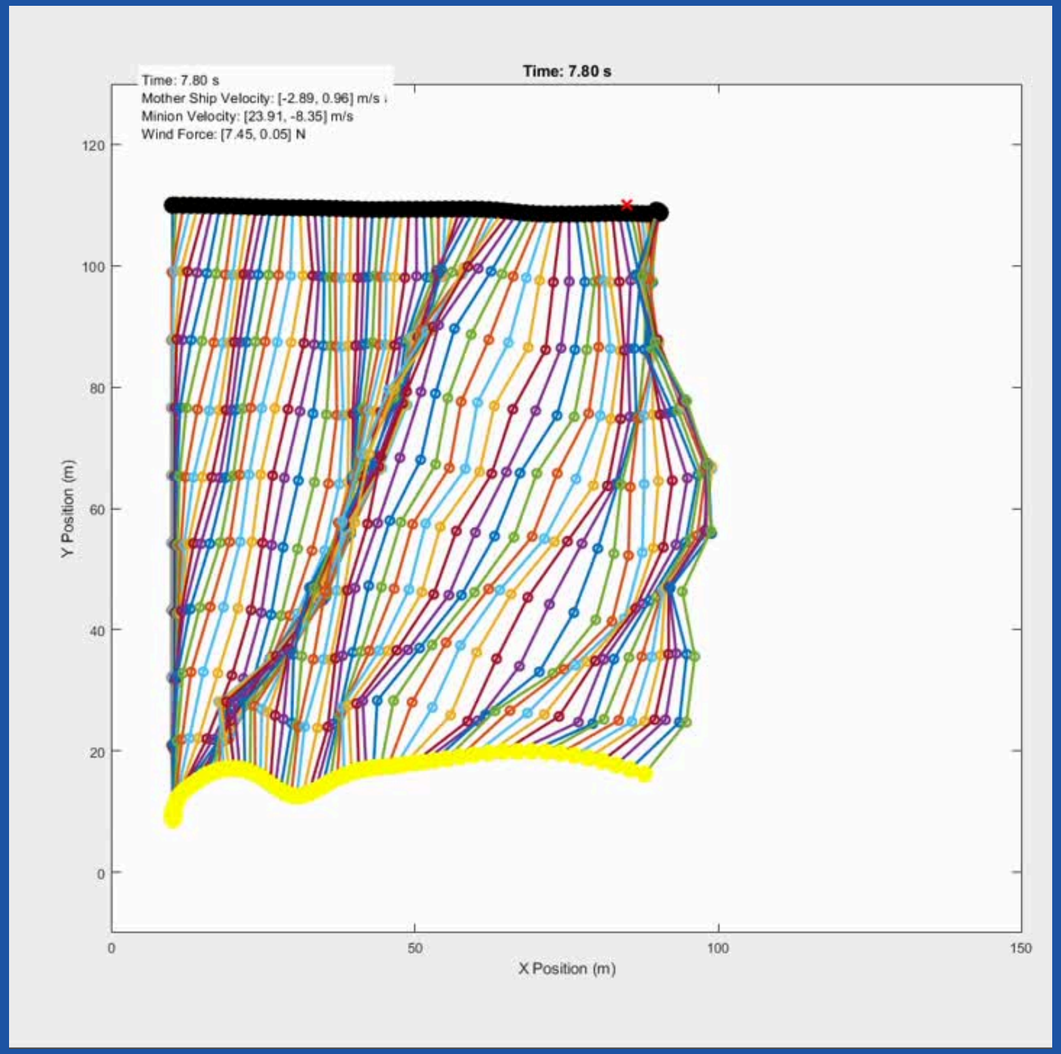
PLANAR DRONE
ON A WINDY DAY



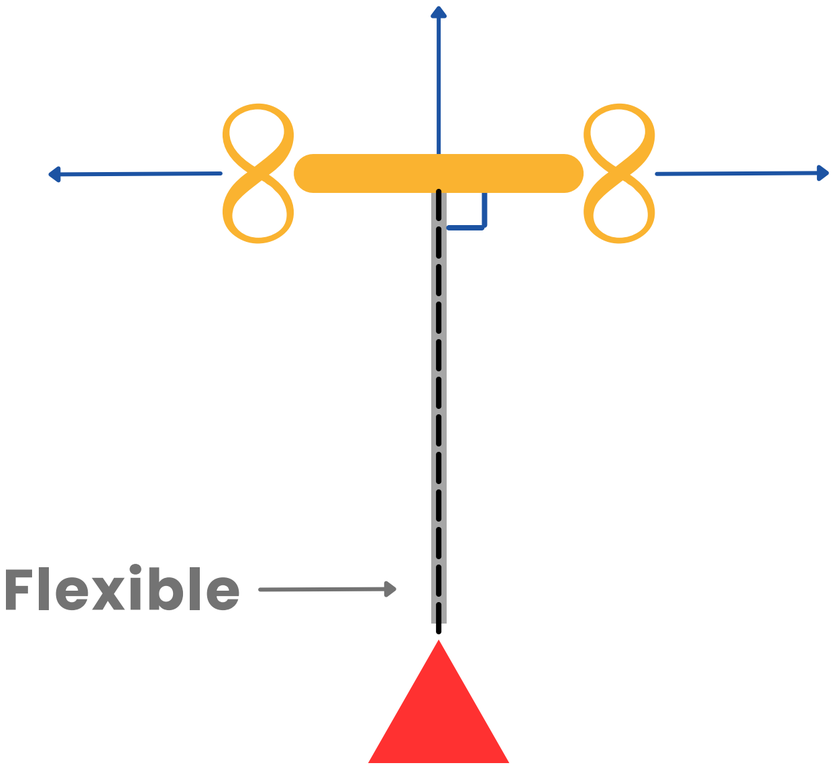


PROBLEM ?


θ

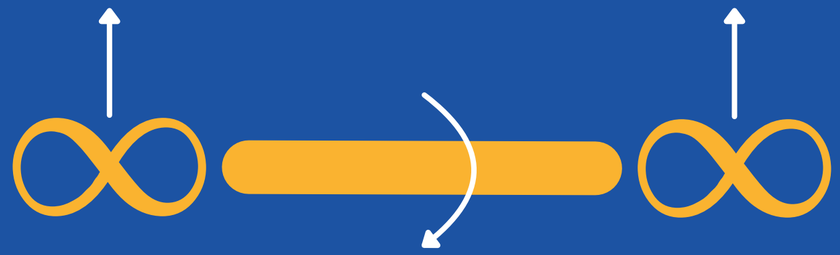

Time: 7.80 s
Time: 7.80 s
Mother Ship Velocity: [-2.89, 0.96] m/s
Minion Velocity: [23.91, -8.35] m/s
Wind Force: [7.45, 0.05] N
Y Position (m)
X Position (m)
0
20
40
60
80
100
120
0
50
100
150

SEMI-SOLUTION



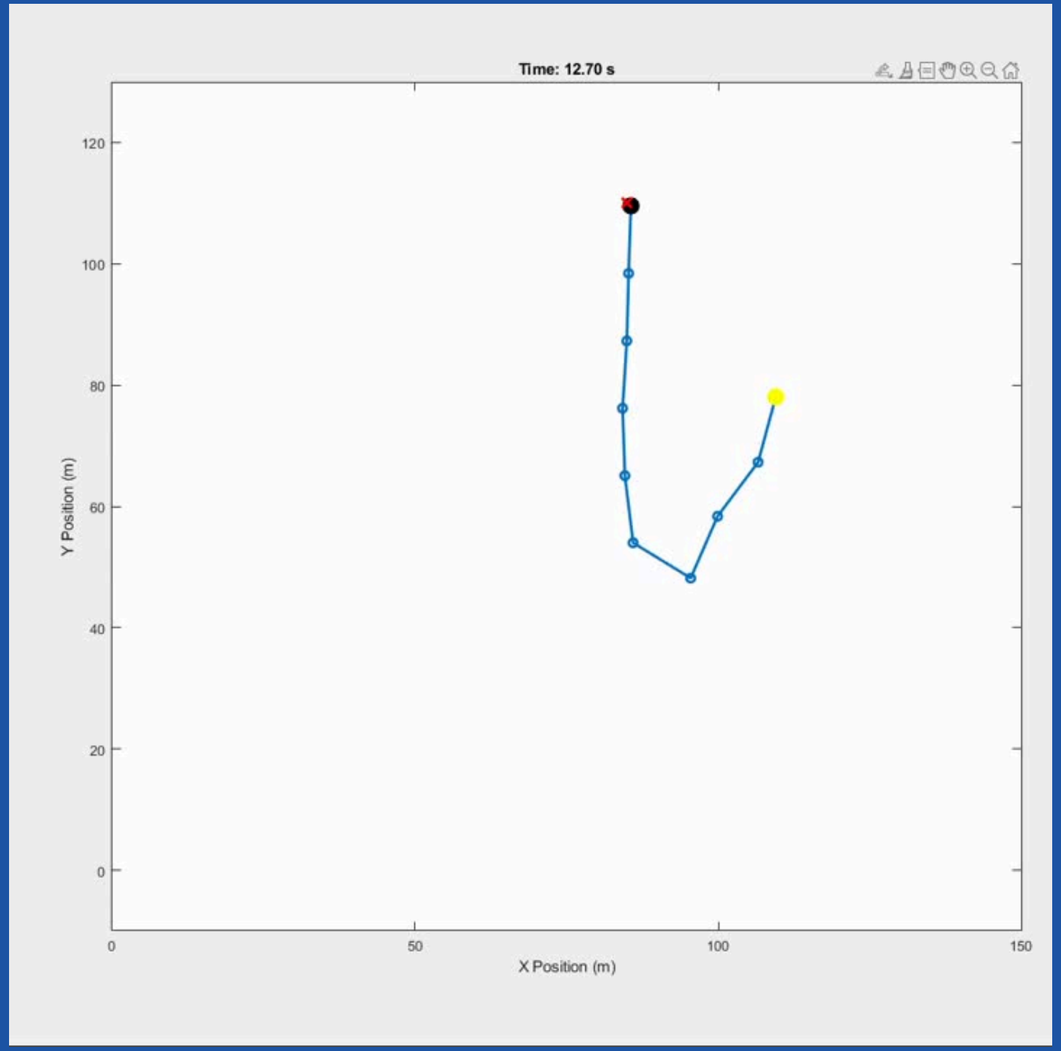
NEW DESIGN

ALSO TURN OFF THE WIND

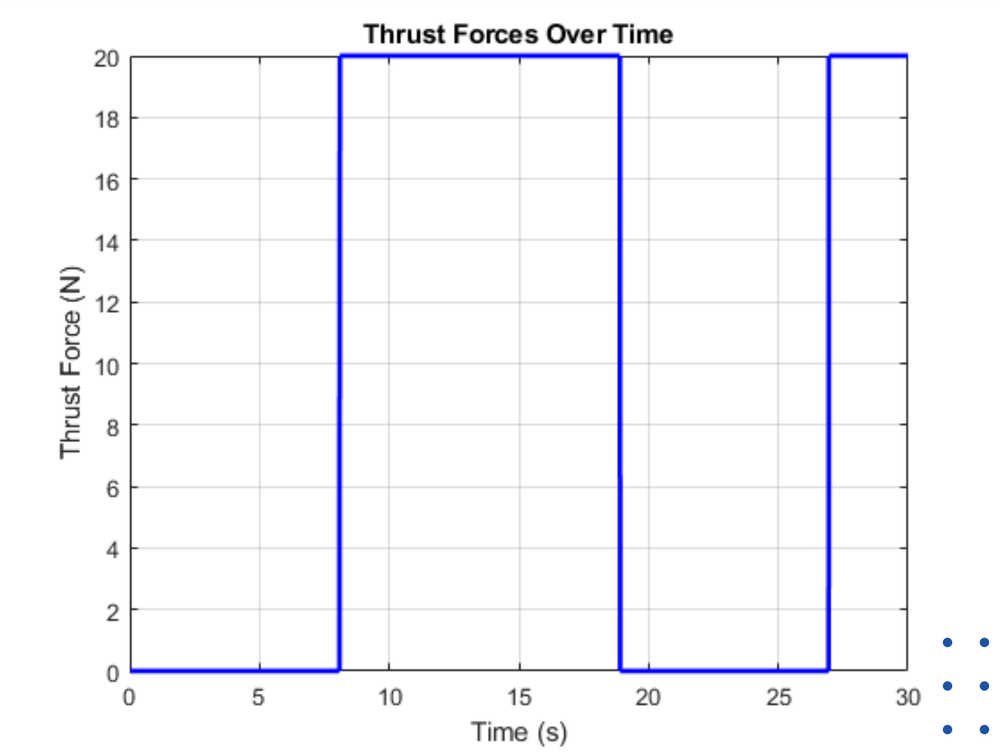


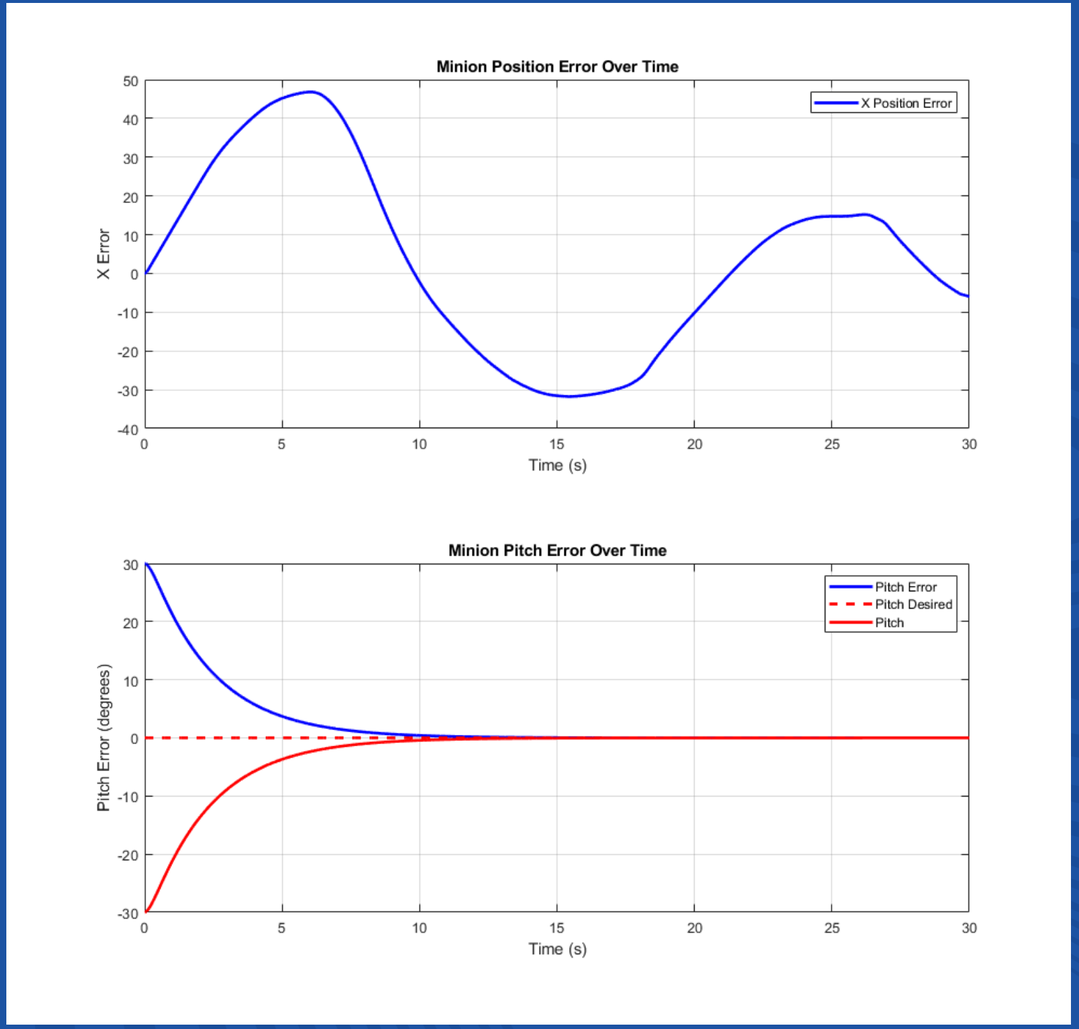
$$x_{minion} \rightarrow x_{mothership}$$

$$\theta \rightarrow 0$$



PROBLEM AGAIN

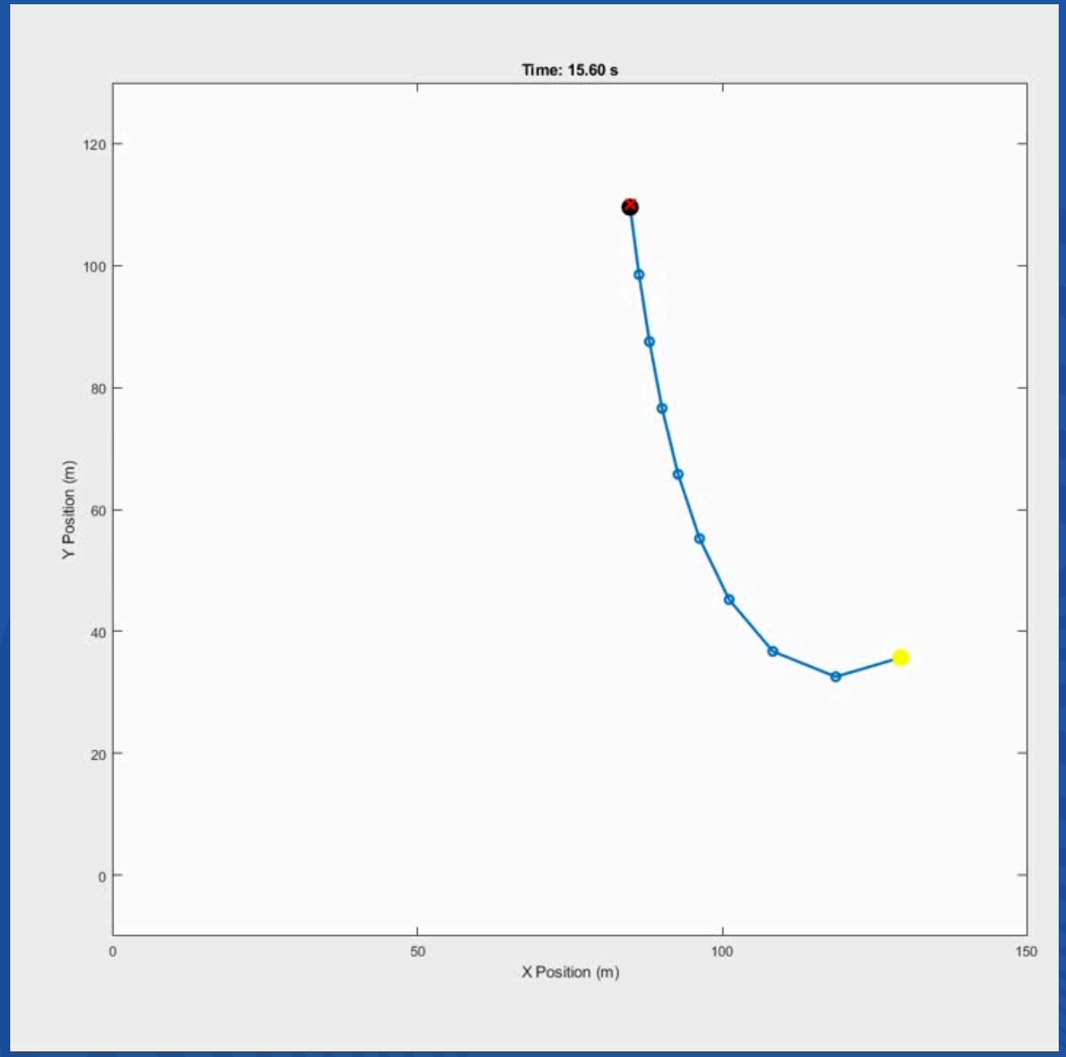




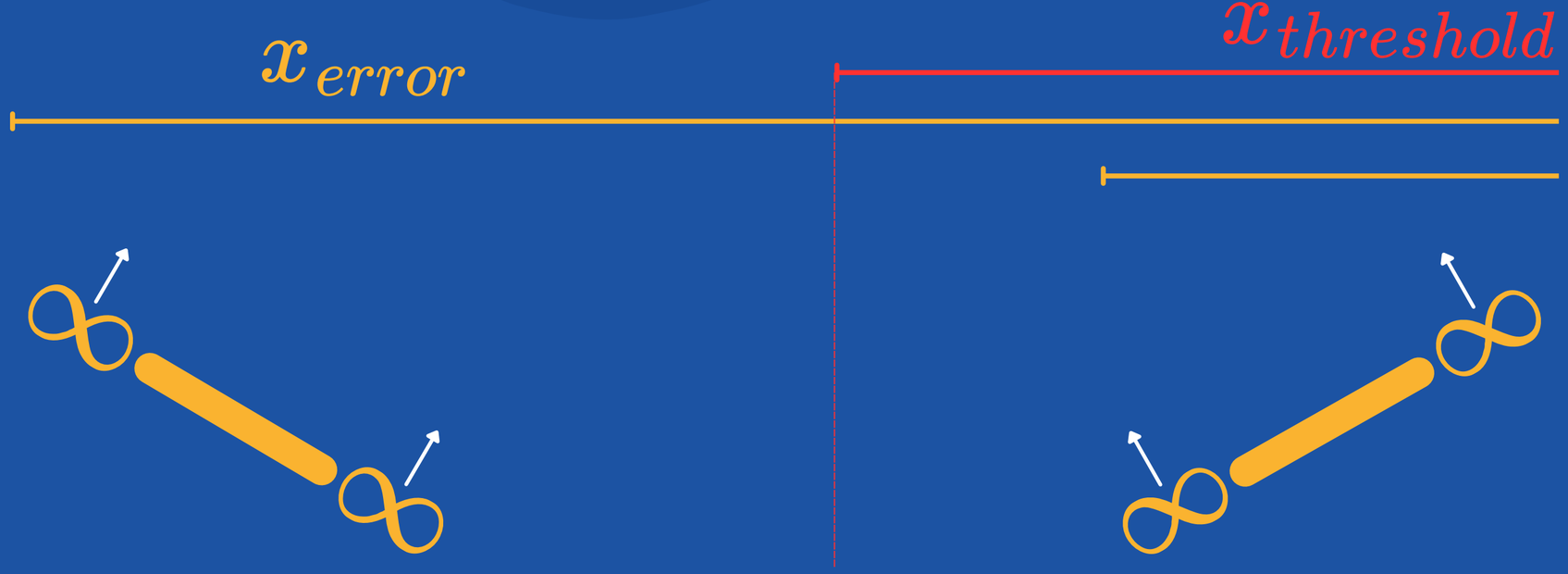
CONTINUE ...

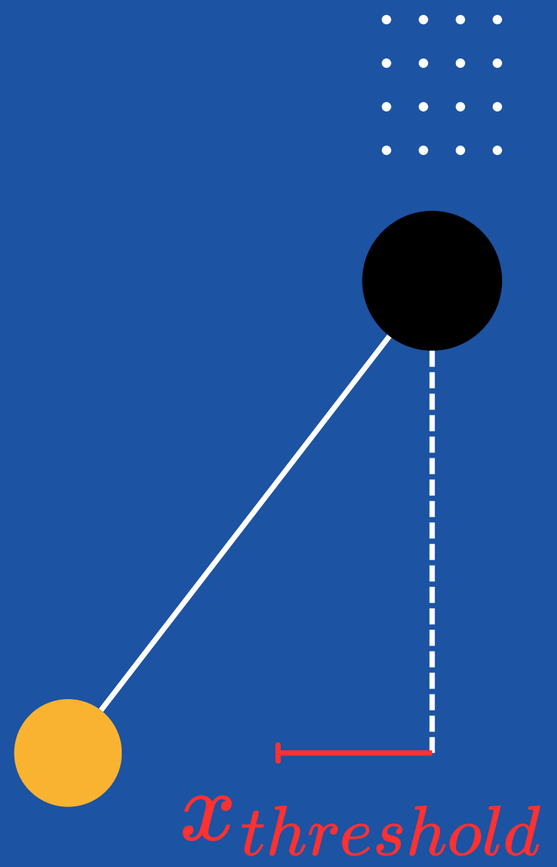
Limit the thrust to better study the behavior:

- Mass is 1 kg.
- Limit the thrust to 10 N.



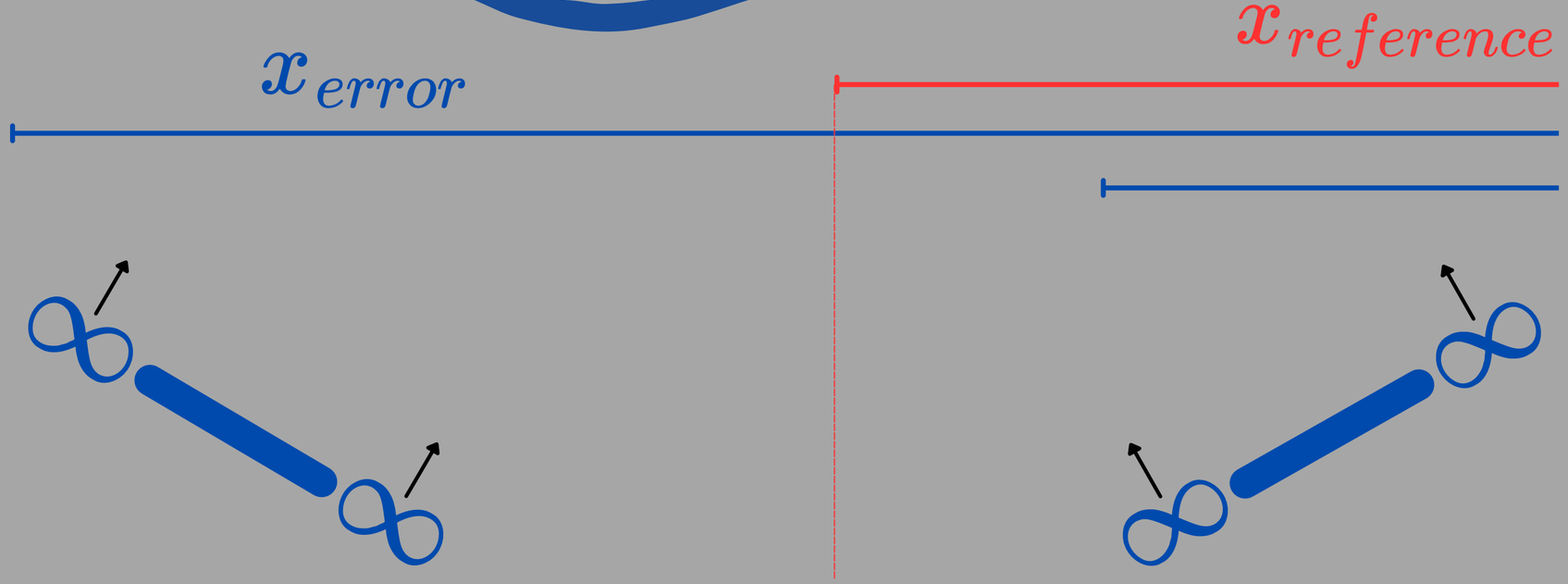
NEW APPROACH

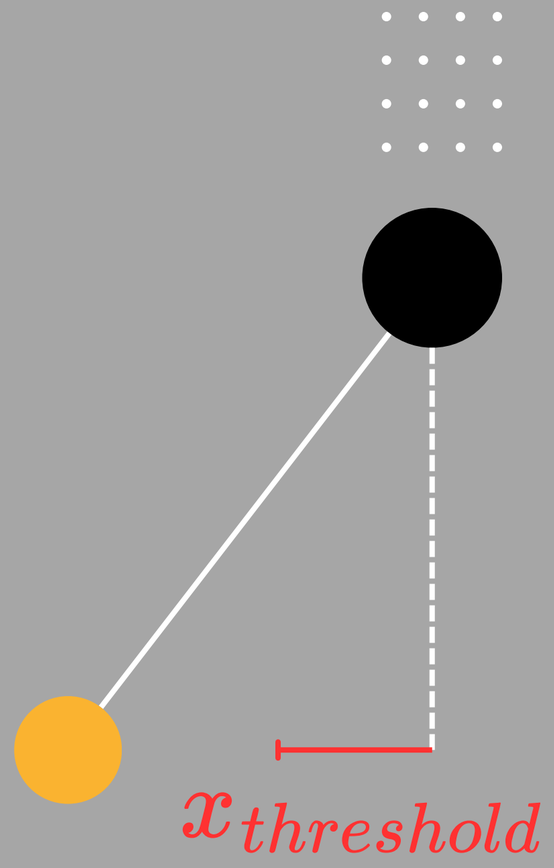




- **Proportional to X(threshold) – x(error)**
- **You can try PD too!**

NEW APPROACH

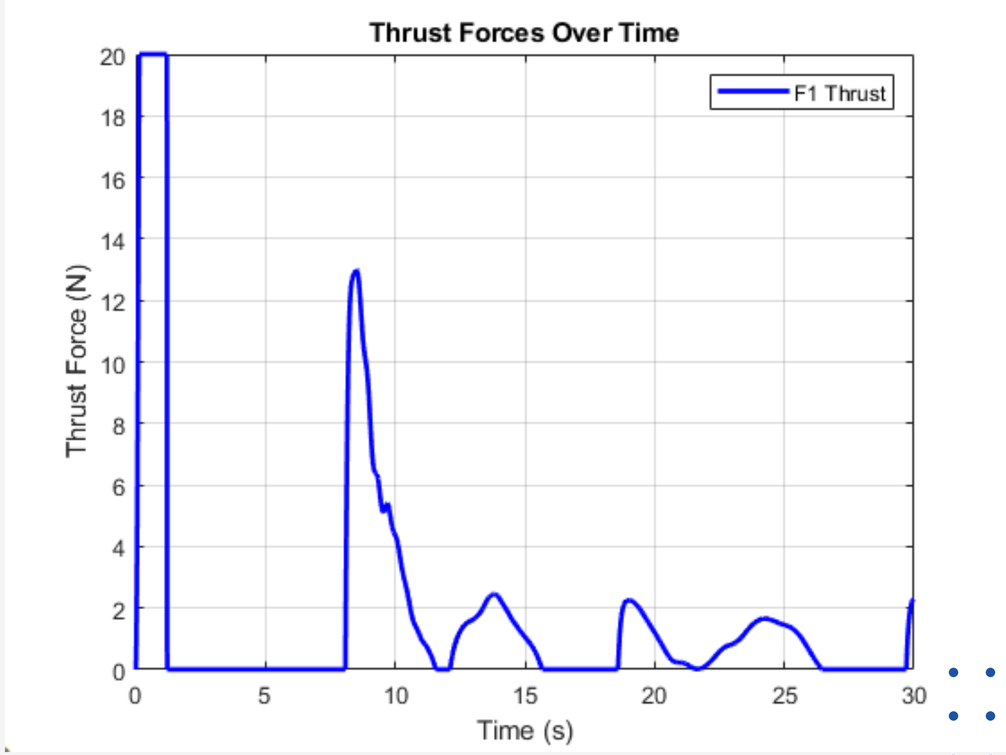


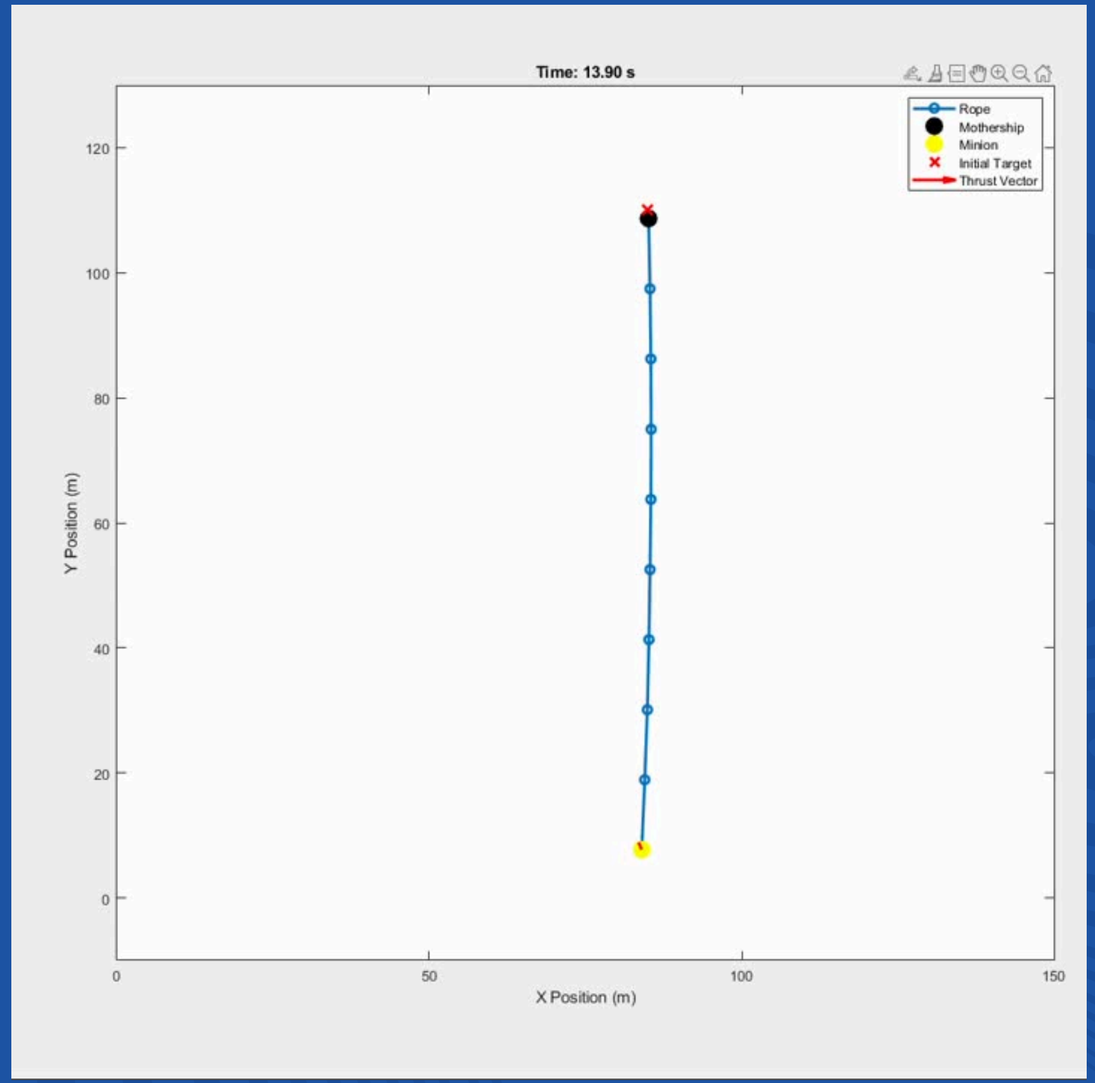


- Proportional to X(threshold) - x(error)
- You can try PD too!

RESULT !

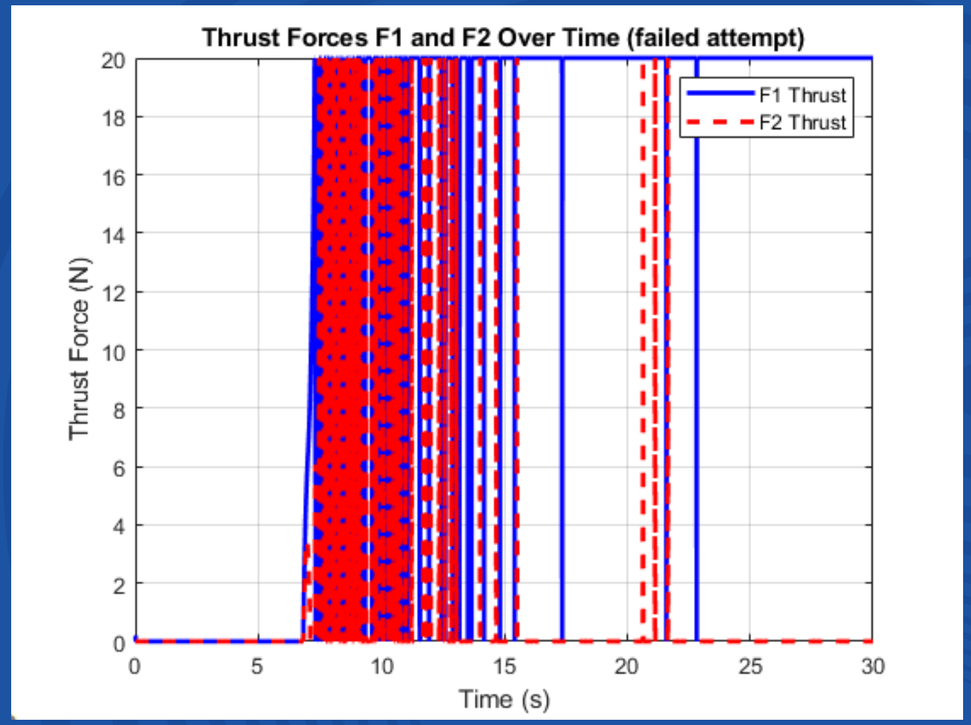
Note: the arrow shows force only. Not torque.



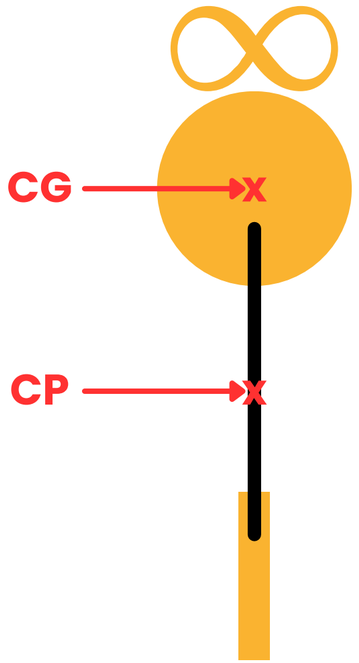


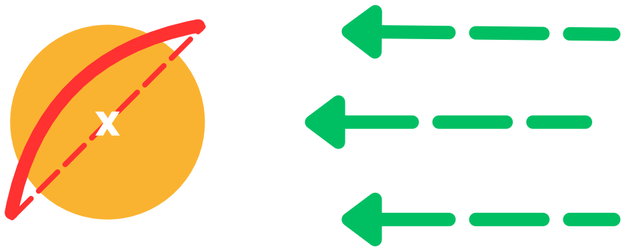
FUTURE IMPROVEMENT

- Calculate F1 and F2
- Better drag simulation
- Tracking the mothership speed instead



POTENTIAL IDEAS





Questions?

Comments?
Concerns?