Mars Rover Presentation

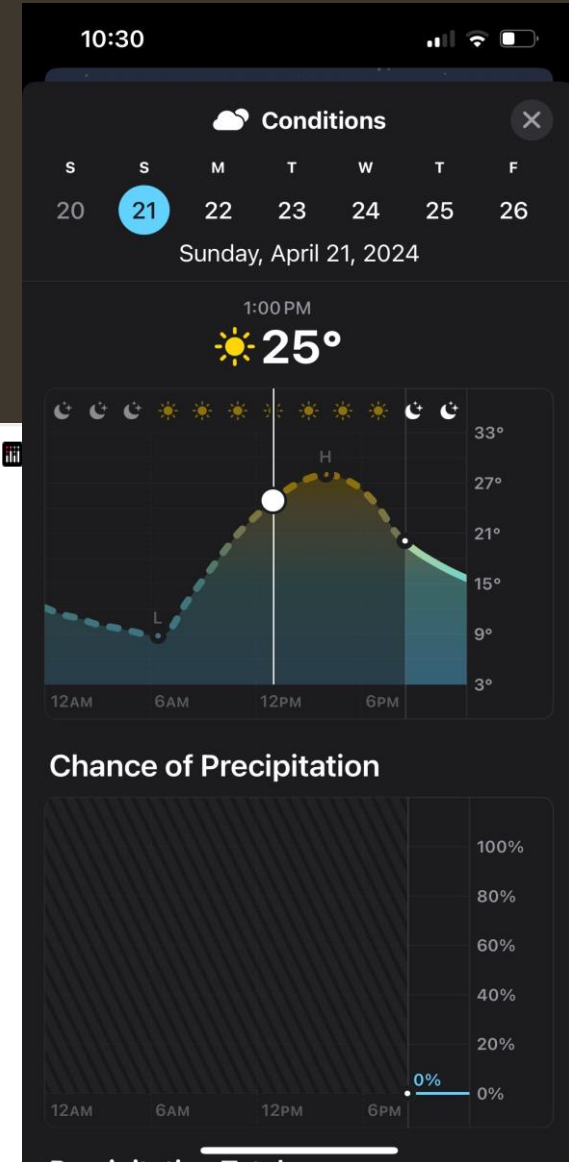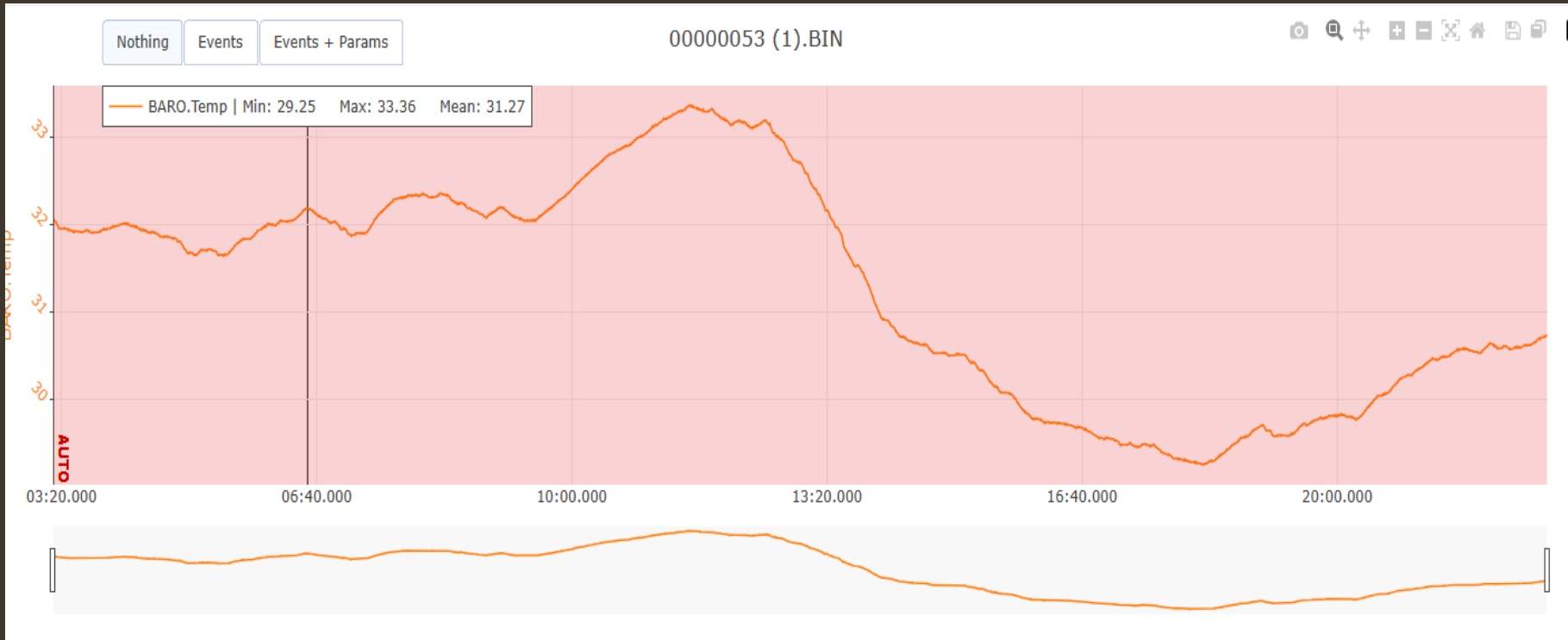By Liam McGuire, Andrew Schalk, and Cheng Chen
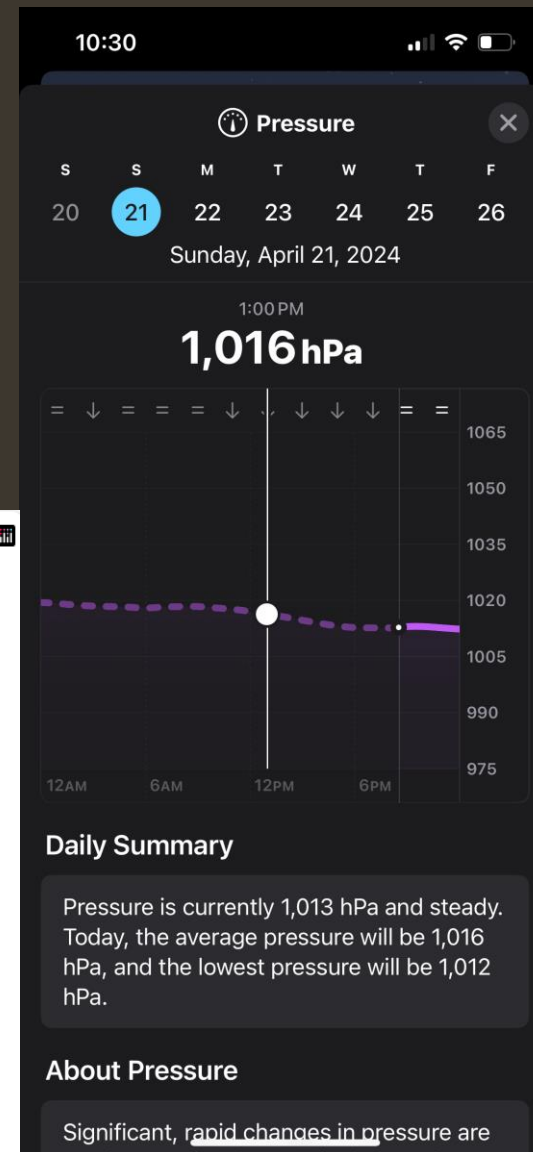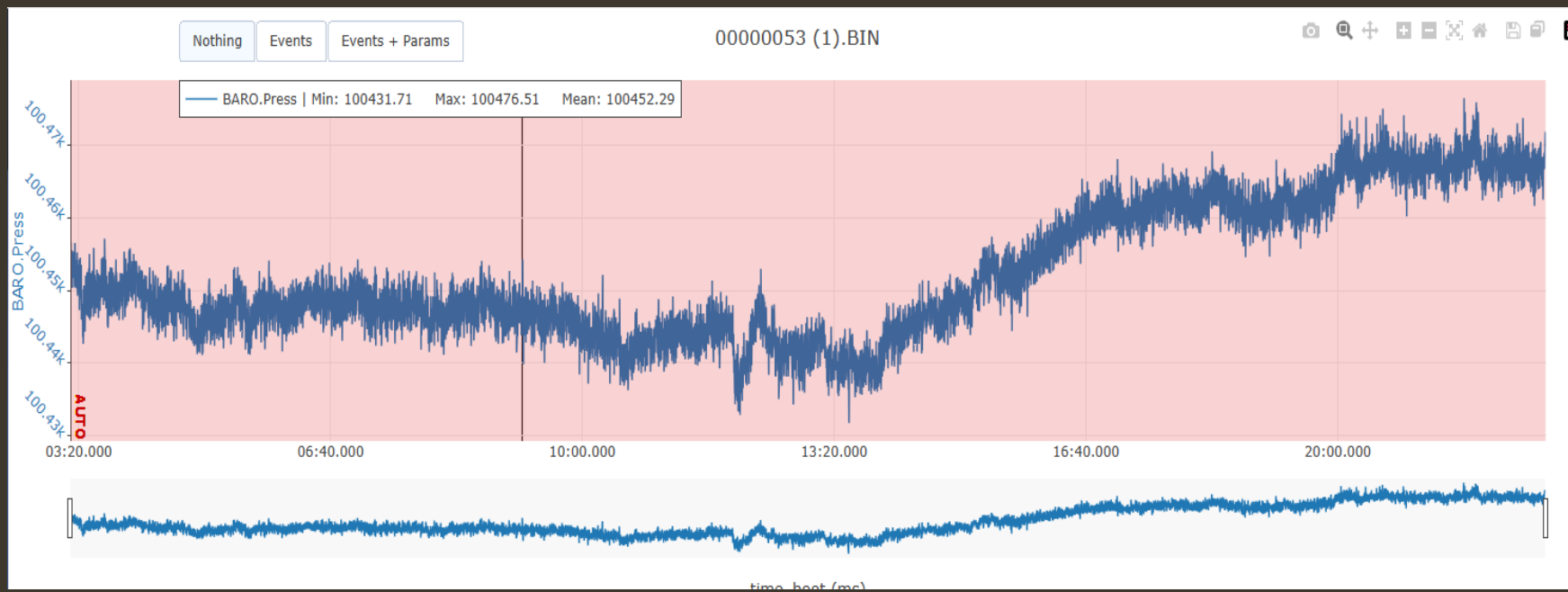
Assembly

- Software
  - Somewhat straight forward with instructions provided.
  - Install and setup mission planner
  - Controller configuration

- Hardware
  - Also straight forward with instructions
  - Wiring got rather tricky being only provided arial view images
  - Completed within a few hours aside from radio setup

Troubleshooting

- Early on it was found that the positive and negative wires for two of the motors were backwards.

- Controller would occasionally lose connection with Rover.

- During multiple initial tests, we received highly erroneous speed data i.e., a constant displayed speed of 1 m/s when rover was still.

  - Recalibrated the IMU and compass, which seemed to work momentarily but error continued to appear on an intermittent basis

- Once we got past troubleshooting, the testing could begin

Measurement data and analysis

Nothing | Events | Events + Params

00000053 (1).BIN

BARO.Press | Min: 100431.71   Max: 100476.51   Mean: 100452.29

100.47k
100.46k
100.45k
100.44k
100.43k

AUTO

03:20.000   06:40.000   10:00.000   13:20.000   16:40.000   20:00.000

time_boot (ms)

10:30

Pressure ✕

S S M T W T F
20 21 22 23 24 25 26

Sunday, April 21, 2024

1:00 PM

1,016 hPa

1065
1050
1035
1020
1005
990
975

12AM   6AM   12PM   6PM

Daily Summary

Pressure is currently 1,013 hPa and steady. Today, the average pressure will be 1,016 hPa, and the lowest pressure will be 1,012 hPa.
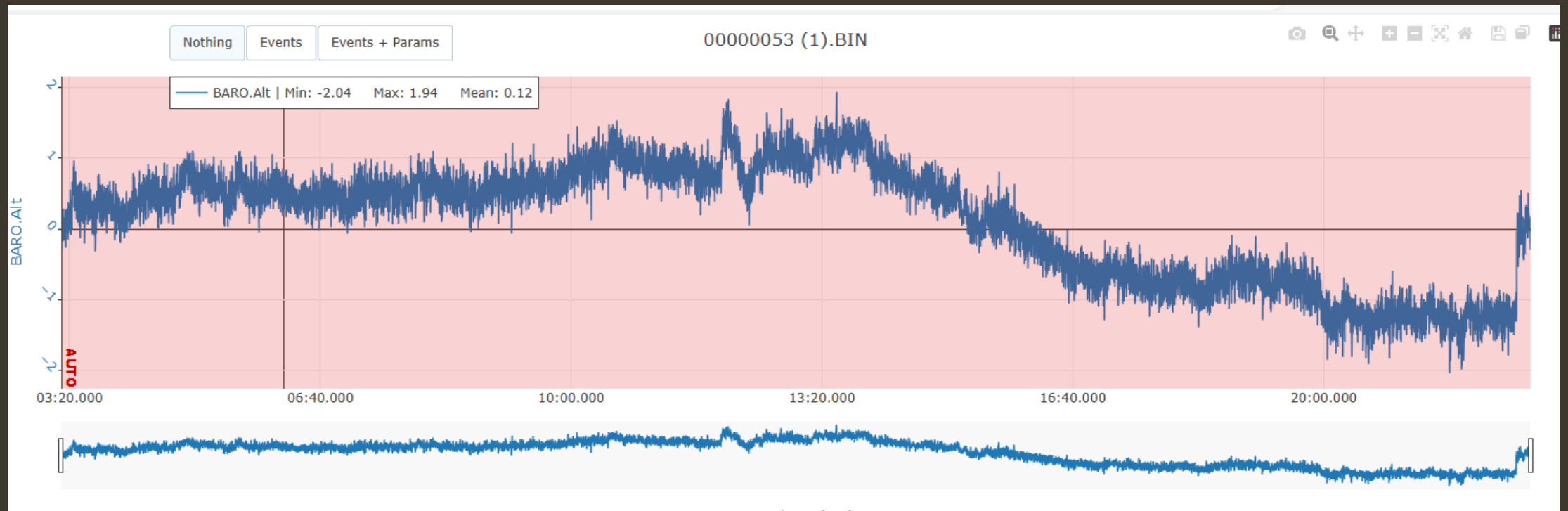
About Pressure

Significant, rapid changes in pressure are

Formula for calculated altitude: $h = hb + \frac{T_b}{L_b}\left[\left(\frac{P}{P_b}\right)^{\frac{-RLb}{g_0 M}} - 1\right]$

Calculated altitude from temperature and pressure: 175.01m
Reference Altitude: 164.03 m
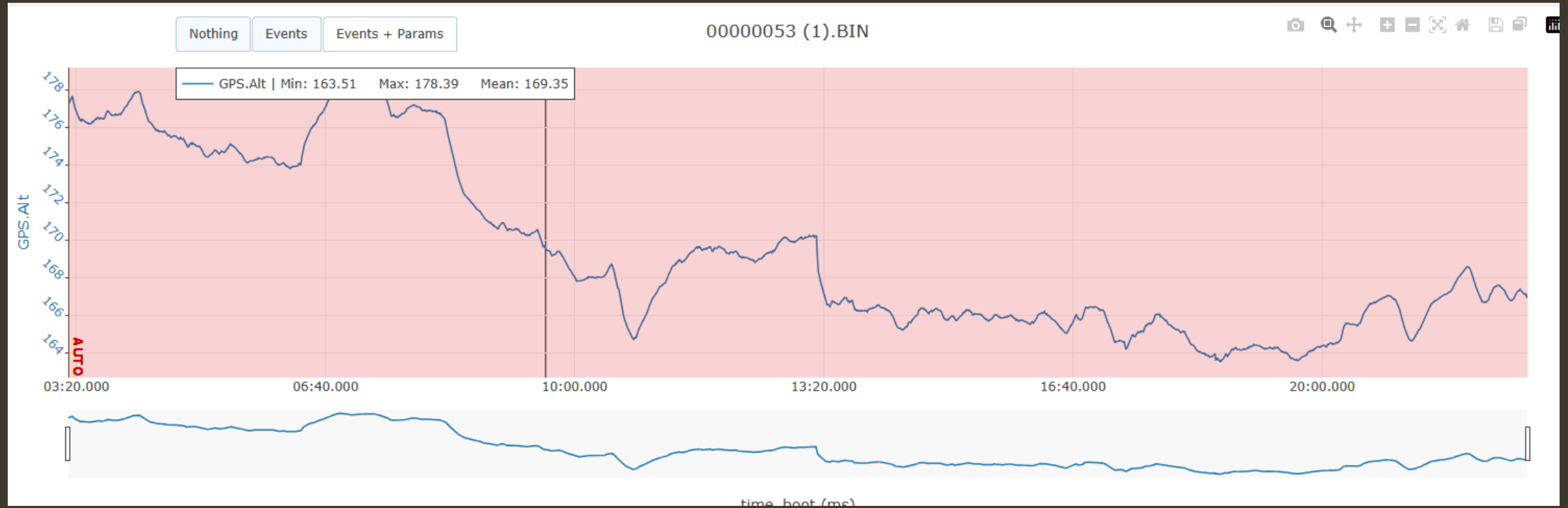
# BAROALT

PID Tuning and Mission configuration

- Speed
  - P:0.7
  - I:1
  - D:0.2
  - FF:0.5

- Turning
  - P:1
  - I:0.4
  - D:0.2
  - FF:1.7

- PID tuning was achieved by using the tuning graph within mission planner
  - Provide step input and monitor step response
    - Overshoot/undershoot
    - Rise time
    - Steady state error
  - Values were adjusted again during test missions for better result.
- Steering controller was also adjusted
  - Navigation period and Navigation damping were optimized
- Pivot turning was utilized to achieve sharper turns

Autonomous Navigation through Waypoints

- Mission Time: 17 min. 24 s

- Max tracking error: 2.16 m

- Max waypoint distance error: 2.01 m
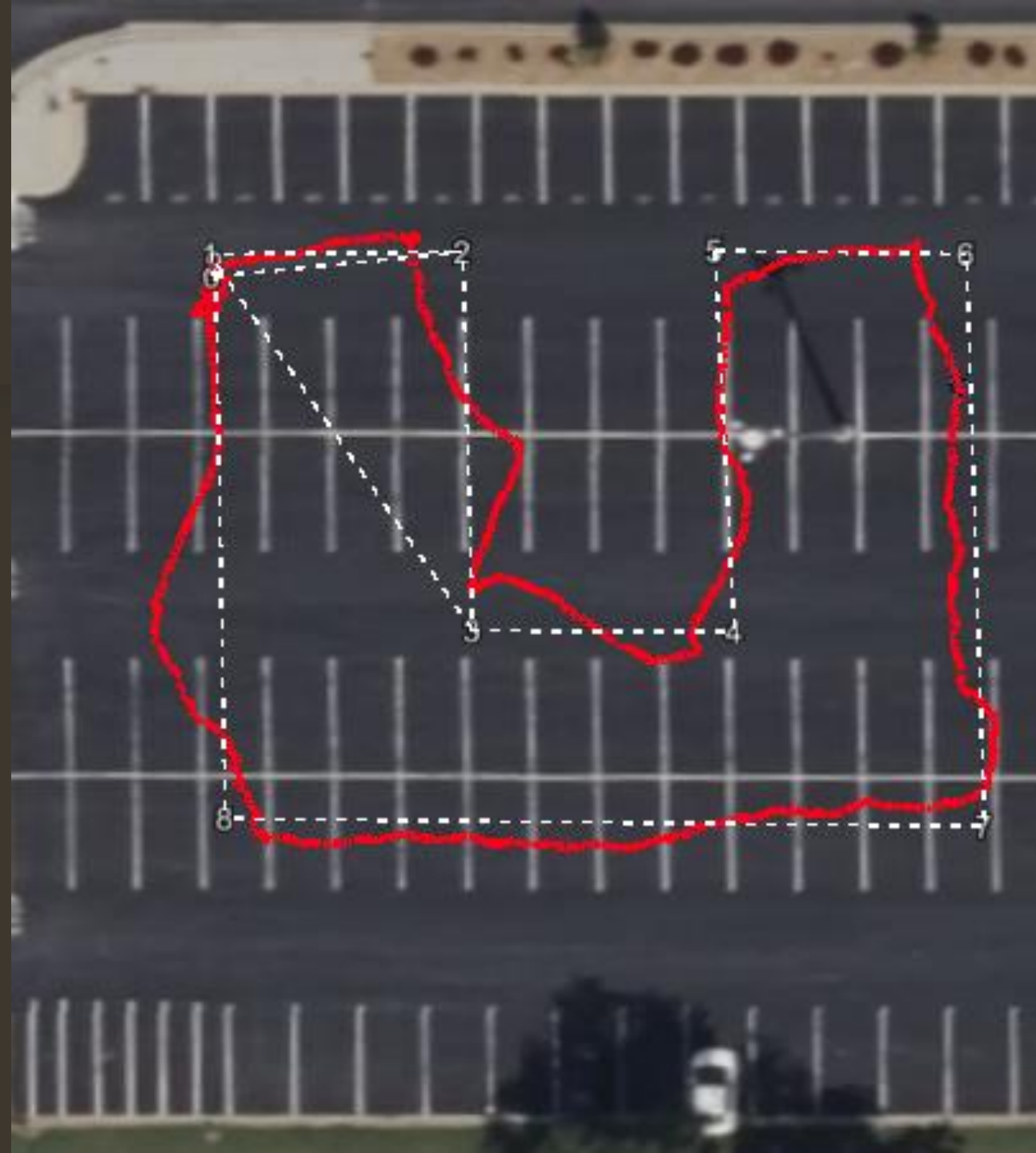
Proposed Mission Improvements

- Continue tuning PID values

- Lower waypoint distance

- Move NAVIO far from high current wires to achieve more accurate heading

- Reseat wires to solve intermittent errors due to disconnection

Questions?