Energy Informed Robot-Autonomy

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Abstract

The goal of this research was to measure and increase efficiency in the batteries that power Parrot Mambo Drones. It was expected drone battery life would last significantly more while performing less engaged task like hovering, and have almost a 50% increase in battery drainage while doing feats such as consistent movement. The installation of Ubuntu, MATLAB, Simulink and other various computer initially failed, so efforts were switched to mobile software. From this software I was able to fly the drone in varying situations to test battery consistency. Hopefully this research of battery implications can help further improve battery efficiency for other products besides drones.

Materials

Parrot Mambo Drone
Run-time: Approx. 9min.
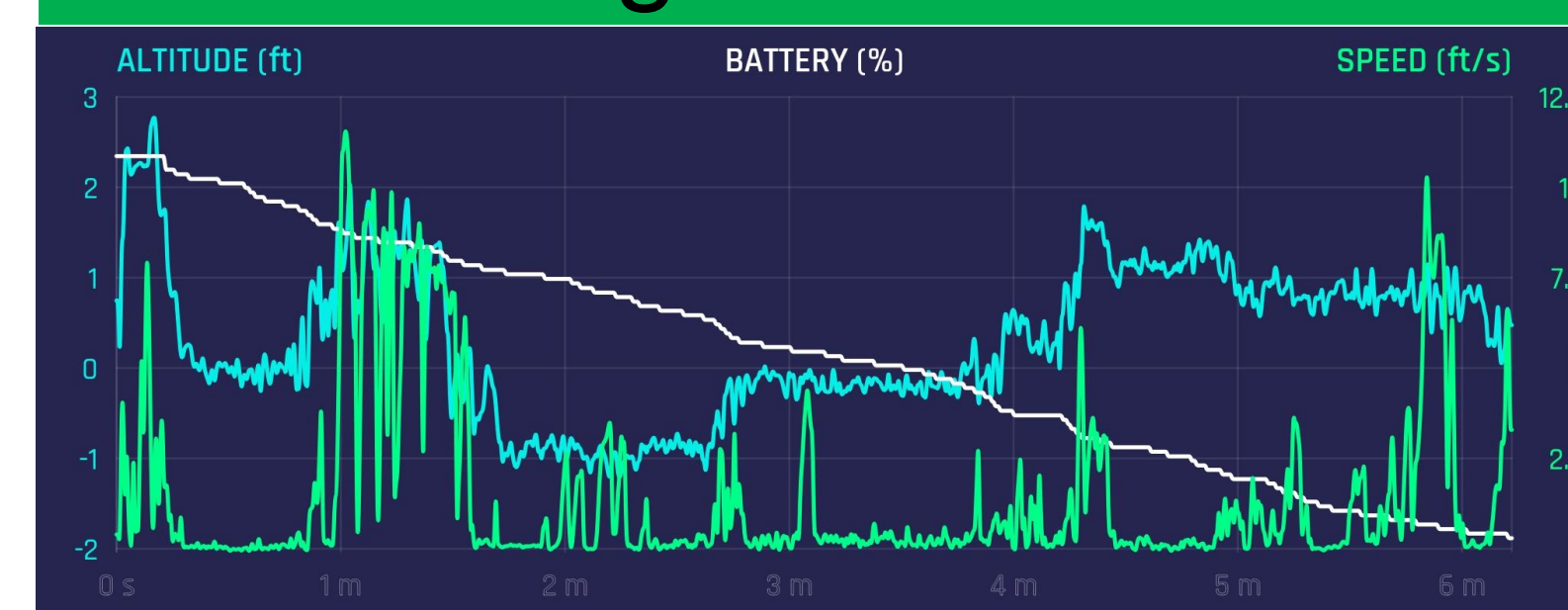Width: 7.1 in
Depth: 7.1 in
Weight: 2.22 oz

Parrot FlyPad
-Increased piloting range up to 200 ft
-200 mAh LiPo Battery
- 6 hours of use with just 2 hours of charging
-Bluetooth compatible

Parrot Li-Po battery
Lithium Polymer
Average output rate 3.7v
Battery capacity of 550mAh
2Watt hours
Charge at 2.5A max
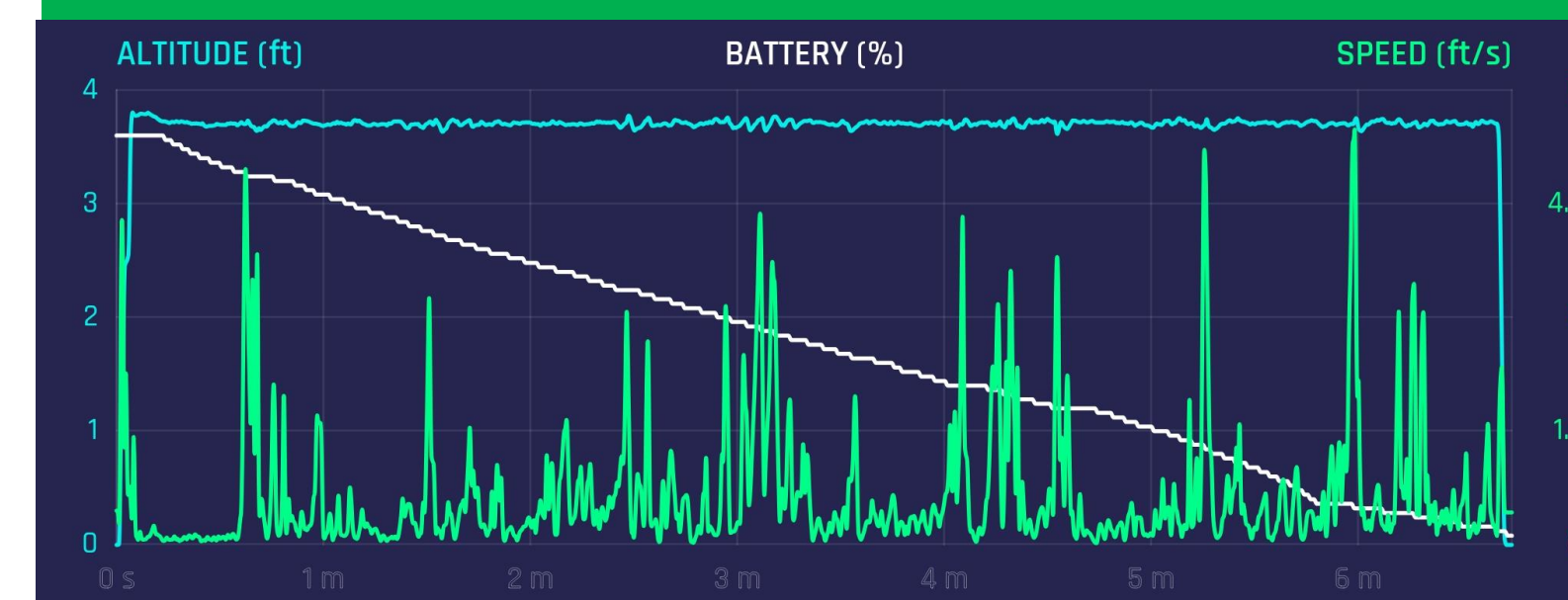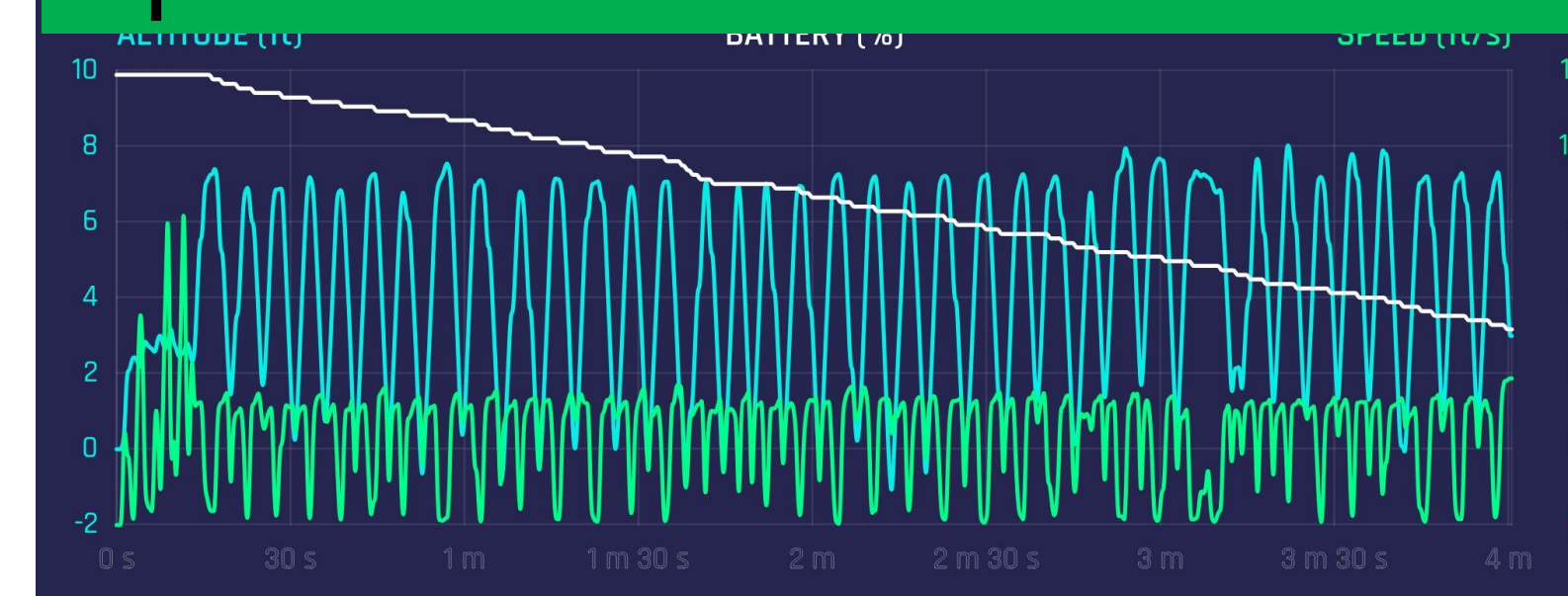15C Continuous Discharge

Flight Data

Outside Flight: Low

Duration: 6m 13s
Battery usage claimed: 84%
Speed: spikes between 0 ft/s to 6 ft/s
Altitude: approx. 7in to 2.75ft
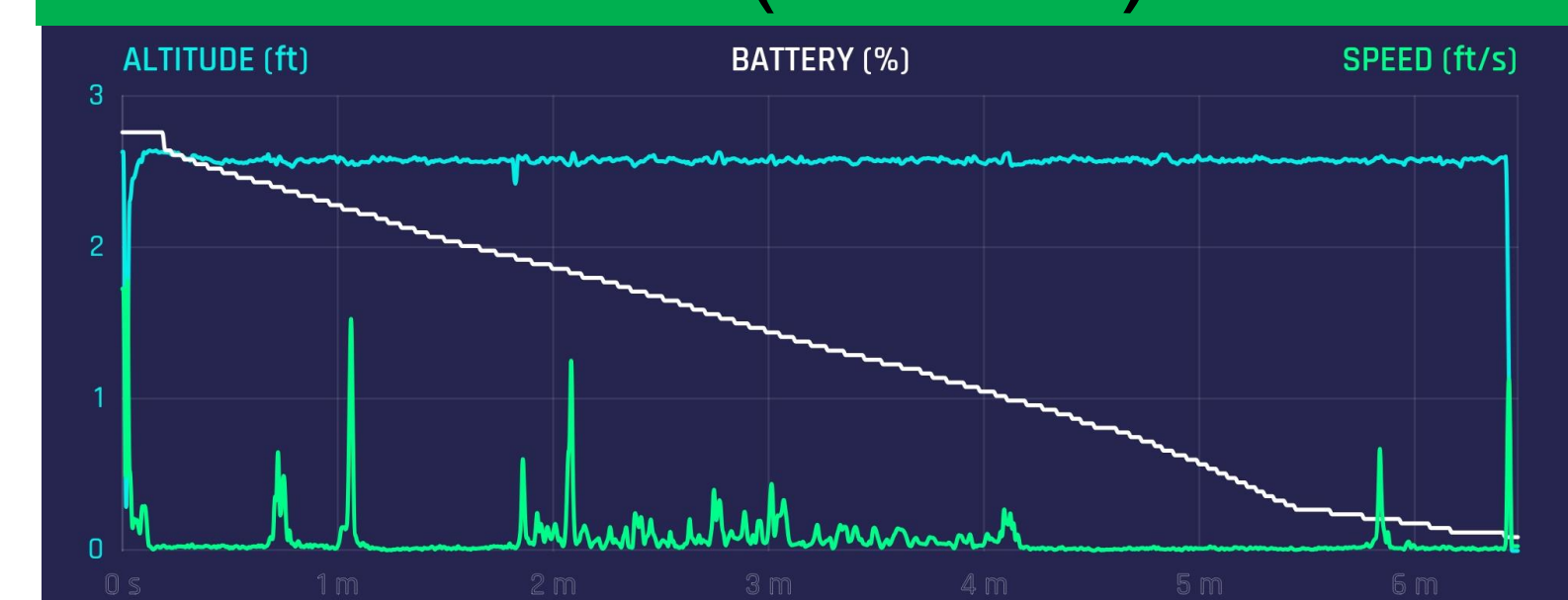Battery usage per %: 13.5v

Forward and Backwards

Duration: 6m 44s
Battery usage claimed: 88%
Speed: spikes between 1 ft/s to 6 ft/s
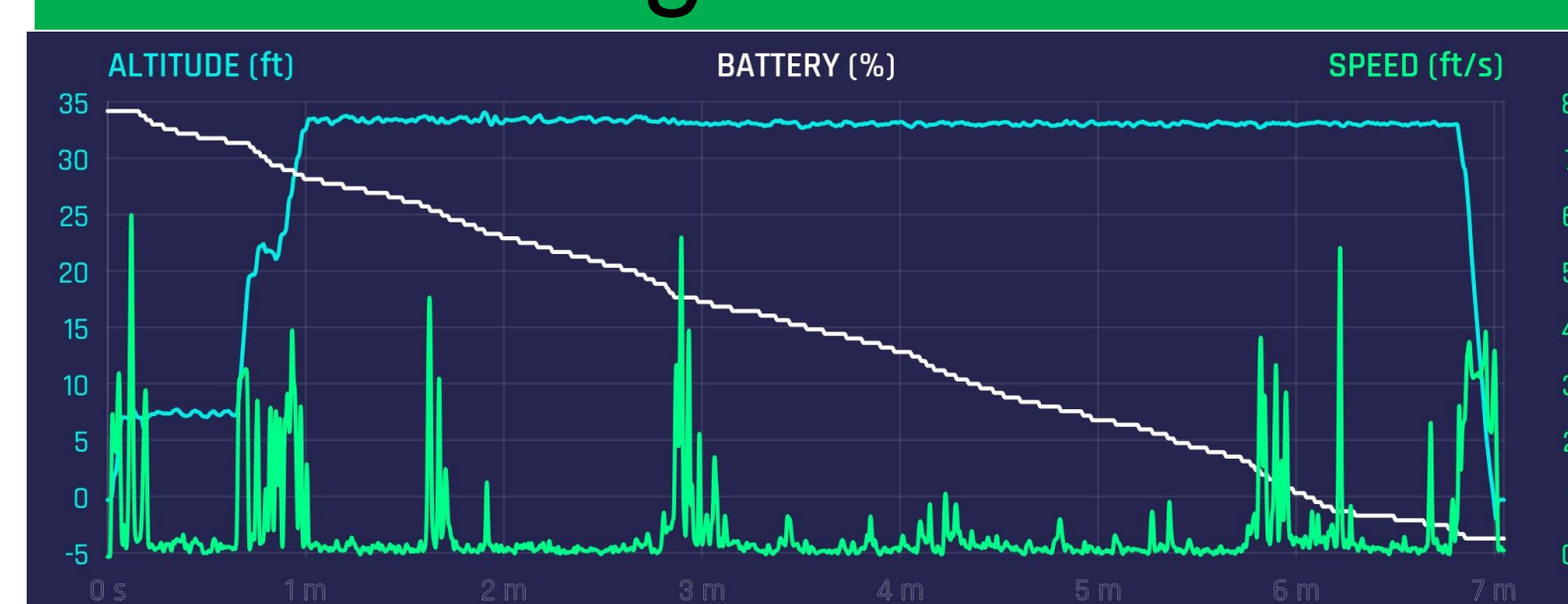Altitude: approx. 3.75 ft
Battery usage p/m: 13.07v

Up and Down

Duration: 4m
Battery usage claimed: 56%
Speed: spikes between 0 ft/s to 6 ft/s
Altitude: altered between 1-ft to 8-ft
Battery usage per %: 14.00v

Inside Hover (Outlier)

Duration: 6m 44s
Battery usage claimed: 56%
Speed: spikes between 0 ft/s to 2 ft/s
Altitude: 2.5 ft
Battery usage per %: 8.3v

Outside Flight

Duration: 7m 2s
Battery usage claimed: 94%
Speed: spikes between 0 ft/s to 6 ft/s
Altitude: 34 ft
Battery usage per %: 12.88v

Methods

1. Charge li-po battery to 100% for testing
2. Choose which varying conditions and action for drone flight
3. Fly drone in chosen conditions till battery has reached 0% or until battery is unable to successfully provide drone with energy.
4. Record data from drone & repeat

Findings

-Even while not being used battery consistently drained while it was not charging.
-Average voltage per percentage was 12.65%
-In most test the drone barely sustained flight for more than 6 min.
-Average flight time between test was 6m 33s
-In every case there remained charge in the battery that the drone was unable to access.

Challenges

"Connect to Parrot Mambo (Windows)" page possibly not being updated for all Window Computers.

Though Simulink is compatible, MATLAB and programs that are specific to the drone's hardware operations are not compatible with Linux.

For certain projects, necessary toolboxes and products for projects weren't stated in complete detail.

Acknowledgements