Antenna for AT&T's Flying COW

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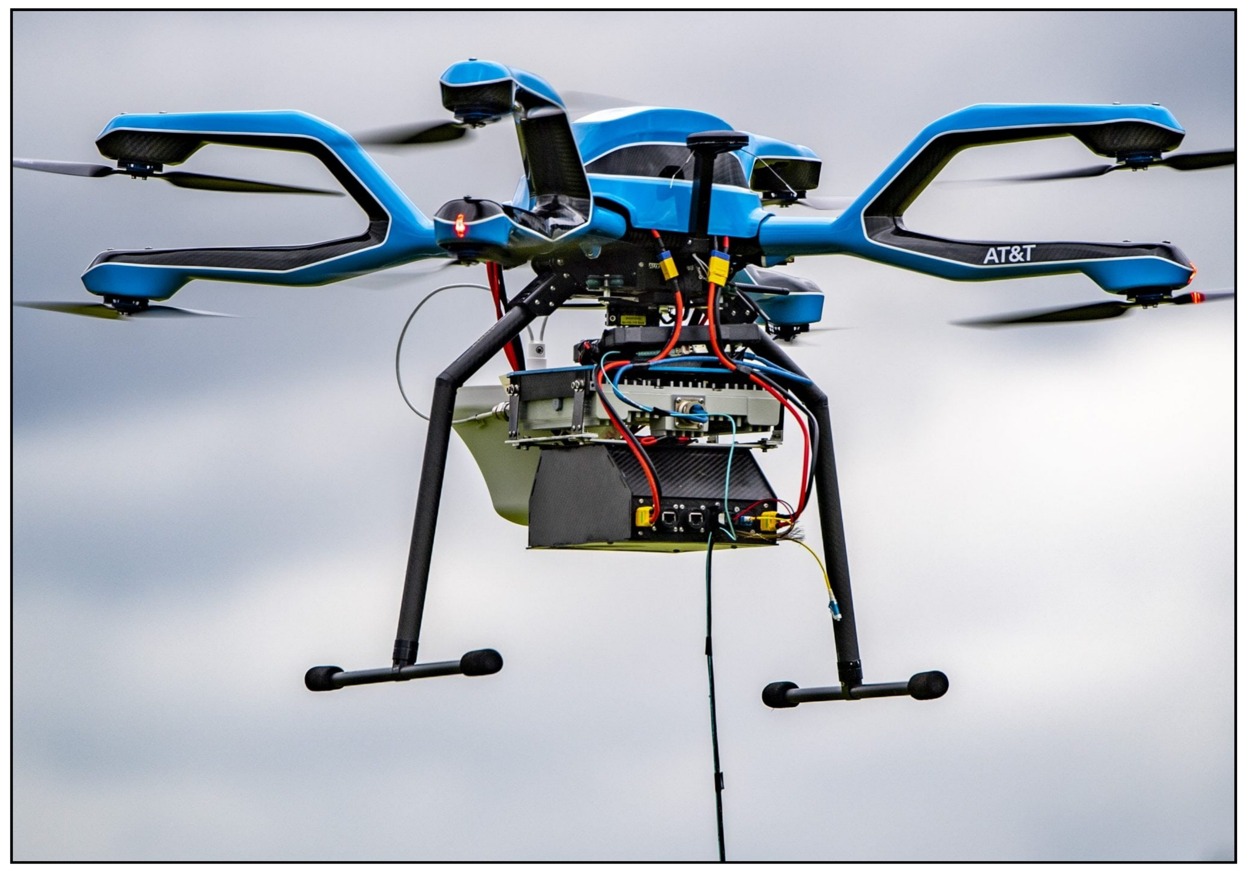
Introduction



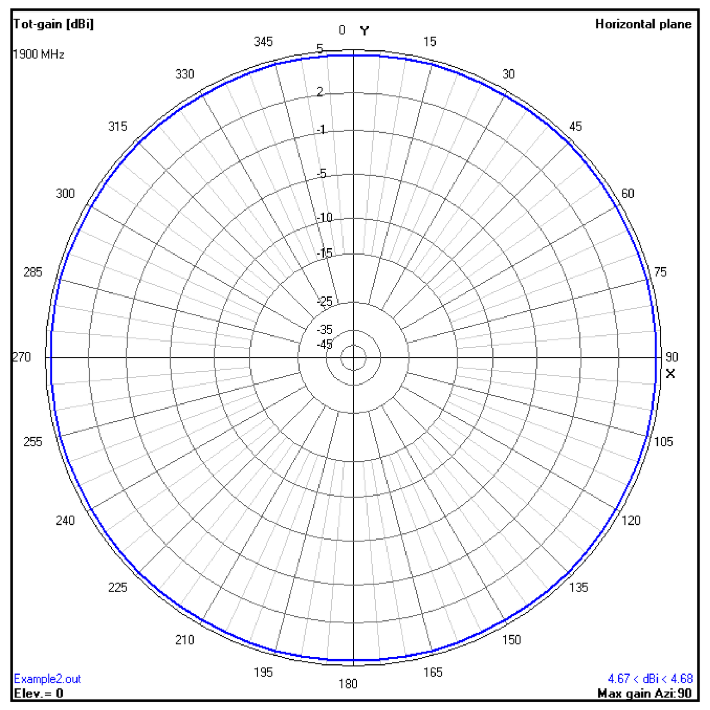
Left: AT&T's Flying COW in flight.

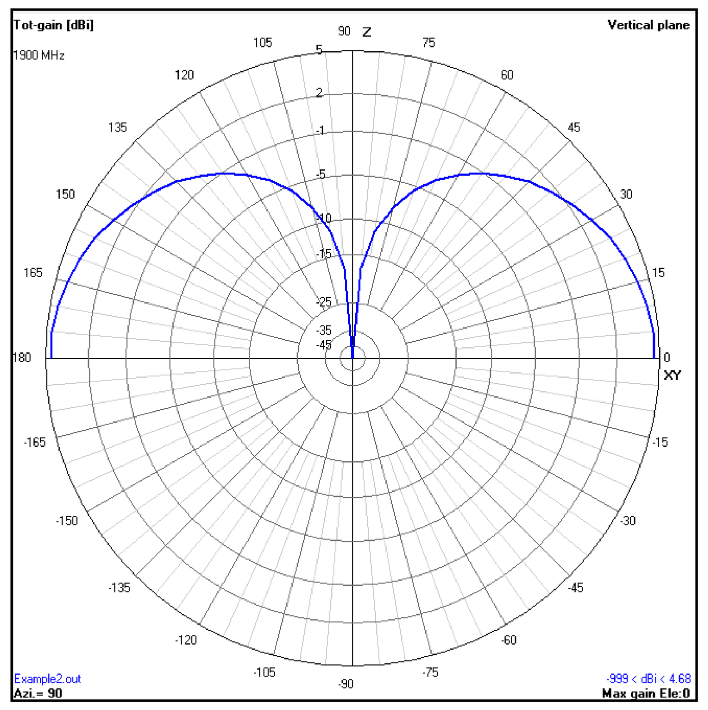
The Flying COW is a drone developed by AT&T that acts as a cell phone tower in the sky. Its intended primary use case is in times of crisis, either for first responders or for citizens when the existing network goes down (particularly in natural disasters). The product being developed for this capstone is an antenna that is able to provide good cell phone coverage while fitted on this drone flying at 400 ft.

Research & Feasibility Tests

The first stage of this project was to research potential solutions. We modeled several antennas and simulated the radiation patterns using software to determine which ones we would physically create. Ultimately, we decided on:

- 1/4-wave and 5/8-wave Ground Plane with Radials
- Discone (2 different kinds)
- Bullet (commercially purchased)

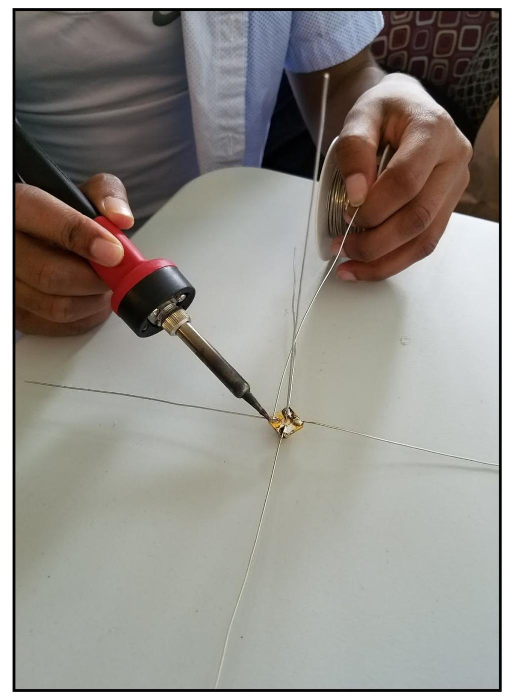


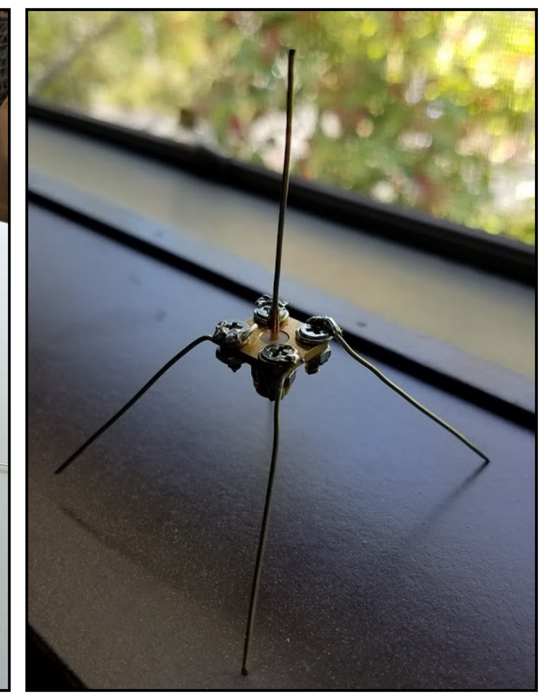


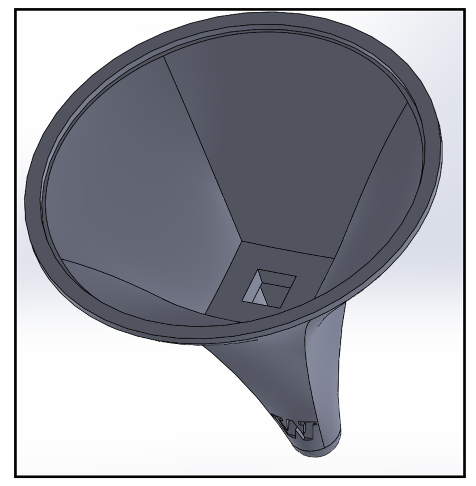
Left: Horizontal RF pattern of a 1/4-wave antenna modeled on 4nec2.
Right: Vertical RF pattern of a 1/4-wave antenna modeled on 4nec2.

Construction Phase

Over the course of the project, we built 4 antennas and 3D-printed casings for each so that they could be mounted onto the drone.



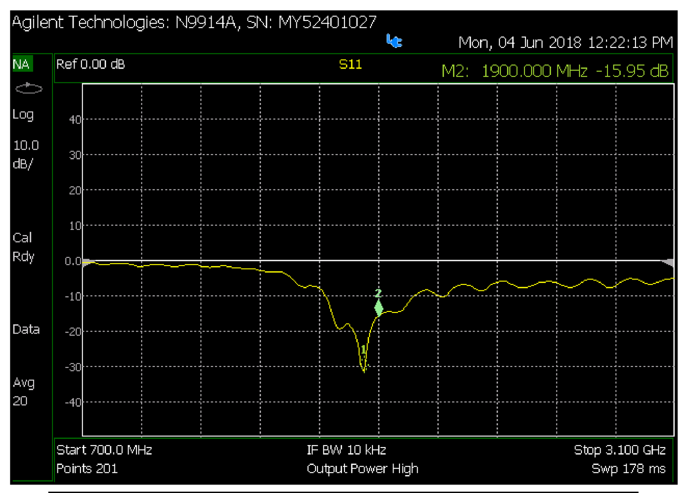


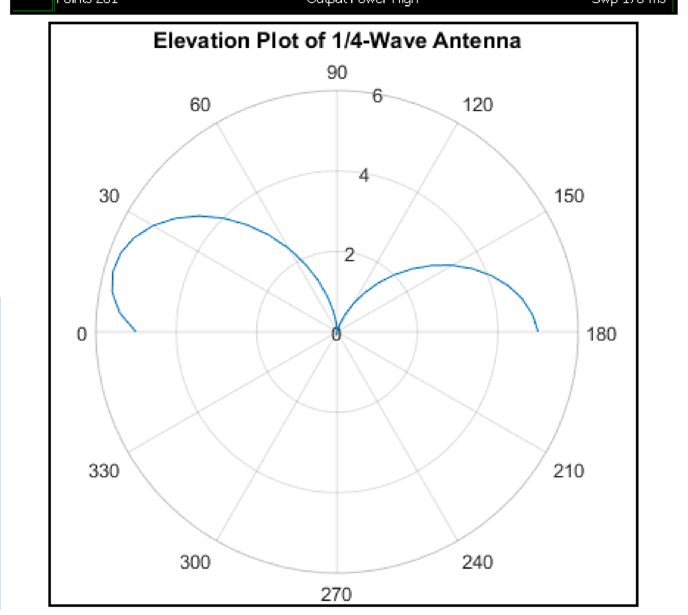


Left: Essey soldering wires to create an antenna.
Middle: An early prototype of a 1/4-wave antenna.
Right: An early prototype of a discone antenna.
Bottom: The CAD model for the housing for the 1/4-wave antenna.

Ground Test (May 20, 2018)

Prior to our ground test, we built testing stands out of PVC and wood to hold our antennas while we recorded key data points such as radiation pattern, resonant frequencies, and impedance.





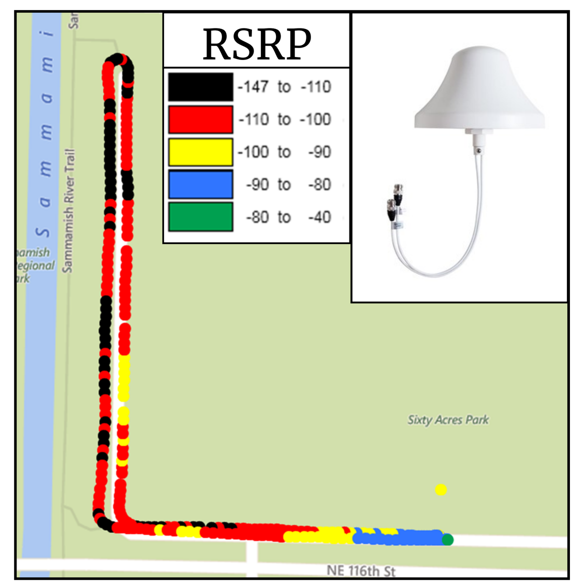
Left: Setup of ground test.
Top-Right: Resonance frequency for 1/4-wave antenna.
Bottom: Experimental elevation RF pattern for 1/4-wave antenna.

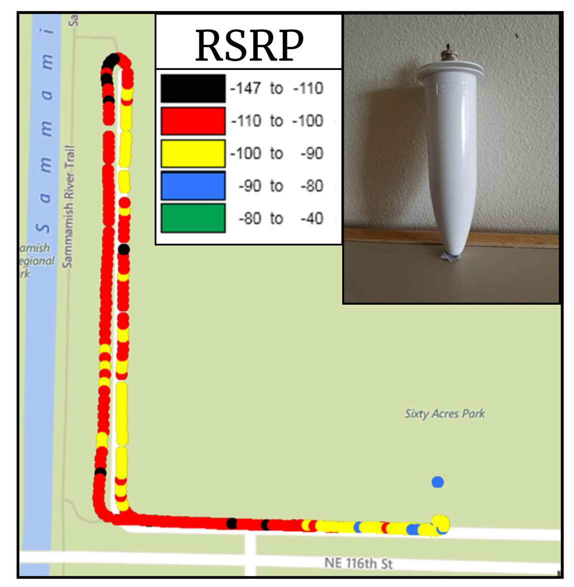
Air Test (May 29, 2018)

With the help of CommScope's and AT&T's RF engineers, we tested a total of 6 antennas on the actual drone flying at 100 ft. Two sets of signal strength data were collected: one static, below the drone, and one dynamic, driving around the perimeter of the park.

Above: Students replacing the antenna on the Flying Cow for their flight test (courtesy of Kiro 7).

Conclusion





Left: Flight test data for CommScope antenna.
Right: Flight test data for Bullet antenna.

Based off our flight test results, we found that the bullet antenna we purchased performed best. However, the radio supports multiple inputs while the bullet antenna only supports a single input. Therefore, future research on this project could include altering the design of the bullet antenna to support multiple inputs to maximize signal strength.

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