

Use and Implementation of the Automatic Packet Reporting System (APRS) on high altitude payloads. (#1156)



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Introduction

Once a weather balloon enters the uncontrollable realm of nature upon release it is subject to a high degree of freedom and flight path options. Passive tracking methods become essential to physically follow the trajectory, the balloon, and its payload. With no radio horizon at zenith, or peak altitude, the Automatic Packet Reporting System (APRS) provides an ideal platform for tracking high-altitude and low earth orbit instruments. Demonstrated aboard the International Space Station, this simple, low cost system provides maximum tracking range at very high accuracy with very low power needs. Licensed amateur radio operators using the APRS network provide a reliable means of communication with ground-team personnel and between teams. Both APRS and very high frequency (VHF) radio communications were used during the August 2017 Solar Eclipse balloon launch by both the College of Charleston and Universidad Interamericana (Puerto Rico). This system became a mission critical component after the primary tracking system failed at 100,000 ft, resulting in a full recovery of the payload.

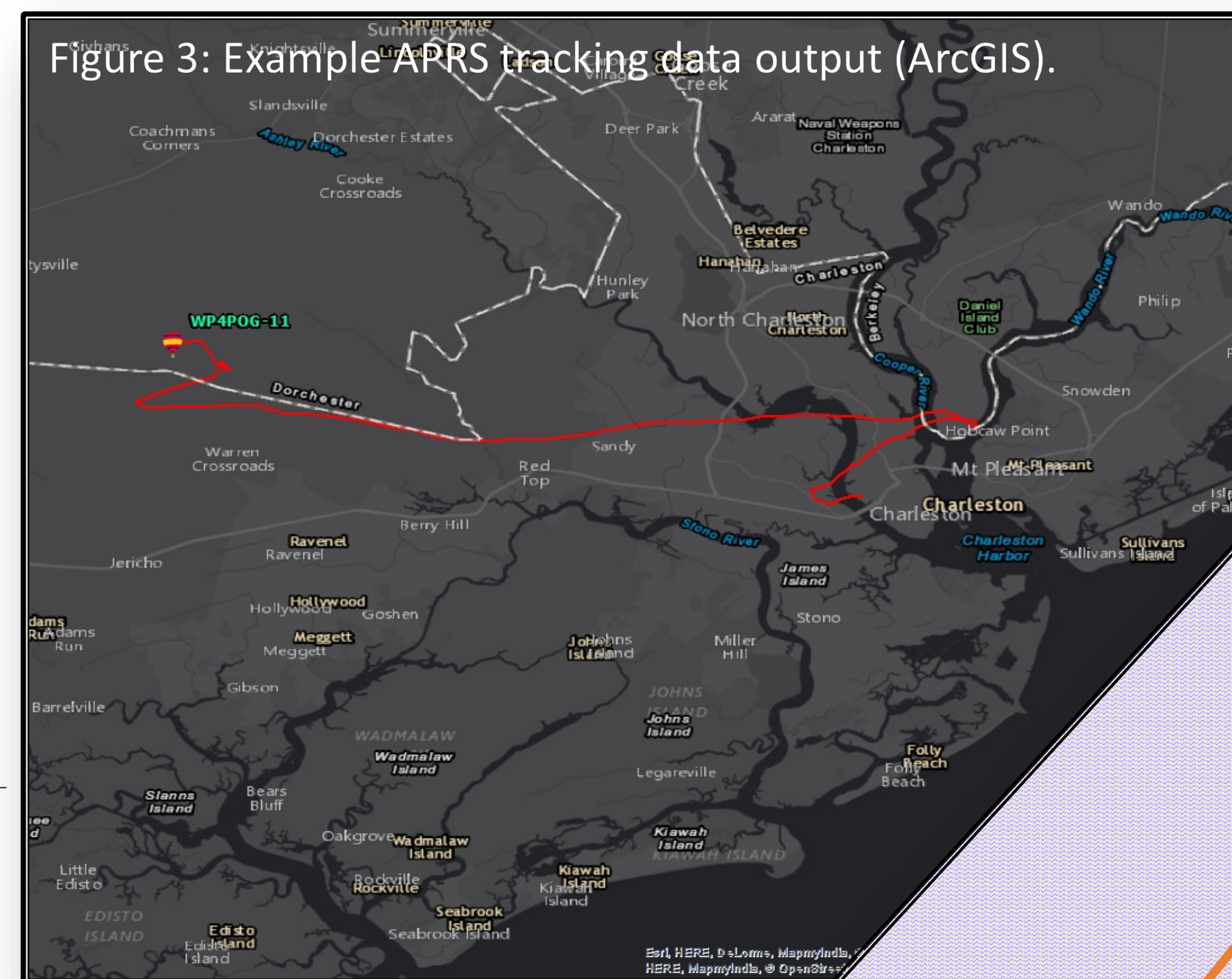
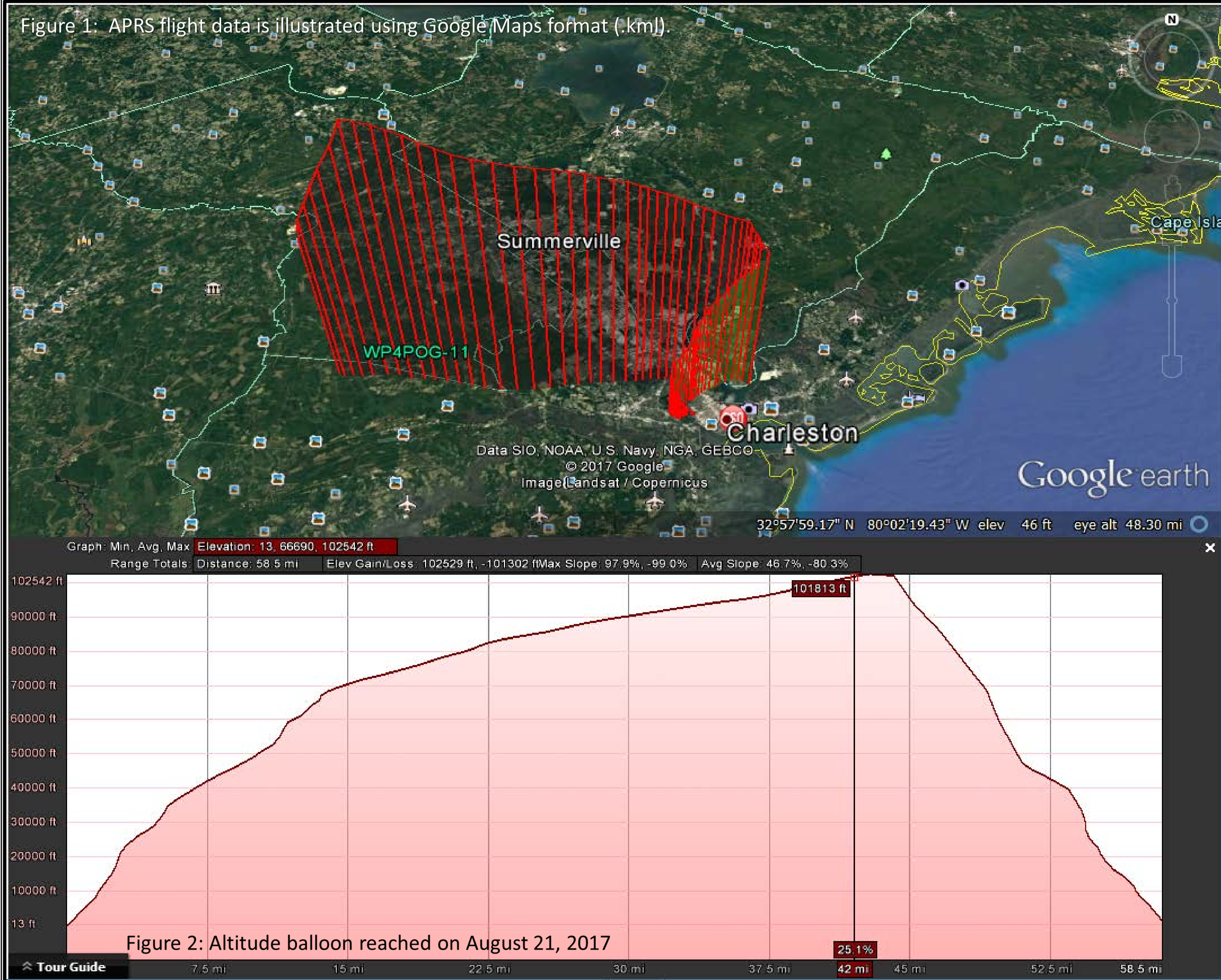
What is APRS?

- Radio enabled tracking device
- Equivalent to a invisible blinking light
- "Blinks" gps data invisibly in Very High Frequency (VHF<Visible Light)
- Transmits text, radio direction finding, email (send only), weather station telemetry, queries
- Very long range
- Utilizes a reliable pre-existing federal infrastructure to communicate
- Easy "set and forget" data collection and storage

2017 Solar Eclipse Balloon Launch

APRS was a part of the scientific payloads aboard the College of Charleston balloon launched from ~10 miles offshore and the Universidad Interamericana balloon launched from centerfield in the Riverdogs stadium. The APRS units were intended to be secondary tracking systems and act as a fail safe to locate the balloons upon landing. Unfortunately, the College of Charleston balloon failed to reach altitude. Fortunately, Puerto Rico succeeded; providing a thorough test of our APRS tracking system.

Data from onboard APRS on balloon was automatically collected by a federal, publicly accessible database which stores all APRS data. Catalogued data can be simply queued and downloaded for each flight as illustrated in Figure 2 above.



2017 Solar Eclipse APRS Configuration

*not to scale

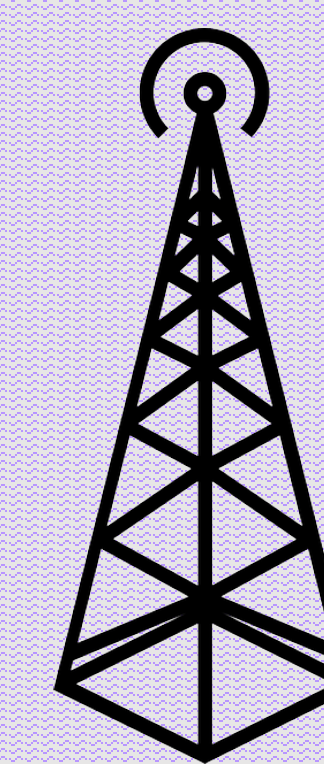
1240+ miles



21 miles



9-12 miles



Why add APRS to balloons?

- +No radio horizon at zenith
- +Very long range
- +Low power, continuous data Tx
- +Stable for long duration operation
- +Set & Forget
- +Free data storage
- +No heavy parts!
- +Tracking Solution

