

Appendix H: BOREALIS Auxiliary Tracking System (BATS)

The BOREALIS Auxiliary Tracking System (BATS) is a recent development for our command module. BATS is designed to provide a low power APRS beacon for an extended period of time, at least 18 hours. This provides a backup to the main APRS beacon in case of a failure and also allows extra time for a recovery team to get to the payloads before they have no more position reports if the payload should land in mountainous terrain or far from the team. While providing this redundancy, the system also had to mass as little as possible and take up a minimal amount of space.

To this end, we selected the Yaesu VX-2R radio, Tiny Trak III TNC, and the Garmin GPS15L GPS receiver with an active antenna. This system is fairly straight forward to assemble and only requires two voltages. Power is provided by two of Rose Battery's LiIon 4000 mAh, 3.6 V rechargeable battery packs in parallel for the radio and GPS. A single 9V Lithium disposable battery provides power for the TNC. This power arrangement was chosen so the system would have no efficiency losses due to converters.

The system can be assembled quickly from the datasheets and user manuals that come with each of the main components. Additionally, only a connector for the power needs to be built and so there is no significant board layout to accomplish.

The Yaesu VX-2R was chosen for its small size and fairly high power for a miniature handheld radio. Operating from the LiIon batteries, the radio can output a maximum of 1.5 W on the 2m and 1.0 W on the 70 cm bands. This power is more than sufficient to receive signals from the balloon with a good antenna and radio. The VX-2R is also well suited for balloon flight with its small size and simplicity in design.



The GPS15L is a WAAS enabled GPS receiver core. This minimizes the mass and power consumption but requires the use of a computer to set the GPS. The WAAS allow the GPS to have a maximum accuracy of 3m. This GPS is used with a Garmin active antenna for the best performance. See the Garmin website for the best antenna to use with the GPS at the time you purchase one. The GPS15L also cheaper and lighter with fewer features than the GPS25LVC that is used with the primary beacon.

Figure H1: Yaesu VX-2R

The Byonics Tiny Trak III is a small simplified TNC. It is designed to interface the GPS to a radio. This is its only function as it is not designed to receive and decode packets. This makes it ideal for use with a balloon beacon as it is minimal mass and excess function. The Tiny Trak III is available as a kit or ready made. A nice feature of the Tiny Trak III and the GPS15L is the mounting holes are nearly aligned and so they can be bolted together.



Figure H2: ←Garmin GPS15L

Figure H3: Tiny Trak III →

