16 Sep 2023

Larry Herman

**Drone mapping procedures**

Tools to bring on every mapping flight:

* SMA wrench
* Multi-tool
* Digital Multimeter
* Small screwdriver and allen key for drone bolts
* Drone rescue kit
* Spare props
* FieldFox (optional)
* Drone and usual equipment/payload

Items to bring if setting up an LWA and operating without an established ALBATROS station (ie soccer field ops):

* LWA
  + Topper
  + Hardware
  + Petals
  + Central fiberglass supports and flange
  + Central pole
  + Base (ie Xmas tree stand)
* FEE (with optional spare)
* Driver screwdrivers for LWA (2 sizes)
* Readout SNAP box with appropriate RF chain
* Hard drive if not internal to the SNAP box
* RF rescue kit (attenuators mainly)
* GPS antenna
* Batteries with cables (jumper and power cable to readout box)
* Coax cables
  + Riser cables for LWA central pole
  + Long cables from LWA to SNAP box

Setup instructions for flying without an established ALBATROS station (ie soccer field ops):

* Determine location of readout system and crew (ie picnic table)
* Determine location of LWA
  + Can uncoil coax cable and use its length to determine this
* Set up LWA with Xmas tree stand base
  + Includes connecting riser cables to FEE
* Jumper batteries and hook up power cable for the readout box (do not plug in readout box yet)
* Connect GPS antenna to readout box
* Connect hard drive to readout box if needed
* Connect coax cables to LWA riser cables and readout box
* Power on readout box
  + Ensure drone config file is in the new\_daq directory and named “config.ini”
  + Ensure drive mounts and dump\_baseband and dump\_spectra run.
* Power off readout box.

Readout system should now be ready for drone operations.

\*\*\*From here on the instructions are applicable with or without a full ALBATROS station\*\*\*

* Perform normal drone preflight procedures.
* *Check all accessible SMA connectors on the drone’s payload before and after every flight.*

The following are general procedures to perform a complete series of mapping sorties. Flights can be tailored to specific needs of each mapping outing.

* Use the drone to measure the antenna’s lat/lon. Record this.
* Create a flightplan with the drone hovering directly over the antenna for 5 minutes at altitude (ideally 200 ft). Upload flightplan to the drone.
* Power on the transmitter but not the chopper.
* Have the drone takeoff and perform the flight (this is the “cal flight”).
* With the drone hovering over the antenna, power on the readout system and allow to autotune.
* Once autotuning is complete, take control of the drone in position mode and hand-fly to a landing.
* Check ADC bit numbers.
  + May need to tune the RF chains or the drone’s emitter
  + Repeat the cal flight as necessary.
* Power on the chopper.
* Perform the following flights (use saved MARS flightplans as references, flightplans can and should be created ahead of time and the pattern simply moved to the measured antenna position on-site). There will probably need to be 2-3 breaks to charge drone batteries (can take up to 1.5 hours):
  + Star pattern used for a quick check (~6 mins).
  + Center beam raster (~30 mins).
  + Orthogonal center beam raster (~30 mins).
    - Probable battery charge break here (~1.5 hrs).
  + Side-lobe raster (larger pattern but more spaced out, ~30 mins).
  + Orthogonal side-lobe raster (~30 mins).
    - Probable battery charge break here (~1.5 hrs).
  + “Disco ball” and roll/pitch flight: hover the drone at various positions and altitudes, yaw the drone 360 degrees and move the drone laterally to make it roll/pitch, this is to check polarization effects (~5 mins).
  + Re-do the cal flight with the emitter and chopper powered off. This is in preparation for the following drone RFI flight.
  + Drone RFI flight: flight with emitter/chopper powered off to try to gauge the drone’s own RF output. Fly either a simple cross or star pattern as time/battery permits.
* Power down / cleanup.