RTK vs. PPK EXPLAINED

What are the differences and why does Headwall utilize PPK for hyperspectral imaging?

RTK = Real-Time Kinematics
PPK = Post-Processing Kinematics

Headwall’s and most other commercial Unmanned Aerial Vehicles (UAVs), also known as drones, rely on the Global Positioning System (GPS), as well as an onboard Inertial Measurement Unit (IMU) for navigation. Without knowledge of where the drone is, it is impossible to fly to an exact location. And the more accurate the geolocation information, the more accurate images from hyperspectral data can be, even of challenging three-dimensional terrain.

Two Methods to Achieve Greater Accuracy

RTK and PPK are both methods to improve the geolocation accuracy of GPS/IMU measurements. The ability of a GPS/IMU to accurately measure its position is limited by its ability to accurately measure timing signals from GPS satellites. Interference between satellites and the GPS receiver often result in measurement errors. The interferences that cause these measurement errors will be approximately identical for all nearby GPS receivers. Therefore, a common method of correction is to simultaneously measure the GPS position of a nearby stationary GPS receiver (a base station) with a known position. The GPS measurement offset is the difference between the base station’s known position and its measured position. Applying this measurement offset to the moving GPS/IMU onboard the drone greatly increases its accuracy.

RTK, by definition, is done in real-time. Therefore, the measured positions of the base station must
be transmitted to the drone. This requires a stable connection between the base station and the drone during the measurement. For the drone this requires an extra antenna and receiver, increasing the payload complexity and Size, Weight, and Power (SWAP). RTK will fail if the connection to the base station is broken. The base station also will require an additional transmitter and antenna. This requires an additional up-front investment.

PPK, by definition, is GPS/IMU data post-processing. PPK applies the same offset correction as RTK, but this is followed by several additional post-processing steps to further increase the measurement accuracy. Thus, PPK will result in more accurate GPS/IMU measurements than RTK. PPK does not require a connection between the the base station and the drone. This simplifies data collection. If the user does not have a portable base station, a connection to the internet is required to download base station and ephemeris (satellite orbit) data. If a user has their own base station this processing can be done more rapidly and for areas where Continuously Operating Reference Stations (CORS) may not be present.¹

PPK: the Obvious Choice for Hyperspectral Imaging

Headwall stores hyperspectral data on board the drone during airborne data acquisition. Headwall does not support in-flight data transfer: in fact, the wireless bandwidth required to transfer raw data would quickly overwhelm systems designed for lightweight drones. So the user needs to land and transfer the hyperspectral data from the solid-state drive (SSD) to a computer for data processing and analysis. Using current technology, high-resolution airborne drone-based hyperspectral data cannot be analyzed and exploited in real-time. Therefore, the advantages that real-time GPS/IMU corrections provided via an RTK system currently have no benefit.

Headwall offers a high-performance GPS/IMU with PPK. In most locations, the CORS network can provide the necessary correction data for PPK. However, the user needs to wait approximately 24 hours for CORS data to become available. A Smart Target base station made by Trimble can be purchased through Headwall to enable PPK correction in areas without CORS network coverage. As part of the pre-flight and post-flight protocol, the base station remains stationary and continues collecting data for at least 15 minutes after the flight to ensure accurate PPK correction. Once the base station is plugged into a computer, the data is available right away, often under an hour after landing the drone.

¹ The CORS network is a network of base stations operated by the National Geodetic Survey (NGA) that provides publicly available base station data.