

The concept of building a ground control archive grew out of the fact that CompassData was receiving multiple requests to acquire new points in the same areas from several of the large raster imagery providers. W. Brant Howard, CompassData founder and CEO, realized the company could reduce the cost to the end user by maintaining ownership of the data sets and then repeatedly licensing control to the geospatial community.

Howard's vision was to continually build the archive and enable organizations to rapidly produce imagery and GIS mapping products without revisiting the same real estate over and over again. As chief Control Freak, Howard has set a goal for CompassData to become the host for the largest ground control library in the world by collecting data and reselling control from qualified partners around the globe.

The concept has caught on in virtually every sector of the image processing and photogrammetry industry. CompassData now counts dozens of satellite imagery and aerial photography firms and photogrammetric service professionals among its clientele.

Ground control is crucial to the rectification process because the surveyed points are used to accurately tie a remotely sensed image to its true location on the Earth's surface. In the orthorectification process, the real world coordinates of all other points in the imagery are calculated based on the locations of the control points. The geometric quality of the entire orthoimage is derived directly from the accuracy of the ground control. This means the quality of any application built upon the orthoimage depends on the control point accuracy as well.

The Microsoft Virtual Earth office in Boulder, Colorado, obtains a large volume of ground control data through CompassData for orthorectification projects, according to Jason Setzer, Microsoft Virtual Earth program manager. "It has been impressive to see them going to other regions of the world to collect points," he said.

"Aerial survey firms are also among the growing users of ground control," said Schlatter. "They use the points as back-up ground control in case their onboard GPS or inertial measurement units (IMUs) fail during flight."

She explained that aerial photography companies buy the points over project areas as insurance against disruptions of the navigation equipment, which can sometimes occur without notice in the air. The cost of purchasing a set of archived control points is much less than the expense of having to mobilize an aircraft to re-fly a project area.

Collecting New Points

Aside from the growing demand for quality ground control, CompassData owes some of its success to the fact that collecting the points is a difficult and sometimes dangerous process. Most geospatial companies simply don't want to deal with the technical and logistical problems that collection entails. In recent years, Control Freaks crews have faced down marauding rebels, angry land owners, suspicious military officials and an uncooperative Mother Nature, all in the name of ground control.

"Access to private property is the biggest obstacle in North America," said Hayden Howard, CompassData field services manager. "But we've literally had crews chased by armed bandits in other parts of the world."

Under ideal conditions, however, a ground control survey begins peacefully at CompassData headquarters. In the first steps of a custom collection, the client sends imagery of the project area. Typically, the client marks the images indicating where it would like the points to be surveyed. For a small town or city, the total number may be 10, but larger metropolitan areas will require up to 50 or more points. In most cases, the target collection zones are selected at even intervals throughout the AOI.

The Control Freaks team then draws a 500-meter-radius buffer around the desired point location and

begins analyzing the imagery for photo-identifiable features that will be easily found on the ground. The best features are geometric shapes on objects likely to remain in place for many years without being overgrown by foliage, such as the intersection of two sidewalks on a street corner. At least one feature is selected in the photo within each buffer zone.



A GPS unit set up on a photo-identifiable point in a road.

For locations in North America, a CompassData Control Freaks crew usually performs the work. Outside of the U.S., the firm has established relationships with GPS survey crews in South America, Europe, Asia, Australia and Africa, which can usually perform the work less expensively due to their proximity. These partners adhere to stringent collection specifications established by CompassData to deliver a standardized product. The in-country teams also have insight into issues relating to local customs, political situations and safety concerns, which greatly facilitates point collection. With assistance from these international partners, the Control Freaks archive contains points from Afghanistan, Myanmar and several African nations that are otherwise inaccessible.

Surveying requires an occupation time of about 20-40 minutes. At the end of each day, the technicians upload the collected location points into a laptop computer for differential post processing. In the United States, differential correction points are usually obtained via the Internet from freely available public GPS base stations or a mobile base station occupying existing control monuments.

"Sub-meter collection results in control points with 0.5-cm horizontal and 0.75-meter vertical accuracy," said Howard. "We also offer decimeter-level accuracy, which requires longer occupation times and different processing methodology."

Before the Control Freaks leave a project site, the crew also collects a GPS reading on a National Geodetic Survey monument. This becomes the corrected process point which enables the team to calculate the quality of the other ground control collected in the area. The technicians generate an accuracy report for each set of points, which comprises the metadata that end users need during evaluation and processing.

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