Precise Airborne GPS Positioning Alternatives for the Aerial Mapping Practice

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SUMMARY

Positioning information derived from GPS measurements has become a reliable component of many of today's aerial mapping systems. However, one of the logistical limitations commonly faced when using GPS for airborne mapping is the need for continuous data collected by a GPS receiver at one or more base stations in the area of the survey (e.g. having a station within 30-50 km of the aircraft at all times). While the use of such data is a means of meeting the accuracy requirements of today's most demanding large-scale aerial survey applications, establishing a base station is often a difficult task when surveys take place over remote or inaccessible terrain. Further, even when dedicated base stations are established, the continuity of the data is not always guaranteed as a result of environmental effects, receiver error, or human error. With these points in mind, the objective of this paper is to evaluate the potential of deriving reliable and accurate estimates of the position of a survey aircraft without the establishment of dedicated GPS base stations. Three approaches have been used here. The first approach is to make use of data available from existing Continuously Operating Reference Stations (CORS) networks to estimate the position of the aircraft. While such stations are often at a considerable distance from the survey area (e.g. 50 to 500 km), they are often large in number and their data is usually freely available. The second approach is using the IGS products, where the precise orbits and the satellite clock corrections are obtained after the fact and used in a single point positioning mode. The third approach is using the satellite-based differential corrections available in real-time. A number of real data sets from real mapping missions that took place in the last three years in the USA and Japan have been used in this analysis. Preliminary test results and analyses are presented and discussed in some detail. Immediate benefits of these approaches include precise positioning for aerial survey applications such as GPS-assisted aerotriangulation, and the generation of Exterior Orientation parameters for direct georeferencing for aerial film or digital cameras, LIDAR, and SAR.