Mapping Matters

Your Questions Answered

The layman's perspective on technical theory and practical applications of mapping and GIS

By Qassim A. Abdullah, Ph.D., PLS, CP

Q: I have a second generation 6-inch GSD orthophoto project. The client is providing a 5m DEM. We do the flying with a LEICA ADS40 aerial digital camera. However, for the AT, the client is requiring that I get control points from last year's 12- inch GSD orthopohoto imagery covering the same area. For my AT, in general, I use 1/3 GSD for standard deviations on surveyed ground control points. Also, I can easily identify two control points from a very reliable source. What standard deviations do you recommend that I use for this project?

Anonymous, Tampa, Florida

Dr. Abdullah: I would like to clarify the term "2nd generation ortho photo" for some of the readers who are not familiar with the term. A "2nd generation ortho photo" is a term we use to describe the production of an ortho photo that is produced from new photography and 2nd generation ground control points derived from existing maps or ortho photos and existing elevation model data (DEM). There is always a need for this type of product as long as the accuracy budget allows for new orthos with degraded accuracy since it is less expensive and faster to produce. When I design a "2nd generation ortho photo" project, I never guarantee accuracy better than the accuracy of the map and the DEM used to extract the GCPs, which in your case are the 1 ft. ortho photos. For 1 ft. ortho photos, you can assume the Root Mean Squares Error (RMSE) of the horizontal accuracy for that scale of ortho photo (1"=200) according to the ASPRS standard is ±2 ft. In addition, I evaluate the elevation accuracy from which you are going to extract the elevation or height for the GCPs. If the DEM is a USGS DEM for example, then the published accuracy for such is about 7 meters as RMSE. If it is coming from a lidar surface, which is usually accurate enough to support 2 ft contours, you will expect much better accuracy (RMSE around 15 cm) from the newly generated ortho photos and so on. I do not recommend that you commit to better accuracy than the one I stated as you need to be very careful with 2nd generation products despite the fact that new sensors are equipped with technologies to precisely measure position and orientation of the sensor. In your case, and if you have a decent quality DEM, the new ortho photos will nicely fit the client's old 1 ft. ortho photos if that is all they care about, assuming that the old ortho photos met the ASPRS accuracy standard when produced at the time. However, the 2nd generation ortho photo generation from ADS40 imagery will probably deviate from the above rule and you may find out that your new ortho photos are more accurate than the source ortho photo used in extracting the 2nd generation ground control points. This is due to the heavy reliance of the ADS40 sensor on an accurate Inertial Measurement Unit (IMU). Unlike conventional aerial triangulation, where the final solution greatly depends on the accuracy of the ground controls points, an airborne GPS-controlled aerial triangulation minimizes the reliance on the ground control points and its accuracy. The aerial triangulation solution for ADS40 imagery can be weighted to rely more on the GPS and IMU data than the ground controls, in which case you may find your 2nd generation product is more accurate than the source data that you generated control points from, especially if your existing elevation data support such enhanced accuracy.

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Q: I would like to know in terms of spatial resolution if satellite data will replace aerial data in the near future.

Anonymous, Hyderabad, India

Dr. Abdullah: In the literal sense, yes it can in the future as the sensor technologies are advancing so rapidly that, without doubt, in the coming years civilian satellites will be able to collect high resolution imagery comparable to the aerial cameras. However, the satellite efficiency is not only related to the spatial resolution but its production reliability and tasking is highly associated with the sky conditions over the project areas. Cloud and other weather conditions tend to limit, if not halt the satellite's capability as an imaging tool. Covering large projects or wide areas can take years to assure cloud free coverage when using satellite sensors. In many instances, satellite imagery may be found very effective and competitive with the aerial imagery especially when there are no restrictions on the time frame of collection. This is not the case with most aerial imagery, where timing and speed are essential to the success of the project and to meeting the client requirements. Based on the above, aerial imaging will always be around no matter what the satellite imaging resolution is going to be in the future.

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