

Mapping Matters

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

Your Questions Answered

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

Question: I have a 500-foot wide corridor project 50 miles long that will be mapped for engineering, 1"=25' and 1' contour mapping from 1:3,000 photo scale. The customer wants to include airborne GPS (ABGPS), but I don't think it is accurate enough.

Frank M. Sokoloski, Photogrammetry Manager, Rice Associates, Inc., Richmond, VA, USA

Dr. Abdullah: Before I provide an answer, I would like to analyze the project in question. I assume we are dealing with film photography, based on the given scale of 1:3,000 (or 1"=250'). So, the intended mapping product is a 1:300 (or 1"=25') planimetric map with one-foot contours. From the given scales of photography and the final map, one can easily conclude that the photo-to-map enlargement ratio is 10, which is a bit larger than the traditional six adopted over the years. However, considering all the advancements in recent years in film quality, coordinates measurement using softcopy plotters, and the advanced mathematical modeling using additional parameters, it comes as no surprise that map makers are pushing the limit of the enlargement ratio. As for the vertical accuracy, historically 1:3,000 photography is used to produce a digital terrain model suitable to generate one-foot contours or better, so there is no contradiction there. Therefore, the given photography is suitable to produce the intended products.

If we assume that the client expects to have products that meet the ASPRS Class I standard, then the horizontal accuracy of the product should be 3 inches (or 7.5 cm) as RMSE (assuming the film will be scanned to produce an orthophoto with a GSD of 1.5 inches). As for the expected vertical accuracy, an RMSE of 4 inches (or 10 cm) is expected from the one-foot contours products. The tight accuracy of these figures does lead to a concern about the ability of the ABGPS to ensure the required accuracy.

"Considering all the advancements in recent years in film quality, coordinates measurement using softcopy plotters, and the advanced mathematical modeling using additional parameters, it comes as no surprise that map makers are pushing the limit of the enlargement ratio."

"A rigorous photogrammetric mathematical model combined with quality ground control points can produce photogrammetrically derived ground positions that are more accurate than the raw camera positions determined by the ABGPS."

If we consider that the final map will not be produced from direct orientation (where aerial triangulation is not used), then there is a lot of room for improvement in the photogrammetric process through a rigorous mathematical model that can compensate for some of the problems in the ABGPS. In other words, the ABGPS may be accurate only to 10 cm, but a rigorous photogrammetric mathematical model combined with quality ground control points can produce photogrammetrically derived ground positions that are more accurate than the raw camera positions determined by the ABGPS.

The current aerial triangulation process used today provides a robust solution for the photogrammetric process, where many geometrical imperfections in the camera parameters and camera positions and orientation can be modeled and corrected for. Most aerial triangulation packages on the market today have the capabilities to model GPS shift and drift in an attempt to reduce or remove their effect on the final adjustment. Finally, with proper planning and execution, a reliable ground control network and suitable software, the ABGPS can be utilized in the aerial triangulation process to produce your customer's intended products.

***Dr. Abdullah is Senior Geospatial Scientist at Woolpert, Inc. He is the 2010 recipient of the ASPRS Photogrammetric (Fairchild) Award.*



The contents of this column reflect the views of the author, who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the American Society for Photogrammetry and Remote Sensing and/or Woolpert, Inc.