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Once Upon a Time ...



Cliff Mugnier, C.P., C.M.S.

A few years ago, I received a telephone call from an attorney (not really named "Henry" in this factual retelling of the story), in the Northwest who told me he had been seeking a qualified individual to do some computations with photographs that had been taken on March 11, ten years prior. He went on to say that after trying several places, he called Eastman Kodak Company and they suggested that he contact me. Henry asked for my fax number so that he could send photocopies to me. A few minutes later, I received three low-resolution black and white images. Henry soon called back and said, "I'll bet you don't know what I need?" I replied that he probably wanted the time of day computed for each photo, and Henry conceded that I was correct.

We discussed rates, agreed on a payment schedule, and I explained that Forensic Photogrammetry is just like aerial mapping from photos in that it's a process of three-dimensional interpolation within a volume of known control points. I told Henry that the location of

his photos was quite a distance from Louisiana, and that he needed to contact a local land surveyor to conduct some fieldwork for me. I estimated that a reasonable rate might be for a couple days' work and Henry said he'd discuss the likely expenses with his client.

Wish List

A couple days later, Henry called back; he said that the original photographic prints (no available negatives) were in the mail to me and that he had received his client's authorization to proceed. A land surveyor, who he was retaining, would soon be calling me for detailed instructions. We had a deal, but the specific purpose of his client's need for the time each photograph had been taken on that long past day in March was to remain a secret. The land surveyor called within a few days, and by then I had received the original photographic prints. I explained that I was going to need a geographic position with an accuracy to within a hundred feet of each building visible in the three photos, and

that I was going to need the orientation (true azimuth) of the buildings in the photos to an accuracy of about twenty arc seconds. Also, there were a number of details in the photos regarding distinct points (cracks in wood, gouges in walls, nicks in a door, wood posts and railings, etc.), of which I was going to need positions in terms of a local X,Y,Z coordinate system to be established by the land surveyor. With the coordinate system set up such that the X-Y plane was aligned with astronomic north, then the azimuth of the buildings and the location of known points, etc. could then be used to determine the azimuth of shadows in the photos after correcting for the tip, tilt, and azimuth of the camera for each exposure.

I prepared overlay sketches of each of the photos with discrete points circled such that the distribution of points covered each photo more or less evenly. Those sketches represented what I hoped the survey crew would still be able to find after ten years had passed! Ha! Fat chance, I thought. A few weeks

passed after I sent my wish list to the surveyor. Then one day I opened my mailbox to find return package which contained almost my entire wish list! It seemed that the administrators of the boy's camp where the photos were taken had not felt the need to paint or make any repairs to the camp's equipment. All of the bumps, nicks, scratches, gouges, etc., were still there to be surveyed ten years later! The positions of the buildings and the azimuths of the buildings were determined by a subcontracted surveyor with dual-frequency GPS receivers rather than being determined with classical techniques. That was an arrangement agreed to between the land surveyor and Henry. The accuracy of the determination was certified; therefore it was proper for forensic use.

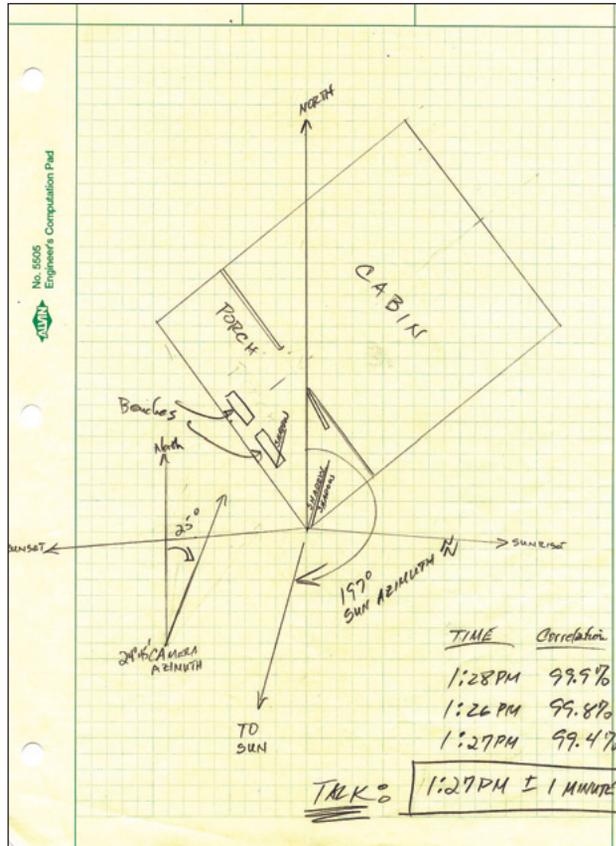
Analysis

The photo prints were scanned and then measured with a softcopy photogrammetric system of my own. The photogrammetric analysis solved for the orientations of the three individual images based on the control provided by the surveyors.

The shadow edges were also measured, and when their coordinates were computed onto the projected floors, a linear regression was computed for each shadow. I used the website for the U.S. Naval Observatory, and computed the solar ephemeris for that day in March long ago. The azimuths of the shadows in the three photos were then used to narrow down the specific times of day for each photo:

The time of day for each photo, corrected for tip, tilt, and swing was computed with the greatest uncertainty being less than 10 minutes of time.

I called Henry and told him to expect a facsimile of the three hand



computation sheets for the three photos. About 15 minutes later, Henry called back and glumly said that my results matched the exact times of courtroom testimony of years ago. The physical evidence (the three photos) was not going to provide a "new-found" alibi for the person that had been convicted. Conclusion: Henry paid the bill, and our work did not constitute a "Get Out of Jail Pass" for his client. Forensic Photogrammetry works, it just doesn't always provide the desired answer for the client. ♪

Cliff Mugnier is a Board Certified Photogrammetrist and Mapping Scientist (GIS/LIS) and teaches Surveying, Geodesy, and Photogrammetry at Louisiana State University. He is also a Contributing Writer for the magazine.

