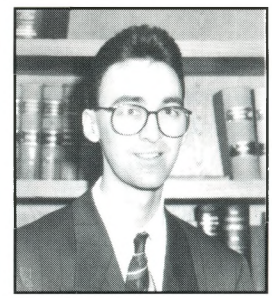
Photogrammetry in Focus
Project Planning



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The business of photogrammetry involves the acquisition of stereo imagery and compilation of data into a client specified format. Obviously, this is a simplified description of a more complex process. With this article, I will endeavour to quantify both the process and requirements of photogrammetrically produced work. This should clarify the planning requirements for the projects that a photogrammetrist performs for his or her clients.

Clients come in all shapes and sizes. There are large government agencies that request large areas of mapping and there are small businesses that request individual maps. Other clients include surveyors, engineers, land planners and utility companies. There is also a peripheral group of clients such as archaeologists, lawyers, and ski hill operators.

The majority of clients are interested in topographic mapping although there are some clients that request single maps or custom photography. Even smaller jobs may consist of aerial photography of a private property or a custom map of the neighbourhood to hang in the den. I will not disregard these small jobs, but for this discussion, I will concentrate on the work generated for larger clients.

The photogrammetrists product for the client is created by his or her staff in a production environment. The majority of the work cannot be automated by machines although computers have (as with many professions) increased the rate of production. This is not to say that a map is an assembly line product, however, the larger the job, the more streamlined the process can become. Different clients can have widely varying specifications. These differences often require changes to production methodologies. With this in mind, the larger the job, the more refined the process and work flow can become.

The typical work flow for topographic mapping is: acquisition of aerial photography, field surveying for horizontal and vertical control, aerial triangulation and numerical adjustment, map compilation, editing, revisions, quality control and finally, the product delivery, whether that is cartographic hard copy maps or digital mapping files. Other types of production activities include orthophotographic and photomosaic compilation, mapping data translations or conversion, digitizing of existing hard copy mapping and attributing loading of nongraphic data to graphic digital mapping files.

Photogrammetrically produced work requires careful planning and consideration on behalf of both the client and the photogrammetrist. It has been said that more than half of Geographic Information System (G.I.S.) projects undertaken in the last ten years have not realized their projected benefits. Also, up to 80% of the implementation cost of a G.I.S. are base mapping related. The planning and purchase of base mapping data is therefore a primary concern of most G.I.S. implementations.

The most important consideration in planning a mapping project must be the eventual use of the data. For example, an engineering company requiring mapping for road design and construction will use highly accurate 1:500 scale mapping whereas a Conservation Area requiring mapping for a river watershed will use more general 1:2000 or 1:5000 scale mapping. Also, the engineering mapping would probably require a Digital Elevation Model (D.E.M.) for three dimensional spatial analysis whereas the topographic mapping would probably require contour lines for cartographic display.

The eventual use of the data dictates the accuracies of the data and the extent of mapping. If a data set requires an absolute accuracy of 10 cm., the scale of the photography would have to be restricted to 1:4000. With a larger photographic scale, ground coverage per photograph decreases and the cost of mapping increases. Therefore, to minimize costs, the client should be willing to compromise the compilation area, but not the mapping accuracies.

Another consideration during the planning stage should be the type of equipment the client will use to manipulate and store the digital mapping data. The collection process can generate vast quantities of data and care should be taken in selecting mapping requirements. A client may not be able to load large data files or benefit from extra peripheral data. I should mention that in the past, this consideration was more important. However, computers have been increasing in speed two fold each year, and the price and size of systems has decreased by half in the same time frame. It has been predicted that this trend will continue for some time to come. With this in mind, a client may opt to receive larger data sets organized in layers of data that can be stored for future use.

Whether mapping data is delivered in '2D' (planimetric data only), '2 1/2D' (contours and spot heights having an elevation attribute) or full '3D' (each element having an x,y and z attribute), it should be noted that the majority of stereoscopically produced work is now captured in full '3D'. In addition, computer software and hardware is now more capable of handling full '3D' data. Therefore, it may be of benefit in the long term to receive a fully '3D' product for applications such as topological studies where currently only a '2D' data set is required.

Maintenance of the topographic data set should be considered during the initial planning stage. Topology and map content obviously suffer temporal change. To upgrade existing mapping, digital orthophotography has gained popularity with the advent of faster computers. Orthophotography by definition has been 'rectified' so as to be planimetrically correct. This product can be used to augment existing vector mapping by displaying updated photography behind the older mapping. Changes in mapping features are easily distinguishable and correctable with this type of product.

Another method of map upgrade and maintenance can be field survey with the total station. This data collection method can be highly accurate but can also be expensive. Whereas a stereo compilation operator can quickly 'trace' features in the stereo model, the field crew must meticulously visit each feature with the target and record a data point. One advantage of this work is the ability to collect data at any time. The mapping process requires photo acquisition during periods of snow and leaf free conditions. A field crew, for the most part, can operate at any time of the year.

The highly accurate, and therefore expensive use of total stations for map maintenance restricts this type of work to 1:500 or 1:1000 scale products. Even then, care must be used to capture only data that requires upgrading.

Finally, a client should be aware of existing topological data. There is mapping coverage of one form or another for most of the province of Ontario. The federal government has mapping data available at 1:250000 and 1:50000 scale and the provincial government has 1:20000, 1:10000 and limited 1:2000 scale data. In addition, local municipalities and towns have mapping in hard copy or digital format at varying scales. If this data is appropriate to a client's project, the photogrammetrist can provide translations to different digital formats and can convert data to different geodetic datums. In addition to existing mapping data, there can also be existing nongraphical database information such as census data or street address data. If this data is appropriate, a photogrammetrist can transfer and upload the data to suit the requirements of the client.

The previous notes examine the process and requirements of photogrammetry. In order to successfully use photogrammetrically produced data, careful planning and attention to detail are essential. Good communications between the photogrammetrist and the client will ensure a good foundation to a project. In addition, continuing communication throughout the project will allow fine tuning to the mapping process.

Using appropriate data captured in a cost effective manner, clients can realize many benefits from the products of photogrammetry.

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In the next article, I will examine digital topographic mapping at various scales. I will include examples of how this data can be used by the land surveyor or his or her clients. If you have any specific questions or comments regarding photogrammetry, please send your correspondence to the Association.

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