

## Market and Economics of Digital Photogrammetric Systems

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The technological state of development of digital workstations has been thoroughly discussed in the literature over the past two or three years, and writers have also raised the economic issues which seem at present to favor retention of analytical photogrammetric systems. Such preference is justified by the high cost of introducing new technology without a clear economic advantage for production. This case was well put by Colomer and Colomina when describing the digital system at the Catalonian Institute of Cartography at a recent meeting of the Photogrammetric Society in London. There is no doubt that the technology is already in place to produce digital products from digital data with the same efficiency as from hardcopy images on analytical systems. At present, a major economic disincentive is the problems arising from the stage of scanning aerial photographs. These include the cost, the quality, and the difficulty of handling the data. No doubt these problems will also be solved in the not too distant future as the problems are recognized and tackled by research groups and by manufacturers.

The integration of photogrammetric systems with image processing systems and GIS is also well advanced, and packages such as ERDAS and ER Mapper offer significant photogrammetric functionality. The R-Wel Desktop Mapping System offers scaled down software at the less expensive end of the market. This development means greater exposure and greater acceptability of photogrammetric software which can only help the spread of the main stream systems.

The major breakthrough required is robust, effective automation. Automation is already being introduced into the interior and relative orientation in systems such as the Zeiss PHODIS, and is operational for the production of digital elevation models (DEMs) in many products, but the essential requirement is for feature extraction tools which will make a significant difference in the compilation and revision of databases. In recent years it has been realized that a philosophy for feature extraction is needed, and this has been developed and propagated by workers such as Forstner (1993) and Schenk (1993) and by Fritsch (1993) and Molenaar (1991) for GIS. A range of tools have been brought into play as it has become clear that bottom up techniques will not be satisfactory and that information from GIS will help in the identification of objects. Already, automatic ground control point identification (Strunz *et al.*, 1994) and image registration (Lee *et al.*, 1993) is claimed, and work is in progress on the use of features rather than points for orientation.

New applications, for example, 3D modeling of urban areas, have opened up new ideas and new products, such as digital orthophotographs, and have created an urgent need for tools for the non photogrammetric user to use to extract data. There is now a large amount of research which is approaching a critical mass moving towards viable solutions.

New ideas in other areas are also assisting development. For example, tools for the computer-human interface, such as a mouse for 3D data manipulation — a Fledermaus (Ware, 1994) — are making possible easy visualization of large data sets and also the validation of data. Another development is the availability of high resolution satellite data. Most of the work on feature extraction has concentrated on aerial photography because of the resolution of individual buildings. Now, with Russian DD5 data, and in the future with commercial U.S. satellites, high resolution digital imagery will be available with similar characteristics. This should also create more demand for systems to handle and extract information from such imagery. These high resolution data are designed for input into GIS; indeed, the GIS market is cited as a main driving force behind launching such satellites. Spectral resolution is not the main interest, but spatial resolution, and hence accurate referencing, is of critical importance. The fact that these data are being produced as a commercial operation will put a great pressure on the producers to provide tools for adding value to the data, and clearly to convert the data to hardcopy is not a sensible option.

Digital photogrammetric systems are here to stay. The next barrier to come down will be less expensive scanning with easy data management. After that will come tools for feature extraction and the integration of the information into GIS. Full automation may take a little longer.

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