

# Photogrammetrically Derived Products

By Tom Noble, Cartographer; Neffra Matthews, Geographer; and Michael A Marchase, Cartographer; BLM, National Science and Technology Center

A variety of maps for use in land use planning and decision making can be developed utilizing both aerial and close-range photography. The photogrammetric process enables the interpretation of imagery and the collection of data necessary to produce reliable maps that give land managers confidence in their decisions and are defensible in court.

These data customarily take the form of topography (terrain or land surface) or planimetry (such as streams, transportation routes, vegetation, and cultural information). When collecting topographic or terrain information, the compilation process can be done manually—where the photogrammetrist digitizes individual contours lines, or automatically—where software generates x, y, z locations. Planimetric data require the photogrammetrist to manually identify the feature to be collected.

## Digital Terrain Model

A digital terrain model (DTM), provides a virtual representation of the terrain surface. A DTM can be produced in a manual or automated mode. Manual mode is a process in which a specialist observes each point in accordance with a specified spacing and records its location, both horizontally and vertically. Automated digital terrain extraction is commonly referred to as autocorrelation or digital image matching. It is a process in which sophisticated software matches pixels (picture elements) with unique spectral and geospatial values in one digital image to similarly valued pixels in the adjacent image of the stereo pair. The addition of more information, such as breaklines (a polyline in which each vertex has its own x, y, z, location) may be required to aid the software in determining pixel matches in difficult to interpret areas.

## Orthophoto

All raw photographs have inherent distortions. However, an orthophoto is a photograph that has been corrected to eliminate distortions and can be utilized as a map. The effects of camera tilt and relief displacement (features at higher elevations are displaced away from the center of the photo) are the main causes of these distortions. To eliminate these, the ground geometry is re-created as it would appear from directly above each point in the photo. This is accomplished by applying a process called differential rectification to each pixel in the image. The resulting corrected image can be utilized as a map.

Producing an orthophoto can be a valuable tool in the analysis process. The orthophoto can be printed as a stand-alone product or displayed as a backdrop with other spatial information. Perspective views can be produced by draping the orthophoto image over the terrain surface. This process allows one to make a “virtual” visit to the area. The parameters of this virtual surface can be further manipulated to enhance, exaggerate, or isolate a certain feature or area of the image. Topographic contour lines can be generated by using DTM, breakline, and planimetric data. The resulting contour can then be draped onto the orthophoto in three-dimensional space. This virtual visit can be extremely useful for land use planning decisions and communicating with the public.



The intrinsic accuracies of data captured from the large-scale photogrammetric process permit the specialist to manipulate and analyze the data in many different ways. These data can be processed with computer-aided design, geographic information system, or other specialty software. These specialized types of software packages can be used for drainage, floodplain, and aspect analysis. Profiles, volume calculations, cut and fill quantities, final grading, and slope information can also be generated using these data.

## **Contact**

Tom Noble, Cartographer  
Bureau of Land Management  
National Science and Technology Center  
Denver Federal Center  
Building 50, P.O. Box 25047  
Denver, CO 80225-0047  
Phone: 303-236-0445  
Fax: 303-236-6564  
Email: [Tom\\_Noble@blm.gov](mailto:Tom_Noble@blm.gov)