Map Publishing

Enhanced electronic map publishing systems offer mapmakers new options for producing maps

By Michael Sena

Electronic map publishing systems—which convert a mapping system's digital cartographic database into final map graphics and, eventually, into color-separated films for plate-making and printing—aren't new to the mapmaking industry. In fact, mapmakers have been using such systems to automate the map-production process for over a decade.

Recently, however, the two major vendors of electronic map publishing systems—Barco Graphics (Gent, Belgium) and Intergraph (Huntsville, AL)—have significantly enhanced their product offerings, while others, including ESRI (Redlands, CA) and Scitex (Bedford, MA), have enhanced their cartographic software to allow for greater data input and output flexibility. As a result, today's electronic map publishing systems are providing mapmakers with expanded functionality and more sophisticated options for producing maps.

An electronic map publishing system is to map production what an electronic prepress system is to newspaper or magazine production; both systems convert graphics and text into reproducible form.

The benefits afforded by an electronic map publishing system are realized in the final step of the three-phase digital map production process. In the first phase, a digital cartographic database consisting of lines, areas, symbols, and text is created; in a full Geographic Information System (GIS), an associated database management system is used to store additional attributes for the cartographic features. In the second phase, the features and attributes are maintained, and in the third phase, the database is converted into map graphics, which are converted into color separations for printing.

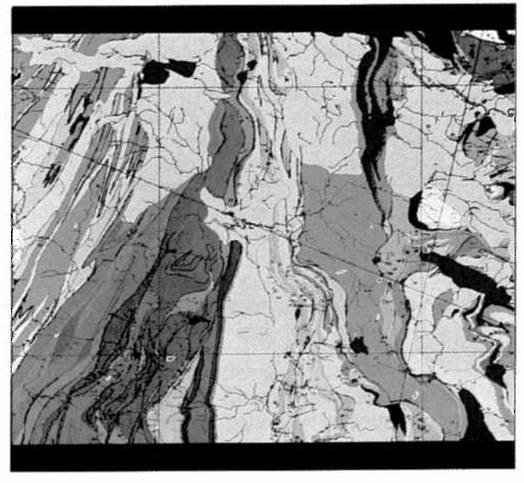
GISes and computer-aided mapping systems address the first two phases of this process. But without a tightly integrated film recorder that can produce an image of at least 30-by-40 inches—or the ability to communicate directly with such a device—these systems offer only a partial solution for digital map publishing. This is where the electronic map publishing system enters the picture.

A map, whether created manually or with a computer, is comprised of several color overlays or layers, each containing a portion of the finished map, such as blue lakes, black text, and red line work representing roads. A complicated map can consist of several hundred data layers.

Using positive artwork, the traditional mapmaker must create masks in a darkroom for each layer to block out ink where only one tint should print. Then, the individual layers must be sandwiched with dot screens to create a set of four composites for the printer. For a complicated map comprised of a multitude of layers, this process can be extremely time-consuming and error-prone.

Electronic map publishing systems eliminate the tedious darkroom process of creating symbol masks and color

The on-screen menus featured with the Barco Graphics Mercator electronic map publishing system enable mapmakers to interactively select screen colors and printing inks and view the changes in real time. Ink control includes screen percentage, screen mesh, and screen angle.



separations. Instead, the mapmaker builds a specification table that defines the map, creates digital masks, text halos, and banded area tints, reverses symbols or text, customizes colors, and performs other manually intensive tasks on the computer using specialized electronic map publishing software. This speeds up the production process significantly, improves accuracy, and saves money.

Barco is the newest company to enter the field of electronic map publishing. The firm, makers of the Mercator Electronic Cartographic Publishing System, emerged last year as a result of the acquisition and merger by Barco of three firms: DISC (which was working on the Mercator system prior to its purchase), Creative Systems, and Aesthedes. Early last year as Barco Graphics, the firm sold its first Mercator electronic map publishing system to the National Land Survey of Sweden.

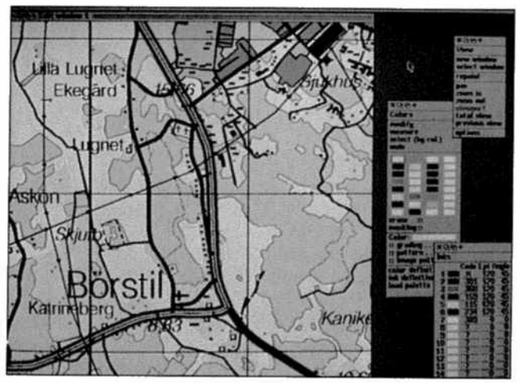
Barco and the Land Survey worked together to perfect the Mercator system, and now the system is in full production on the Land Survey's 1:20,000 map series. When full production is reached, the Mercator system at the Land Survey is expected to generate up to 10,000 pieces of film per year.

The Mercator system serves as a vector database-to-raster cartographic output system and is the link between the map production database system and printed film output. The system uses DEC VAX and MicroVAX computers connected to Barco's BG-2200 workstations and BG-3900 scanner/plotters.

The BG-2200 workstation features multiple RISC processors, 1340-by-1024-pixel resolution, and 28 memory planes. With a Motorola 68040 32MHz applications processor and 32M of internal memory, the workstation can download and operate in real time large map files in high resolution.

The BG-3900 scanner/plotter produces film output in resolutions of 1000, 1270, 2000, 2540, and 4000 pixels per inch at an output speed of 4800 revolutions per minute. This means that four 30-by-40-inch films can be plotted at 2000-dot-per-inch resolution in about one hour. The BG-3900 also features automatic film loading. Considering the speed of the BG-3900, unattended plotter operation is a significant advantage.

Intergraph first entered the electronic map publishing field about three years ago, when it and its Optronics subsidiary were in the developmental stages of electronic map publishing with VAX-based software.



Map publishing at the Geologic Survey of Norway is accomplished on Intergraph's system, which offers software to collect and organize data, create symbols and text, and generate WYSIWYG displays of maps prior to final output. Files are then plotted on Intergraph's MapSetter film recorders.

Today, Intergraph is the only company offering an electronic map publishing system with an integrated computer-aided mapping/GIS front-end solution that allows mapmakers to create a digital cartographic database by digitizing, scanning, image processing, and raster-to-vector conversion; prepare the data for output; and plot a map on an Intergraph-supplied laser film recorder.

Intergraph recently ported its system to the Intergraph RISC environment, with Microstation software as the base graphics and geometry subsystem. Configured around Microstation in Intergraph's Modular GIS Environment (MGE) are numerous application-specific software modules. Two of these, MGE Map Finisher and MGE Map Publisher, are of particular interest for electronic map publishing.

MGE Map Finisher compiles and symbolizes the map, and then displays the final plot on the workstation to let the mapmaker see the results before plotting. MGE Map Publisher provides tools for complete map production, eliminating the expense incurred in creating color proofs that normally are used to verify content quality, registration, and masking. Instead, mapmakers generate their color-separated, screened, composite films directly, using one of Intergraph's film recorders, such as the Optronics 5040 or the new MapSetter series, which outputs images in sizes ranging from 20-by-26 inches to 47.2-by-62.4 inches.

Besides plotting film positives for the four-color printing process (cyan, magenta, yellow, and black), Map Publisher can also produce negatives for multi-color lithographic printing.

Three years ago, Scitex's Response 280 Cartographic System represented the only viable option for mapmakers. The system featured vector-to-raster processing, full cartographic specifications, and high-resolution, large-format film output. The Response 280 Cartographic system's proprietary architecture, however, proved to be a drawback for users. Rather than porting the Response 280 software to an updated platform, Scitex stopped manufacturing it and its accompanying ELP Scanner/Plotter in 1989.

Scitex continued to provide software support and full system maintenance, however, and in late 1990 the company released a new version of its cartographic software which opens up the Response 280 system to Postscript data and provides for the transfer of raster data into and out of the system via the

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Handshake format. Postscript and Handshake input allow access to the plotter from other systems, including those from Barco, Intergraph, ESRI, and makers of desktop graphics packages, while Handshake output provides Scitex users a migration path for their raster data to other electronic map publishing systems.

Meanwhile, ESRI is attempting to bring map publishers closer to final film output with its latest software release, Arc/Info Revision 6.0. With this package, users can define final map graphics specifications as a plot file, preview the map on the workstation, or output it to a color plotter. The plot file, converted to Postscript format, can be transferred to an imagesetter or to Scitex, Intergraph, or Barco systems for large-format plotting.

Another software company, Zeh Graphics (Houston), markets its ZPS raster plotting software, which offers a great deal of the symbolization found in electronic map publishing systems. ZPS can convert Intergraph, Arc/Info, or other vector formats to raster formats ready for plotting on Scitex or Optronics equipment and runs on a variety of hardware systems, including Sun Sparcstations, the DECstation 5000/Ultrix, the IBM RISC/6000, and the Intergraph Clipper and Microstation Mac.

While these product offerings are designed essentially for the same task, each provides different features and levels of functionality and accomplishes the task in a slightly different manner.

For instance, unless the map data is Postscript-based, mapmakers using Intergraph's system must process the vector data through Microstation and structure it topologically so it is organized for Map Finisher: Areas must be closed shapes with uniquely identified sides in order to be filled with a tint or pattern, and if an area, such as a park, shares a boundary with a road, the shared segment must be identified as both a park and a road boundary.

The Barco and Scitex systems do not require the use of topologically structured data. They accept graphics input in several formats, including Intergraph SIF, Autodesk DXF, Scitex DIGIT, and Adobe Postscript. Each line segment

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must have a unique identifier for converting the vector data into the desired graphics specification; however, mapmakers can fill an area by placing a point symbol inside the area. The system then replaces the symbol with a spot color and expands the color until it reaches a defined boundary, whether it is an area boundary, road, or stream.

These techniques aside, the major difference between these systems is the way in which the digital database is converted to screened plotting files.

For instance, Scitex reads external vector data and translates the data into an internal vector format (DIGIT). Then, the mapmaker uses a symbol table to convert the vector data to map graphics specifications and to convert ASCII text strings to Bitstream fonts. At this stage, the raster data is a bit-mapped image. A low-resolution image is used for display, but the displayed raster data is editable; and modifications made by interactive raster editing will appear on the final plot.

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Users of the Intergraph system take the data through a number of steps. First, the mapmaker expands feature centerlines using for line widths a predefined feature table found in Map Finisher. This results in a vector file that can be displayed on the workstation with colors that are similar to those used on the final map. The file is then sent through plotting software such as I/Plot, where the data is converted to raster format.

The raster file can then be displayed and edited using I/Image, or it can be loaded into DP/Studio, Intergraph's graphics publishing software. Edits made to the raster data are not reflected back to the vector database. Finally, the mapmaker specifies desired line screen, screen percentage values, and angles using Map Publisher and plots the result on the MapSetter.

Barco Graphics takes another approach. As with the Scitex system, external vector data is converted to Barco internal vector format. The mapmaker builds feature specification tables which define the appearance of the final graphics.

Two Barco raster image processors convert the vector data to raster format: One displays the data, the other plots it. There is no raster editing capability because the raster data displayed on the workstation is not the same as the plotted raster data. Mapmakers can, however, edit the displayed image as vector data, see the change in raster form, and reflect the change in the final plot.

In most scenarios, an electronic map publishing system ranges in price from between $200,000 to $500,000. And it is the cost of the large-format laser film recorder, which produces the films used to make the printing plates from which the maps are printed, that accounts for a major portion of this cost (generally, such devices are in the $150,000 range).

However, a new electronic direct imaging technology will, when fully developed, make it possible to make the plates directly from the data, without producing film. Presstek Inc. (Hudson, NH) has developed such a system which it is testing with commercial printing press manufacturers. Besides saving on the equipment and associated costs of a film recorder, direct imaging uses fewer materials and chemicals, making it an environmentally cleaner solution.

With the options available today, there is little doubt that the use of electronic map publishing technology will increase dramatically in the next few years. As vendors continue to expand the functionality of their products, demand for these systems should proliferate among map producers worldwide. *CGW*