DIGITAL BRIEFING

JEPPESEN ELECTRONIC CHART CLINIC
FIRST IN A SERIES

BY JAMES E. TERPSTRA
SR. CORPORATE VICE PRESIDENT, JEPPESEN

There is magic in the air. No more paper. No more revisions. No more pages with coffee stains. No more pages torn from continuous use. Let the electrons do their work. Let the image project from a screen that is bright at night as well as during the day.

As you can imagine, behind all that magic exists much thought, energy, planning, and manipulation of those bits and bytes to make it happen. This article is the first in a series discussing the new generation of aeronautical charts that are beginning to appear in cockpits.

All Electronic Charts are not Created Equal

Basically, there are three different types of formats for displaying aeronautical charts in electronic format. Let's discuss their formats to help understand why some images look different from others and why some have different capabilities. The three types of electronic chart formats include raster, vector, and data base generations.

Charts that are in raster form have the capability to look virtually the same as an original chart. Charts in raster form are typically loaded into a computer by scanning an original chart and converting it to pixels (picture elements). One of the advantages of raster charts is that they are easy to capture, don't require a lot of original creation since the electronic image has already been created for paper.

The most common examples of raster charts are sectional charts, WACs, and other visual aeronautical charts where the tremendous amount of details that have been accumulating over the years on master maps don't have to be redone for electronics.

When the visual aeronautical charts are scanned in color, the size of the file is incredibly large. As an example, the WAC charts vary in size from about 7 MB all the way up to more than 12 MB. And that is for one chart. Because of the large size of the files, the visual charts are typically stored and kept on a CD-ROM where the full world set will fit on one CD. The WAC charts could be stored in smaller files, but the "crispness" or resolution of the charts would deteriorate and much of the detail would be lost. Another means to reduce the size of the files would be to store less color in each of the pixels but then the end result would not appear as close to the original printed charts.

Geo-Referencing

Thanks to the ingenuity of programmers, scanned charts can be geo-referenced. This means that each location on a chart can be set to recognize its real position in latitude and longitude coordinates and has the capability with software to match signals with inputs from GPS receivers. This capability creates the ability to have a moving map when connected to a GPS receiver that has compatibility with the format of the messages sent from the GPS receiver.

All the above represents good news. So why aren't all charts done in raster? There are numerous limitations that are overcome by other formats.

Fat Pixels

One of the weakest features of scanned charts (besides their size) is that scanned images can be enlarged only a limited amount before the image deteriorates significantly. Each pixel in a scanned map is a finite size.

If the chart is zoomed in a number of levels, each pixel becomes larger and larger. Since each pixel is typically a square dimension, the enlargement of a number of pixels starts to make the image very ragged (in the industry we call that the "jaggies").

In the illustration, you can see that the obstacles, when enlarged, are quite difficult to read with the elevation of 5,884 feet for the twin towers.

Another disadvantage to raster is that the image is what we call a "dumb" image. It lacks the intelligence to differentiate between different elements or items on the chart. Since the file is composed of just a series of pixels, the pixels don't have the intelligence to know if they are a VOR, an NDB, an airport, a body of water, or the title of the chart. This makes it virtually impossible to be able to turn information on or off as it is needed or no longer wanted.

Raster has another significant disadvantage. Many of us who fly airplanes like to have the top of the chart or map that we are using pointing the same way we are flying. I recall flying with a private pilot student on a heading of south while flying parallel to a highway and railroad. While trying to teach chart reading, I was trying to explain that he should look on the chart and note that the lake was to the left of the railroad. Now look outside and the lake was to the right of the railroad. After about five minutes of being confused about trying to identify our current position and flying the cross country, my student took the map and rotated it 180° and now everything to the right of the road on the chart was also to the right of the road looking outside. Much easier.

Raster maps can be used in avionics systems to fly heading up or track up, but when a raster map is rotated, so is all the text. Consequently, the text may be upside down or at some other angle that makes it difficult to read.

Ever fly off the edge of a chart? That happens not only in the paper world, but it also happens in the electronic world with scanned charts. When charts are scanned, the implementation of going from one chart to another can be smooth, depending on the software that is being used. But sometimes it takes quite a while for the adjacent chart to be recognized, to be retrieved from the storage device, and then "edge-mapped" to ensure seamless transition from one chart to the next.

Have you ever noticed when you change from one electronic chart to the next, that not everything lines up, and that the colors are not exactly the same? That happens because printed charts were not designed to be scanned and used electronically from one to the next.

In the next article, we will continue the discussion of chart formats. In this series, we will discuss which electronic charts work in which airplanes, cover the certification of electronic charts, database-driven charts, and explore other issues related to the future of electronic charting.

Jim Terpstra is senior corporate vice president, flight information technology at Jeppesen. His ratings include ATP, single and multi-engine, airplane and instrument flight instructor. His 6,000+ hours include 3,200 instructing. For comments, please Email: jim.terpstra@jeppesen.com