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From Lewis and Clark to Landsat

Digital maps marry past and present.

By Wade Roush

For $140, you can buy a handheld Global Positioning System receiver that will gauge your latitude and longitude to within a couple of meters. But in 1804, when Meriwether Lewis and William Clark ventured across the Louisiana Territory, a state-of-the-art positioning system consisted of an octant, a pocket chronometer, and a surveyor's compass.

But somehow, Clark -- the cartographer in the group -- made do. When San Francisco map collector David Rumsey took his copy of Lewis and Clark's published map of their journey, scanned it into a computer, and matched landmarks such as river junctions against corresponding features on today's maps, he found that it took only a slight amount of digital stretching and twisting to make Clark's map conform to modern coordinates. In fact, Rumsey was able to combine Clark's depiction of his party's route to the Pacific with pages from government atlases from the 1870s and 1970s and photos from NASA Landsat satellites, creating a digital composite that documents not only a historic adventure but the history of mapmaking itself.

To Rumsey, maps are far more than two-dimensional portrayals of landscape; they have the power to send users on intellectual journeys to distant places and long-ago times. Rumsey believes that by using the latest digital technology, we can learn remarkable things about politics, culture, and science, as seen through the eyes of mapmakers. As the Lewis and Clark composite shows, for example, the Indian tribes whose location, size, and economies Clark described with keen anthropological interest would, within half a century, be cast as enemies and herded onto reservations. Putting one map next to another makes such contrasts leap out at the viewer, says Rumsey. "What excites me is context," he says -- meaning the ability, using onscreen tools and the Internet, to juxtapose maps from different periods, or even to examine letters and paintings related to the maps.

Today, visitors to davidrumsey.com (http://www.davidrumsey.com/) can create juxtapositions using the thousands of map images Rumsey has digitized and a toolbox of sophisticated map-browsing programs that he developed in collaboration with Luna Imaging, a digital-archiving firm in Los Angeles. The site, which is in its fifth year and

attracts two million visitors annually, exists because Rumsey is one of those rare collectors whose interest in sharing their collections eventually surpassed their interest in adding to them.

Rumsey, 61, is a New York City native who earned several fine-arts degrees at Yale University in the late 1960s, then made what he calls an "accidental" fortune developing real estate in San Francisco. His success allowed him, in the early 1980s, to start looking at real estate in a different way -- through historical maps. Rumsey spent years combing the world for 18th- and 19th-century maps of North and South America. At the time, the maps were not in great demand and therefore cheap; he would often buy 30 or 40 in a day.

The resulting collection is one of the world's largest: more than 150,000 maps in a variety of formats, from wall maps to atlases to globes to wooden map puzzles, plus related material such as manuscripts, books, and lithographs, all arranged on neatly indexed shelves on the ground floor of Rumsey's elegant four-story Victorian, a few blocks from Golden Gate Park. From the beginning, Rumsey wanted to open the collection to scholars and map mavens. But he couldn't exactly invite thousands of people into his home every year--and the materials themselves are too fragile to withstand regular use.

So around 1998, Rumsey says, he "stopped adding to the collection and turned to the digitizing effort." Making and publishing high-resolution digital facsimiles of maps and other historical documents was -- and is -- a slow, painstaking process. But several technological advances converged in the late 1990s to make the job more manageable, including high-resolution digital cameras and scanners; wavelet compression, which let Rumsey reduce 300-megabyte files to three megabytes with no significant drop in image quality; viewing software, developed with Luna, that lets users call up just one area of a map at a time, then pan or zoom without having to download an entire map; and, of course, the advent of broadband Internet access.

Rumsey's website now holds some 11,000 items, including gems like an 1894 illustrated directory of downtown San Francisco, the only complete visual record of the area, which was mostly destroyed by earthquake and fire in 1906. An interactive section of the site provides software based on geographical information systems (GIS) standards that lets users fly through 3-D maps of San Francisco, Yosemite Valley, and other locales, or compare up to four historical maps of a given location on one screen.

Anyone is free to copy and reuse the maps for noncommercial purposes under a Creative Commons license. Rumsey himself looks forward to a near future in which location-aware devices such as cell phones and digital cameras will allow people to create their own geo-referenced content, which they can then mix with maps from his collection or others'. "What these location-based technologies are going to allow all of

us to do is to become like explorers -- to make our own maps," says Rumsey. "And I think people are going to use that to build a whole new interpretation of our culture."

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Upcoming Events

Lab to Market Workshop (http://www.technologyreview.com/emtech /09/workshop.aspx)
Cambridge, MA
Tuesday, September 22, 2009
http://www.technologyreview.com/emtech/09/workshop.aspx (http://www.technologyreview.com/emtech/09/workshop.aspx)

EmTech 09 (http://www.technologyreview.com/emtech)
Cambridge, MA
Tuesday, September 22, 2009 - Thursday, September 24, 2009
http://www.technologyreview.com/emtech (http://www.technologyreview.com /emtech)

Nanotech Europe 2009 (http://www.nanotech.net)
Berlin, Germany
Monday, September 28, 2009 - Wednesday, September 30, 2009
http://www.nanotech.net (http://www.nanotech.net)

2009 Medical Innovation Summit (http://www.ClevelandClinic.org/innovations /summit)
Cleveland, OH
Monday, October 05, 2009 - Wednesday, October 07, 2009
http://www.ClevelandClinic.org/innovations/summit (http://www.ClevelandClinic.org /innovations/summit)

Optimizing Innovation 2009 (http://www.connecting-group.com /Web/EventOverview.aspx?Identificador=6)
New York, NY
Wednesday, October 21, 2009 - Thursday, October 22, 2009
http://www.connecting-group.com/Web/EventOverview.aspx?Identificador=6 (http://www.connecting-group.com/Web/EventOverview.aspx?Identificador=6)