Casady, Chris (NPS contract illustrator):
http://www.tilenut.com/nps/

Foley, Don (NPS contract illustrator):
http://www.foleymedia.com/

Google Earth
http://earth.google.com/

Library of Congress Panoramic Maps 1847-1929:
http://memory.loc.gov/ammem/pmhtml/panhome.html

MSN Virtual Earth
http://virtualearth.msn.com/

NOAA - LIDAR DEMs:
http://www.csc.noaa.gov/crs/rs_apps/sensors/lidar.htm

NPS Harpers Ferry Center
http://www.nps.gov/hfc/

Virtual Los Angeles:
http://www.ust.ucla.edu/ustweb/projects.html

Whiteman, Lily. The High Life. *Audubon Magazine* (online article)
http://magazine.audubon.org/birds/birds0011.html

Wood Ronsaville Harlin, Inc (NPS contract illustrators):
http://www.wrh-illustration.com/

Software
Adobe Illustrator and Photoshop:
http://www.adobe.com/

ArcGIS
http://www.esri.com/

Bryce
http://bryce.daz3d.com/

Canoma
http://www.canoma.com/

ImageModeler
http://www.realviz.com/

Maya
http://www.alias.com/

Sketchup
http://www.sketchup.com/

Surfer
http://www.goldensoftware.com/

World Construction Set and Virtual Nature Studio:
http://www.3dnature.com/

---

cartographic collections

From Drawer to Digital:
A Statewide Collaboration for Building Digital Historic Map Collections

By Peter Michel, Special Collections Director,
University of Nevada, Las Vegas
Linda Newman, Geoscience & Map Librarian,
University of Nevada, Reno
Katherine Rankin, Special Formats Cataloger,
University of Nevada, Las Vegas
Vicki Toy-Smith, Special Formats Cataloger,
University of Nevada, Reno
Glee Willis, Digital Projects Coordinator, University of
Nevada, Reno

ABSTRACT
Nowadays, when you tell someone you recently visited a map library, it's hard for them to discern whether you mean virtually or in person. The two comprehensive public universities in Nevada are building complementary digital collections of historic maps of interest to the region to enable virtual map library visits. This article briefly describes the two university library map collections, discusses the criteria that were used to select maps to be digitized, provides insight into some of the scanning issues and how they were resolved, discusses technical considerations in using CONTENTdm®, and talks about metadata issues in the collaborative effort. The conclusion provides insight into what has been learned and why the project is important as a foundation for the future.

INTRODUCTION
The history of mapping the New World and the North American continent goes back to the 16th century; until the mid-nineteenth century, Nevada, along with much of the Southwest, was identified, if at all, as terra incognita – unknown land. Historic maps of Nevada and the Southwest are relatively scarce and, within Nevada, are scattered across a large territory among a

small number of historical institutions, libraries, and repositories. These maps have not been readily accessible to researchers nor to the general public except through on-site visitation. Compounding the issue of physical access, cataloging of these historic Nevada maps has been limited and incomplete; therefore, these maps were largely unknown.

The two comprehensive universities in Nevada – the University of Nevada, Reno (UNR) and the University of Nevada, Las Vegas (UNLV) – are changing this reality. The in-state rivalry between the two universities not withstanding, their many shared concerns include a deep interest in making resources available to university clientele and citizens of the state and world. Both institutions have developed digital historic map collections which make these maps available to anyone with Internet connectivity. The goal is to make these historic maps available and easily accessible to the public and to researchers in our respective university communities.

Nevada is a sizable state with only two universities. With limited staff and limited digital capabilities, UNR and UNLV have worked together to develop digital historic map collections for the state available to scholars worldwide as well as students in the state's remote one-room schoolhouses. UNR and UNLV have collaborated extensively and continuously, sharing digital expertise while respecting the local focus of each institution in presenting digital historic map collections that replicate original printed copies housed in hundreds of map drawers spread throughout the state.

NEVADA'S UNIVERSITIES' HISTORIC MAP COLLECTIONS

Significant historic map collections documenting the exploration and settlement of western North America are located in the Special Collections Departments in the libraries of UNLV and UNR, the Mary B. Ansari Map Library at UNR, the Nevada Historical Society (located on the UNR campus), and the Nevada State Library and Archives (located in Carson City). Due to the proximity of the Nevada Historical Society and the Nevada State Library and Archives to UNR, these maps are readily available, via special arrangement, to staff at UNR. Each university's collection focuses on the area of the Great Basin that became the state of Nevada; the local history of its respective half of the state is emphasized.

The universities also serve as repositories for the oldest government publications and maps including the 19th century government surveys and explorations by Fremont, Wheeler, King, Hayden, and Powell. Other 19th century maps in the collections came from travel accounts, diaries and commercial maps and atlases. Most of the maps were published on printing presses but some are handwritten manuscripts. Most are in English but a few are in other European languages.

SCOPE OF THE DIGITAL MAP COLLECTIONS

The digital map collections offered by UNR and UNLV currently include rare historic maps of great interest to virtual users. In the future, they will include historic maps in high demand. The maps in each digital map collection provide not only a history of each region through its changing political boundaries, but also a history of map-making and the development of the cartographic knowledge of this area. These collections are being developed as clearinghouses for those who might not otherwise have the opportunity to view and use them; we have in mind not only the most sophisticated researchers in our respective university communities but also the public for personal and professional use. When considering user interface design concerns, we often cite as a target audience the students in the one-room schoolhouses in the remotest corners of Nevada. They are also considered in the collection-building process when deciding whether a map fits the scope of the digital map collections. Preservation concerns, in addition to providing remote access, also affect the decisions made regarding what materials get added to the digital map collections. Rather than physical, now there will be "virtual" wear and tear on these rare and fragile artifacts.

COLLABORATIVE DIGITAL COLLECTION BUILDING

A variety of factors went into deciding which maps would be scanned for inclusion in the initial digital map collections. Some factors were philosophical – the importance of the map and the likelihood of use (remember the student in the one-room schoolhouse). Many factors were more practical in nature – physical condition, ease of scanning, preservation concerns, etc. Where possible, there will not be duplication of scanning efforts, but there may be duplication of digital versions of the maps between the two collections. Future additions to the sites will broaden the spectrum of maps represented in the digital collections.

Selection -- UNR

The maps chosen in the initial phase of building the digital collection in 2002 by UNR were selected, by the map librarian, from indexes of historic U.S. Geological Survey topographic maps[1]. This first group included maps bordering Nevada with a variety of scales: 1:250,000, 1:125,000, and 1:62,500. The digital collection was later extended to include most 'historic' topographic maps no longer in print, including the 15-

minute topographic series. As federal publications, the maps are not subject to copyright restrictions. When this series was discontinued, it was quite incomplete for Nevada.

Along with the topographic maps, scanning was commenced on significant Nevada geologic and mining district maps because they are fragile, rare, relatively uncataloged and not to be found in any one map collection in Nevada.
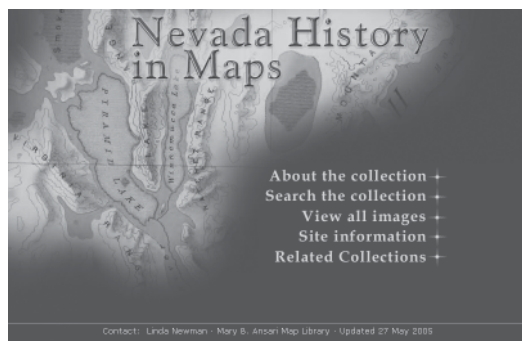

Figure 1. Opening page for UNR's digital historic map collection (http://www.delamare.unr.edu/maps/ digitalcollections/nvhistory/). (see page ?? for color version)

The maps chosen for the collection's second phase, begun in November of 2003, were selected from the substantial map collections of the Nevada State Historical Society, the UNR Special Collections Department, and the Nevada State Library. This Nevada History in Maps portion of the digital collection covers a span of history and events of importance to Nevada's political and physical development. Maps published by the U.S. government, Nevada and other state or territorial governments, local and national publishers of commercial maps and atlases, and associations such as the Lincoln Highway Association have been included. The intent is to depict the region's European development of one of the last of the American frontiers. Native American subjects are included, albeit as presented by European settlers.

Selection – UNLV
UNLV's digital map collection, Southern Nevada and Las Vegas: History in Maps, was unveiled in late October of 2004. It documents the cartographic history and context of the region, telescoping in scale from the western hemisphere to the streets of Las Vegas. Maps were selected to highlight individually important maps as well as to illustrate the breadth and variety of the collection. These maps show the history of the exploration of the West and the Southwest, the drawing and re-drawing of political boundaries, the creation of the state of Nevada from the territories of Utah and New Mexico, the geology and water re-
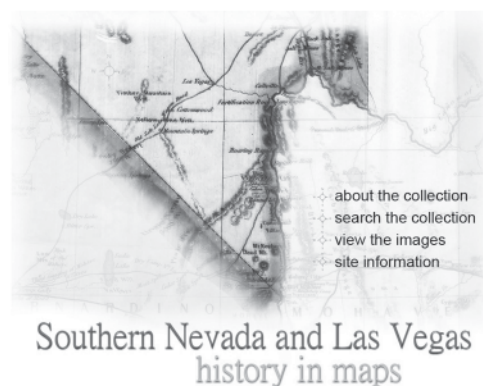

Figure 2. Opening page for UNLV's digital historic map collection (http://www.library.unlv.edu/maps). (see page ?? for color version)

sources of the region and the dynamic growth of the city of Las Vegas.

The maps for this digital collection were selected by age, condition, and how well they would be presented on a web site, in addition to their general representation of the development and settlement of the area which became the state of Nevada.
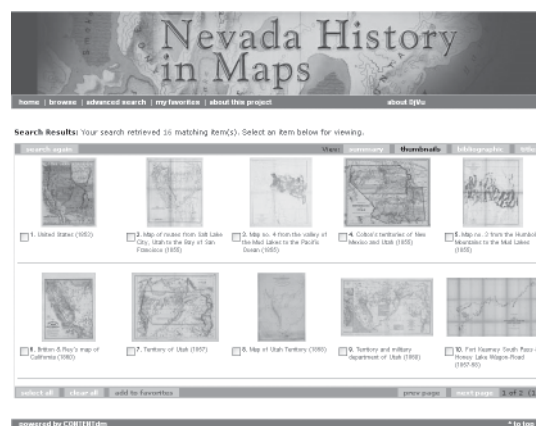

Figure 3. Thumbnails display for a CONTENTdm digital collection. (see page ?? for color version)

SCANNING -- FROM OUTSOURCING TO IN-HOUSE PRODUCTION
The initial scanning efforts at UNR came about with the convergence of the elements of need, favor and convenience: In 2001, AngloGold, a major gold producing company in Nevada (indeed, the world), approached the UNR map librarian to express its interest in creating digital reproductions of non-copyrighted geologic maps in her collection for its own use, and an agreement was struck soon thereafter. AngloGold was granted special permission to borrow, for scanning purposes, a large set of USGS

publications relevant to their exploration. In exchange, a few maps selected by the UNR map librarian were scanned for UNR. These complimentary map scans, at 200 dpi, represented the modest beginning of a digital collection. At the time, UNR had no convenient means by which to scan large format items. When Anglo's project ended in 2002, UNR next outsourced its large format map scanning to the Nevada State Library and Archives' Micrographics and Imaging Program in Carson City, 30 miles south of Reno. All of the maps scanned in Carson City were scanned at 300 dpi.

During this period it was learned that maps could be scanned while encapsulated provided the scanner's settings were carefully maintained to avoid glare. Indeed, it was required for the protection of fragile pieces—they were inserted into a 3-mil Mylar envelope for the process.

In 2003, the outsourcing venue changed yet again when the Nevada Bureau of Mines and Geology, conveniently located in the building next door to the UNR map library, purchased a large format scanner, and was willing to accept scanning commissions. During this time, the maps were still being scanned at 300 dpi. All outsourcing of large format map scanning ceased early in 2004 when, with financial assistance from the Mary B. Ansari Endowment for the Map Library at UNR, the library acquired its own IDEAL/ Contex Magnum XL 54" Plus Color Scanner. We continue to use the commonly accepted scanning rate of 300dpi although some other projects use a higher resolution.

Owning the hardware and directly supervising the scanning staff is preferable to outsourcing, but in this case, the latter initiated this effort and provided a demonstration of the possibilities, the methods, and the value to the end users. In the long run, it resulted in administrative and funding support to expand UNR's efforts.

Maps in the UNLV libraries were all scanned at 300 dpi by the staff in its Web & Digitization Services Department using a 24-bit color Vidar TruScan Titan Atlas 40"' scanner set to the default color configurations.

TECHNICAL CONSIDERATIONS IN CONTENTdm PROJECT PLANNING

In 2003, UNR created the first phase of its CONTENTdm-based digital historic maps collection, Nevada History in Maps, loosely modeled after Washington State University's (WSU) Early Washington Maps collection (http://www.wsulibs.wsu.edu/ holland/masc/xmaps.html). Since maps interest an audience that covers a range of computer users, we needed to provide access to our scanned maps in several choices of file formats, including one that is highly compressed since, for some of our users, the

sizes of the files they are viewing are of greatest importance. As was noted previously, students dialing up from the one-room schoolhouses in extremely remote locations in Nevada such as Jiggs and Duckwater are an audience of equal importance to scholars on campuses with ultra-high speed Internet connections.

The most important idea gleaned from the WSU collection was the use of a hyperlink included in the metadata in its CONTENTdm records as a pointer to a location on a file server. We logically inferred from this that the scanned files could reside on a server other than the one being used for CONTENTdm. UNR already had a fileserver that was devoted to storage of a collection of GIS files and data, as well as scanned map images.

A group of 63 historic non-topographic maps held by UNR were selected to be the first to have CONTENTdm records created for them as a test of how suited WSU's model would be for use by Nevada's university libraries. The ability to hyperlink from within a metadata record in CONTENTdm allows access to as many different file formats as is deemed appropriate. Three different file formats are provided for each scanned map: TIFF (uncompressed), JPEG (medium compression), and DjVu (wavelet-based high compression). Hence, each metadata record includes three hyperlinks per map for each file format in the "View map image" field of the metadata (see figure 4).

Figure 4. Example of the "View map image" field including multiple URLs for various formats for scanned historic map files in a CONTENTdm record. (see page ?? for color version)

The file sizes for the TIFF and JPEG formats for scans of large maps can be huge -- often up to 450 Mb for a TIFF for a map scanned at 300 dpi. Of the many paths that could have been taken to offer highly compressed files to our end users, the one we felt would work best was also the one that required the least expense, both for us and for them. Since we had not, at the time, planned to georeference any of the

historic maps, we opted for the much higher file compression we would gain by using the DjVu® Solo 3.1 encoder from LizardTech™ rather than its MrSID® encoder. For wavelet compression on georeferenced maps, the MrSID encoder must be used. We opted not to use the MrSID product, thus there was no need to purchase the MrSID server, nor to use the MrSID encoder, nor to require the end user to download the MrSID web browser plug-in. Instead, we downloaded LizardTech's free standalone DjVu encoder which converts files in TIFF format into files in DjVu format. Although not the ideal solution, we decided to require end users wishing to view the maps at their smallest file sizes to download and install the DjVu browser plug-in. Both institutions provide links to the DjVu plug-in download.

By December of 2004, UNR had added almost 400 historic topographic maps to its digital collection. Earlier in 2004, the UNR libraries' GIS unit volunteered to georeference them, which has allowed digital access to georeferenced versions of the historic topographic maps as a fourth hyperlink in the "View map image" field of its metadata.

In response to DiMeMa's July 2004 release, with version 3.8, of its JPEG2000 extension to the CONTENTdm software, both institutions will migrate their DjVu files into JPEG2000 files in the future because they will provide fast viewing and the ability to zoom and pan without requiring the users to download any web browser plug-ins. Neither institution has yet decided whether we will rescind/discontinue access to the DjVu formatted versions of the files. Regardless, access to both the TIFF and the JPEG formats will continue to be provided.

CREATING METADATA FOR THE DIGITAL COLLECTIONS

At the northern end of the state, UNR's historic maps have not been cataloged, so its special formats cataloger created the metadata for them directly in CONTENTdm, working from the scanned images rather than having the map in hand. When the standard sources of cataloging records held multiple records for the same map, it was often time-consuming to determine which one best fit the map that had been scanned. At the southern end of the state, UNLV's special formats cataloger worked from the actual map, cataloging them all first in MARC for entry into the online catalog. Out of the 88 maps that UNLV scanned for its first digital map collection, only 20 required cataloging for the project.

UNLV and UNR are members of the Utah Academic Library Consortium (UALC), and are participants in its collaborative digital initiative, the Mountain West Digital Library (MWDL) -- a multi-site harvester of the consortium's CONTENTdm metadata

records. In order for our CONTENTdm metadata records to be properly harvested into the MWDL, they must comply with its Dublin Core metadata standards. In turn, the MWDL's metadata standards conform to those formulated by the Dublin Core Metadata Working Group of the Western States Digital Standards Group.

CONTENTdm uses Dublin Core as its default metadata schema and allows for customization of the labels for each field in the metadata viewed by the end user. CONTENTdm also allows for the use of additional non-Dublin Core fields, as appropriate. Both institutions use similar custom field labels for their historic maps digital collections. Each field is configured to be either hidden or visible to the public, as well as either searchable or not; each field has a configurable data type such as text, date, or full text; and each field can be configured to hold a large number of characters (as in a transcription).
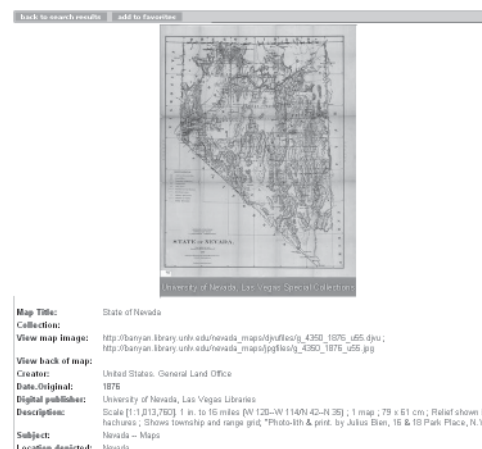

Figure 5. Sample record display from UNLV's digital collection. (see page ?? for color version)

Both collections use the following fields: title, identifier, creator, date original, date digital, original publisher, electronic publisher, description, LC subject, type, coverage, rights, contributing institution, format, digitization specifications, contributors, language, relation, and audience.

To minimize keying of metadata that is duplicated throughout the collection, CONTENTdm provides a metadata entry template into which constant data can be entered for the appropriate fields. Any field can be configured to use a controlled vocabulary for authority control such as the Thesaurus for Graphic Materials or a local subject heading file.

PRESENTATION

UNR has developed several types of searchable indexes to its historic digital maps collection. For the

CONTENTdm Field Properties

Click on a field name to edit the properties for that field:

Field Name	Dublin Core Mapping	Data Type	Large field	Searchable	Hidden	Controlled Vocabulary
Title	Title	Text	Yes	Yes	No	No
View map image	Identifier	Text	Yes	No	No	No
Creator	Creator	Text	Yes	Yes	No	No
Date Original	Date	Date	No	Yes	No	No
Electronic Publication Date	Date	Date	No	Yes	No	No
Original Publisher	Source	Text	No	No	No	No
Electronic Publisher	Publisher	Text	No	No	No	No
Description	Description	Text	Yes	Yes	No	No
Map Type	None	Text	No	Yes	Yes	Yes
Geographic code	None	Text	No	Yes	Yes	No
Subject	Subject	Text	Yes	Yes	No	No
ResourceType	Type	Text	No	No	No	No
Location Depicted	Coverage-Spatial	Text	Yes	Yes	No	No
Rights Management	Rights	Text	Yes	No	No	No
Contributing Institution	None	Text	Yes	Yes	No	No
Format	Format	Text	No	Yes	No	No
Digitization Specifications	None	Text	No	No	No	No
Contributors	Contributors	Text	No	Yes	Yes	No
Language	Language	Text	No	Yes	No	No
Relation	Relation	Text	Yes	Yes	No	No
Audience	None	Text	No	Yes	No	No

Figure 6. Field properties definition screen in CONTENTdm®.

Figure 7. UNR's search page for its digital historic maps collection. (see page ?? for color version)

historic topographic maps, it has built alphabetical, chronological, county, and geospatial indexes. For the historic non-topographic maps, it has formulated numerous pre-defined search queries for its visitors to execute as "explorations" of the collection -- these include time period queries, topical queries, and broad geographic area queries, the latter reflecting the

evolution of the state from terra incognita into a territory and finally into a state. UNLV has assigned local subject headings that will be the basis of similar predefined queries to be constructed in the near future.

Both institutions have constructed web "front ends" for their historic digital maps collections. These front ends include explanatory information about the scope of the collection, site and contact information, and links to browse and search pages. UNR has customized the look that visitors see when they are viewing the CONTENTdm display pages.

STAFFING
At UNLV, the participants in building its digital historic map collection were the director of the Special Collections Division, the special formats cataloger, the server administrator, and staff from the Web & Digitization Services Department including the head of the department, the scanning technician, and the graphics/multimedia designer. At UNR, the participants in building its digital historic map collection were the map librarian, the special formats cataloger, the graduate student who scanned the maps, the digital projects librarian, the web development librarian, and the server administrator.

MORE ON COLLABORATION
Because UNR was already working on its digital maps project and had more experience with digital projects in general than UNLV, the UNR digital projects librarian provided substantial assistance to UNLV with technical problems. In October 2004, the UNR digital projects librarian, the map librarian, and the special formats cataloger traveled to meet for the day with staff involved in UNLV's digital map project. They discussed technical problems, decided which Nevada maps each institution would scan, and agreed to share, upon request, reprinted paper and/or digital copies of maps owned by the sister institution.

FUTURE OF THE DIGITAL HISTORIC MAP COLLECTIONS
Expansion of these digital historic map collections in Nevada is ongoing. UNR's Nevada History in Maps site is being enlarged with a significant contribution of maps from its special collections department. Likewise, UNLV's Southern Nevada and Las Vegas: History in Maps site is being expanded with the maps of Mexico and the American Southwest that were scanned for an online exhibit (http://www.library.unlv.edu/millionth) about UNLV Libraries' millionth volume, Historia General de los Hechos en las Islas I Tierra Firme del Mar Oceano, by Antonio de Herrera, published in Madrid in 1601-1615. Maps scanned for other research or digital

projects may also be added to the site.

At UNLV, pre-defined queries will be added to guide users through suggested explorations of the digital collection. At UNR, alphabetical, chronological, county, and geospatial indexes for the historic topographic maps will all be migrated onto the search page in the Nevada History in Maps collection. The geospatial index is being expanded to indicate not just topographic maps, but any map in the digital collection from the area selected from the geospatial index.

CONCLUSION

The collaboration between UNLV and UNR in developing and creating parallel digital map collections is instructive of how institutions geographically distant can support each other. While the UNR and UNLV map projects were, for the most part, conceived independently, they were collaboratively developed based on similar interests, collections, institutional agendas and awareness of earlier model projects for providing access to historic digital map collections within CONTENTdm. It was a convergence of ideas shared by a number of people in Nevada, an interest in the history of Nevada, in historic maps, the need to preserve them and, most importantly, to make them accessible and usable with the most sophisticated technology at hand. The benefits of these two projects go beyond the presentation of this still relatively small collection of maps. Both institutions have benefited from the sharing of ideas, problems and solutions. As we have learned to resolve technical issues in our own institutions and to help each other solve problems, we have developed a desire to work with each other on future projects.

Both institutions will add to our digital map collections using new enhancements as they become available and as we master them. We now have a deeper knowledge of each other's collections, the potential and limitations of hardware and software, and a better idea of how we can build a truly statewide digital collection that presents the rich history of the entire state of Nevada while highlighting the unique aspects of our own regions. It is the best of both worlds -- local detail in a state and regional setting, in a format and with information that can be shared anywhere in the world. We have helped each other develop and create new digital collections that benefit all the people of Nevada. The digital world is about sharing; this sometimes presents a challenge when we are customarily so focused on our own collections and institutional structures and agendas. Collections and technology to access, link and use collections should also link the people who manage these collections. In Nevada, the success of this first digital collections collaboration has laid the foundation for real and effective future collaboration.

REFERENCES

[1] Map index to topographic quadrangles of the United States, 1882-1940, Riley Moore Moffat, Western Association of Map Libraries, 1985.

A cartobibliography of separately published U.S. Geological Survey special maps and river surveys, Peter L. Stark, Western Association of Map libraries, 1989.