

U. S. GEOLOGICAL SURVEY NATIONAL CENTER FOR EARTH RESOURCES OBSERVATION & SCIENCE (EROS) ANALOG ARCHIVE PRESERVATION EFFORTS

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Abstract

The U.S. Geological Survey's (USGS) Earth Resources Observation & Science (EROS) facility in Sioux Falls, South Dakota is responsible for a diverse archive that includes; the National Satellite Land Remote Sensing Data Archive (NSLRSDA), the Earth Observing System Land DAAC (Distributive Active Archive Center), USGS digital cartographic archive, and the USGS long-term aerial film archive. These archives contain satellite imagery, cartographic/elevation data, and analog aerial photography. An aspect of the USGS/EROS archive that is often taken for granted is the analog film collection. This archive involves over four million images that were acquired from 1939 to present and exist only on film media. The USGS/EROS film archive includes over 60,000 rolls, of which over 19,500 are affected by a problem known as vinegar syndrome (VS). VS is the slow decay of the film as the acetate base separates from the emulsion. The VS problem can be mitigated by making a dupe copy of the film, digitally capturing data from the film, or by freezing the film to suspend any further decay. EROS has plans to do all three. Over 700 rolls have been duplicated for the most severely affected rolls. Four digitizing systems are currently at work collecting imagery for every frame on each roll to create browse imagery and medium resolution products that greatly enhance access and re-use of the analog film archive. USGS/EROS also has four high-resolution bed scanners in place that are currently used to create customer products. These scanners can capture data at a resolution of 7, 14, or 21 microns. USGS/EROS is not ready to replace its film archive with digital scans yet, but technology is being developed that may provide this option in the next few years.

Background

A primary mission of USGS/EROS is:

- To promote new uses, new users, and new understanding of land information, so that others can better understand our planet.
- To ensure that scientists, researchers, businesses, decision makers and the public have ready access to the land information they need.
- To safeguard and expand the world's largest archive of remotely sensed land data.

USGS/EROS performs the critical role of managing and preserving the remote sensing, cartographic and Earth science archives for the USGS Geography Discipline through the use of collections management techniques with a strong adherence to archival standards. This role began with the creation of the Earth Resources Technology program in 1966 and evolved into an implementation that began in Sioux Falls, South Dakota in the winter of 1971. The USGS/EROS archive facility was opened in the fall of 1973. USGS/EROS requirements for a full service photographic laboratory to support of the early Landsat program provided the impetus for growing services to include aerial photography. The USGS mapping photography used to create the 1:50,000 and 1:24,000-scale topographic maps were consolidated from their regional locations around the United States to Sioux Falls. The Land Remote Sensing activities within USGS and NASA continued to draw national attention to EROS. Other federal agencies and organizations realized the benefits of sending their aerial film to the USGS/EROS archive to promote access to their collections and provide one-stop service for remote sensing products. Over twenty different organizations sent photography to Sioux Falls under memos of understanding and other project agreements to take full advantage of the photo lab and archive facilities at USGS/EROS.

In its peak production years of 1992 to 2000, the EROS Photo Lab produced an average of over 350,000 products per year. Production volumes and customer demand for photographic products have declined in the last five years (figure 1) as soft copy/digital files began to eclipse the need for analog products. Several major suppliers of photo-processing chemicals and supplies are converting to digital product lines and are discontinuing their photographic lines. Therefore, with production expenses becoming increasingly higher than can be recovered through product sales, and with a fundamental transition in the photographic materials industry, the USGS discontinued photographic products in September 2004. The power of the desktop computer began to replace the need for light tables and stereoscopes.

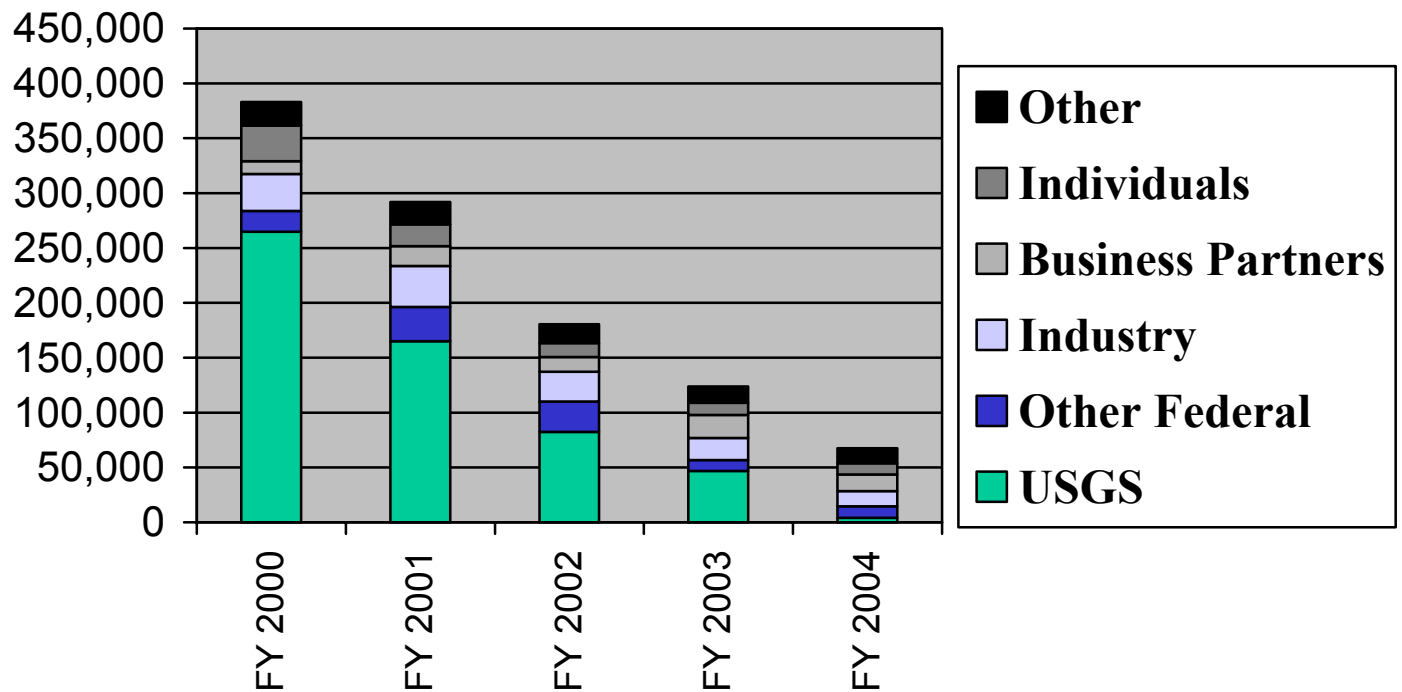


Figure 1. Production in Frames by Customer Category for the Last Five Years

The Present

Today the USGS/EROS archives consist of over 107,000 rolls of aerial and satellite imagery or roughly 13 million frames of imagery. The archive includes 19,500 rolls of chemically unstable “vinegar syndrome” acetate base film that must be transferred to the National Archives and Records Administration (NARA) for preservation in cold storage. The USGS was able to photographically duplicate 759 film rolls that were of highest risk before shutting down the EROS Photo Lab. Contacts with NARA have been made to begin this 2 to 3 year transfer process. The first of six shipments to NARA will occur in the winter of 2006 followed by an additional shipment every six months until complete.

USGS/EROS has transitioned from providing traditional photographic products from its historical film to providing only digital products. One of the new digital products is a high-resolution, digitally scanned product, which became a standard USGS/EROS product in July 2004. These products are produced on a user-demand level by scanning the film data at approximately 1200 dpi (21 micron spot size). The output file size is approximately 120 megabytes for a black and white photograph and 360 megabytes for color. The scanned data are provided in a TIFF format. The files are not archived by EROS since the current scanning resolution does not replace the need to retain the film source at this time.

The second digital product is a medium-resolution file. This product is created by digitizing the film at approximately 600 dpi with a digital camera mounted above the film (figure 2). The output file size is approximately 15 megabytes for black and white and 45 megabytes for color. The medium-resolution digitized products are also provided in a TIFF format and became available October 2004.

USGS/EROS has completed the transition from producing traditional photographic products to providing digital versions distributed via CD, DVD, and through secure network connections. Sample products of an area over New York City, illustrating the two different products, have been prepared and can be downloaded using FTP from the following location: http://edc.usgs.gov/phoenix_iv/new_york

(Due to this transition, EROS no longer offers wet lab photographic products. Customers that need paper or film products are encouraged to make them on their own or contact a USGS Business Partners or other commercial vendor)

The Future

In fiscal year 2006 the USGS/EROS will continue its plan to significantly improve access to the historical film archive by digitizing the film holdings with state-of-the-art fourteen mega pixel digital cameras to create digital browse images and medium resolution data products. Additionally, the photo indices, the antiquated method used to access nearly 70% of the film collections, have been digitized and will be made publicly available through the Earth Explorer (<http://earthexplorer.usgs.gov/>). Significant progress has also been made in implementing an in-house metadata generation capability to create single frame coordinates for each image on the photo indices. A tool kit approach, using Arc View and other commercial off the shelf packages, was designed and implemented for frame-based metadata generation. It is expected that the medium resolution products will fulfill the imagery requirements of many of USGS/EROS customers that need both satellite and aerial images to conduct change analysis. The digitizing plan includes the operation of 4 robotic systems operating 2 shifts per day. The average daily production involves 64 rolls and the systems process over 44,000 images per week. High-resolution scanner (figure 3) products are also produced on demand at the cost of full filling and shipping an order.

Summary

USGS/EROS is responsible for the preservation of a diverse collection of data. That responsibility includes providing access and products to support the science community and general public. The USGS/EROS uses records management techniques and data life cycle concepts (Faundeen, 2003) to manage the land remote sensing data, digital and analog. The success of future science requires preservation of the archive, regardless of its archive media, so these data are ready to serve the needs of tomorrow. USGS/EROS is moving forward with its plan to assure improved data access and preservation of the analog film archive in addition to its well-known support for digital data sets. Technology moves forward and so do the archives of the USGS/EROS facility in Sioux Falls, South Dakota.

References

Faundeen, J.L. (2003) *The Challenges of Archiving and Preserving Remotely Sensed Data*. Data Science Journal, Volume 2, October 2003



**Figure 2. Medium-resolution
Digitization System**