

Drawing on the Archive

The U.S. Geological Survey's EROS Data Center has acquired nearly 20 years of continuous Landsat data, providing a rich archive of information about the dynamics of land surface conditions. This availability of an uninterrupted flow of information in a consistent data

format gives researchers an important baseline for studying surface change.

Major changes to the surface features of the planet can be measured and studied using satellite data. The effects of desertification, deforestation, pollution, cataclysmic volcanic activity and other man made and natural events are examined by resource scientists using data acquired by the Landsat series of earth-observing satellites.

Landsat Multi Spectral Scanner

(MSS) data at 80 m spatial resolution has been collected continuously since 1972. There have been a total of five Landsat satellites (launched in 1972, 1975, 1978, 1982 and 1984). This 20 year record of satellite data, archived at the EROS Data Center, has become an essential archive for the study of land surface change.

MSS provides the only consistent historical global record for the 1970's. Other satellites flew during

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Great Salt Lake, Utah



Landsat MSS Image
September 13, 1972



Landsat MSS Image
August 14, 1988

From 1982 to 1988, the water level of Utah's Great Salt Lake rose over 12 feet, increasing the lake's size more than 600 square miles. This significant increase in water level can be seen by comparing a 1972 image with one acquired on August 14, 1988. Also noticeable are the results of a pumping project which began in 1986. A dike, which extends southeast from the Newfoundland Mountains, allows overflow from West Pond to flow back to Great Salt Lake.

UP FRONT

It often seems the EROS Data Center is in the midst of some kind of transition such as redefining existing technical programs, redirecting important projects, or pursuing new initiatives. One area that traditionally has been immune to change has been the makeup of the Center's senior management staff. Now, as all of you are well aware, that is changing too.

Over the past months we have witnessed a period of significant change in management staff. In early May, Russ Pohl, a close colleague and trusted friend, retired from government service. Then, the anticipated transfer of Al Watkins to the position of Chief, National Mapping Division materialized. Furthermore, R. J. Thompson's earlier transfer to the EOS Data Systems Project Office and my temporary detail to the Front Office have created necessary changes in Computer Services Branch and Science & Applications Branch. This shuffling of management personnel has led to a number of "acting" assignments as we adjust to the changes in staff and still maintain critical program responsibilities.

New project assignments and research opportunities continue to occur as the Center's excellent reputation becomes more well known. For example, the enormous satellite data processing effort expended during the Desert Shield/Desert Storm campaigns demonstrated our responsiveness and reliability when the Department of Defense called for our assistance.

Other changes occurring at the Center include the new EOS Data and Information System responsibilities, the design of the addition to the main building, and the delivery and installation of several state-of-the-art computer systems. These changes, as well as the ones occurring in the management staff, are contributing to an important and challenging period in the history of the EROS Data Center. But then—it is, in my opinion, challenges such as these that make the Center both a unique institution and an exciting place to work.

Donald T. Lauer

Pape Answers His Nation's Call

Over 500,000 United States troops were deployed to the Persian Gulf to liberate Kuwait from Iraqi aggression. It seemed as though almost every American had either a loved one or an acquaintance that was called to active duty. Jerry Pape, a 47-year-old computer operator in the U.S. Navy Reserve was the Data Center's lone entry in the Gulf conflict.

While the EROS Data Center monitored events in the Persian Gulf from hundreds of miles in space, Pape was acquiring first-hand knowledge of how the war was unfolding—from the deck of a Navy cruiser in the waters of the Persian Gulf.

Pape, a computer operator at EROS, is a 23-year Naval Reservist. As a DS, pay-grade E-5, he's trained to monitor the onboard computers of Navy ships. After being notified by mail on January 10, 1991, Jerry was one of 40,000 Navy Reservists nationwide to answer his Nation's call to active duty.

While most of us were sampling

pre-game munchies in anticipation of a good Super Bowl matchup between the Buffalo Bills and the New York Giants, January 27, 1991, Pape was departing for the Middle East. According to Jerry, he had no idea that the Navy would activate him.

Jokingly, Pape said, "If somebody would've asked me June 9th (1990), I would've bet money on it (the prospect that he would not be activated). I said no way. They don't want this old goat."

Ironically, the mascot for the U.S. Naval Academy is a goat. The Academy goat must have remained in Annapolis because Pape was on his way to the Gulf after brief layovers in Norfolk, Virginia, Dover Air Force Base, Delaware, and the Italian island of Sicily.

He set foot on the sands of Saudi Arabia, Tuesday, January 29, 1991. Following short stops in Jiddah and Riyadh (where he saw the Patriot missiles set-up on the airport runways), Saudi Arabia and the nation of Bahrain, Pape was taken to



a place called Brown and Root.

"The next day we went to a World War II Prisoner of War compound. They reopened this place and threw all of us in there. The only job we had to do in there was just to watch TV, eat, and be ready to go in five minutes notice. I actually spent two weeks in there before I got called out to a ship."

The first ship Pape was called out to was an "oiler"—a ship that refuels other ships. After three days, he was helicoptered to a cruiser, the U.S.S. Horn. For the next two and a half months, Jerry spent most of this time monitoring a large computer that operated the Horn's onboard radar and weapons systems.

"At the height of the War," explained Pape, "one-third of the U.S. Navy, or 90 ships, were in the Gulf. In addition, we had 512 planes in the air, yet our ship's computer was only being utilized about 20-percent. It (the ship's computer) will identify all airplanes, what type, how fast, who it belongs to, and how many minutes it'll take before it gets out of the radar zone (a 250-mile area) of the ship."

Another high-tech naval computer system Pape became familiar with during his stint in the Gulf was the JOTS system.

"If a ship calls in," explained Pape, "we can pickup its identifying number. It (JOTS) identifies the number that the ship calls and will draw a map instantly on a big TV screen pin-pointing the ship's location...and this is throughout the world. It doesn't make any difference if it's near California or right next to you."

While Pape's ship normally was 25- to-60 miles off the coast of Kuwait and Iran, he didn't see any first-hand battle action. He saw and heard plenty however.

"We came across a few dead bodies. They were Iraqis who got shot off of some oil platforms or got shot in a boat and drifted out to sea."

Pape continued with other memories of his Gulf experience.

"We were in a constant stage of bombing. You could go out in the morning with a cup of coffee to what the Navy calls the fantail of a ship and hear the bombs go off. We could hear the waves of aircraft going over so well because we were the most northern ship, called the north point. We were close enough



A U.S. Navy helicopter returns as fast as another departs with supplies for allied vessels.



From aboard the U.S.S. Horn, Pape captured some seamen on the deck of a passing U.S. Navy frigate.

to see the battle ships when they'd fire their shells, especially at night you could see the illumination of the gun shells."

As a crewman on the northern most ship in the U.S. Naval fleet in the Gulf, you might expect that Pape's ship was in constant peril. Jerry says the only really close call that his ship experienced during his duty in the Gulf occurred the night

of February 25th.

"We had a missile alert," explained Pape. "A French missile had been launched and we were told that one was coming in. Everybody was a little bit shook because where we're at on that ship is the highest part...and that's usually where they (the missiles) hit. That's our General Quarters Station

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Pape Answers His Nation's Call
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and you can't leave those. All you could do was look around and try to see which hole it was coming in and...you know, determine how bad's it going to be. Everyone was wondering if they were going to die in fire right away."

After putting his life on the line for almost 3 months in the Persian Gulf, Pape returned to the Philadelphia Naval Station for what he thought would be an uneventful trip back to Sioux Falls the next day (April 19th).

"Just as we left for take-off (for Sioux Falls), we had plane trouble. The number two engine blew-out. We had to fly around Philadelphia because it was too late to abort the flight on take-off. The pilot was going too fast and he was running out of runway."

After circling the City of Brotherly Love for a while, Pape said the plane finally got back on the ground.

"He (the pilot) kept telling us that everything was all right. And it really was...but everyone was scared. We finally made our last pass and I happened to glance out the window and noticed all of the fire trucks, ambulances, and red lights blinking down there."

After shifting his weight in his chair Pape grinned and said, "I got a little apprehensive on that one."

While many soldiers like Jerry continue to return from the Gulf region, impacts of the War continue to be felt by thousands of Kurdish refugees and others throughout the world. The long-term impacts of this war, maybe the most environmentally destructive in the history of warfare, will be monitored for years to come. According to Pape, it remains very dark and hazy because of smoke from the burning Kuwaiti oil wells.

"We escorted a ship one time into Kuwait and we got within just a few miles. At one point fog horns were sounded, and we're talking high noon. It was that black out. You constantly had this burning oil smell."

After answering his Nation's call for 23 years, Pape is set to retire from the Navy reserves at the end of 1991. Even if his decision to retire may have been a year too late, hopefully the only burning oil that he smells from now on will be from his kitchen or from his car exhaust.



In the wake of Jerry's vessel, two U.S. cruisers line up to refuel.



A U.S. helicopter transports supplies above troubled waters of the Persian Gulf.



A powerful explosion of smoke and water form a mushroom cloud where an Iraqi water mine once floated in deadly suspension. This mine was detonated 600 yards off the port side of Pape's ship, the U.S.S. Horn.

In the public service

In 1986, the USGS started a volunteer for science program. The program was designed to involve the citizens in public land concerns, to foster responsibility and respect for the Nation's natural resources and to develop interest in science and public service.

In the first 3 1/2 years, more than 300 volunteers donated over 317,000 hours to the USGS

- field checking of geologic structure
- studying historic archives
- sorting catalog materials for libraries
- photographing flora for background studies
- assisting in public inquires and conducting facility tours

Many of the volunteers are retired survey employees who have the background and interest in the host institution. Others are students who are considering careers in public service or the sciences, or teachers who wish to learn the latest techniques in their areas of interest.

For the first time, this past summer, EDC hosted a volunteer for science candidate. Graham Zoller, a student at Saint Cloud State, worked in the Data Services Branch. Under the supervision of Donna Scholz and Dana Nelson, Graham worked to identify and format pertinent

derivative projects' metadata for entry into the AVHRR production data base inventory. Graham needed to learn UNIX and UNIFY commands and to become proficient with the tape library data base.

The result of his work may be illustrated by an example. Scientists in the Science and Applications Branch have directed the development of a number of "greenness" maps. Those final products were created through a series of intermediate image products. A system was needed to inventory the various intermediate images and the final scenes. Graham created a data base which cataloged the collection of materials and the final greenness maps. The products now are accessible to outside customers.

The experience gave Graham an understanding of the data processing systems, the characteristics of the imagery, and the uses of remotely sensed data. As a student of geography he now has a more complete understanding of Center capabilities.

This first experience in the Volunteer for Science program was valuable to the Center. An excellent student helped to solve a complicated matter and his attitude and abilities encouraged his

colleagues.

Plans are underway to expand awareness of the program in this area. Information will be distributed to local schools and civic organizations to encourage volunteers to consider programs at the EDC.

Further, the Technical Information Section is working with USGS management to produce a four minute and an eight minute videotape for the USGS Volunteer for Science program. These videos will be used as part of recruitment displays at career/volunteer fairs and related events, in classrooms, at promotional meetings with civic groups and at volunteer training sessions. The videos will provide a brief history of the program, general information about typical volunteer assignments in the five USGS divisions and the Director's office. They highlight active volunteers and will include segments on the requirements to become a volunteer, with details on where to obtain more information. Staff from the video production group filmed unusual volunteer assignments at the Hawaii Volcanoes National Park and the North Rim unit of the Grand Canyon.

The Volunteer for Science program is good for the host agency and for the volunteer. Over 570 active participants in the program are helping the USGS manage its earth science activities, offering their special talents and enthusiasm.



Dennis Hood, Chief of the Technical and Administration Services Office (left), congratulates volunteer Graham Zoller

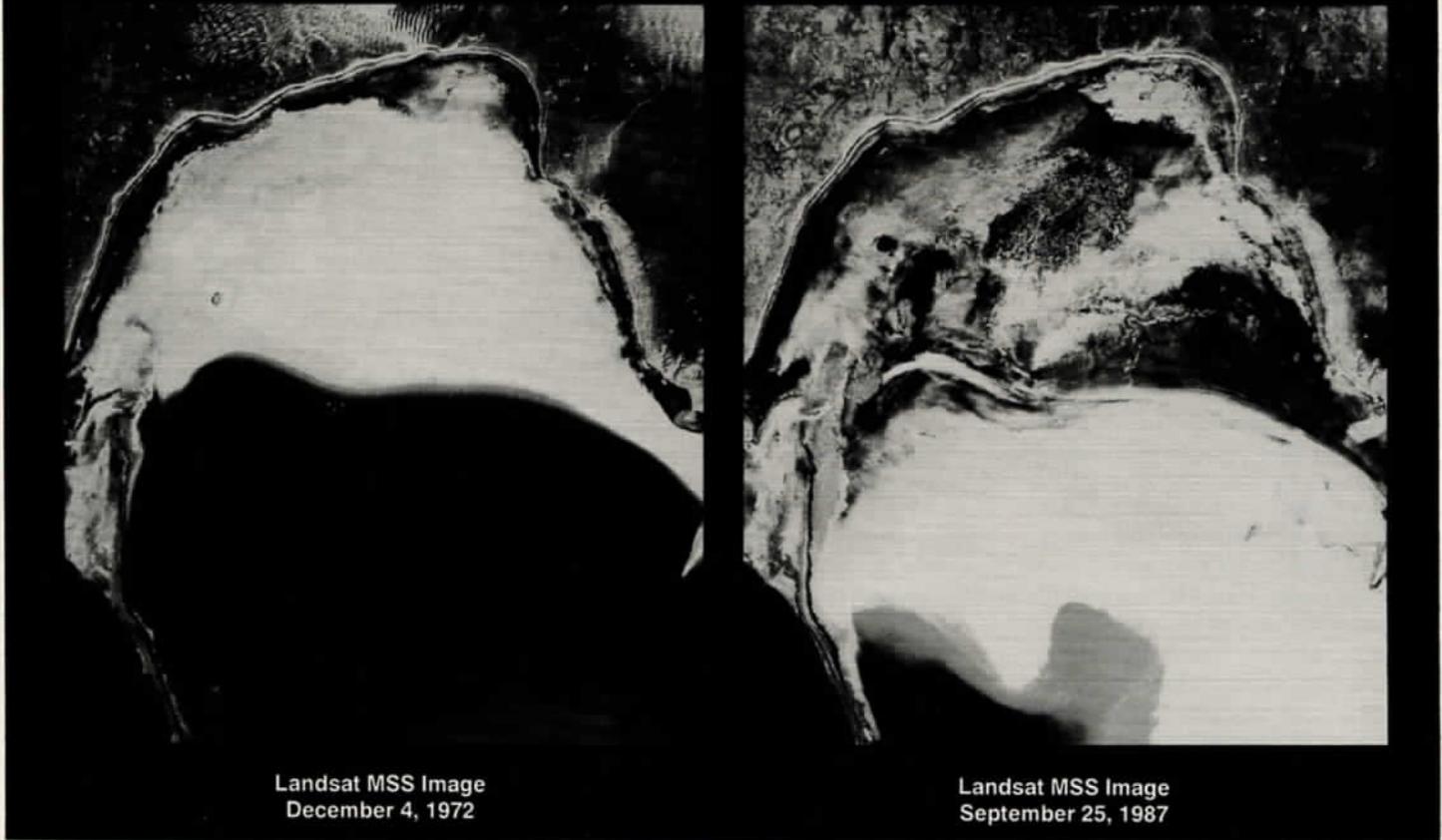


Don Becker prepares for film assignment in Hawaii.

Drawing on the Archive

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Zaliv Kara-Bogaz-Gol, USSR



Landsat MSS Image
December 4, 1972

Landsat MSS Image
September 25, 1987

This pair of images show the depletion of water in the Zaliv Kara-Bogaz-Gol, an inlet on the eastern side of the Caspian Sea. From December 4, 1972 to September 25, 1987, the salinity of the Zaliv KBG jumped to 330 parts per thousand, rendering the bay poisonous to virtually all forms of life. The reduction of water in this bay is a direct result of the diversion of water from the Ural, Volga and Ehmba rivers. Also, in the mid 1970's the Soviets built dams across the inlets between the Caspian Sea and the Zaliv KBG to reduce the loss of Caspian sea water by evaporation within the Zaliv KBG.

that time, but none of the data collected could match Landsat MSS data for consistent and repetitive global coverage.

Example pairs of changes are being collected by Center staff. A series of image pairs can illustrate surface changes. In many of the cases, 1972 imagery, matched with 1986 or 1988 imagery at the same scale, shows remarkable alteration. For example, Cairo, Egypt has undergone major population growth in the past 18 years. The Landsat examples from 1973 and 1987 show a significant expansion of urban areas in the previously agricultural zones. This example and a number of other pairs will be used in a lobby display and in a booklet explaining the benefits of preparing historic pairs from the

established archive.

The U.S. Geological Survey has, from the beginning, played an important role in the Landsat program. The USGS helped define many of the technical specifications for the early satellites and provided much of the stimulus for the actual development of the satellite system. The USGS's EROS Data Center has been the major archive, processing and distribution facility for the data.

The USGS has made significant contributions to improve Landsat data processing, image enhancement, and inquiry/access capabilities. The Survey is currently developing an on-line inquiry system to provide global change researchers with information about land-related data availability. The large Landsat archive is central to

that inquiry data base.

Recently, the U.S. government formulated the U.S. Global Research Program to facilitate scientific investigations into earth systems and humankind's influence on these systems.

Further, the USGS is actively involved in the development of NASA's Earth Observing System Program. That program, scheduled to begin in the mid-1990s, will provide an expanded capability to study global environmental dynamics. The experiences from the Landsat program in documenting changes to land surface features will aid researchers in the critical information gathering and analysis programs of the future.