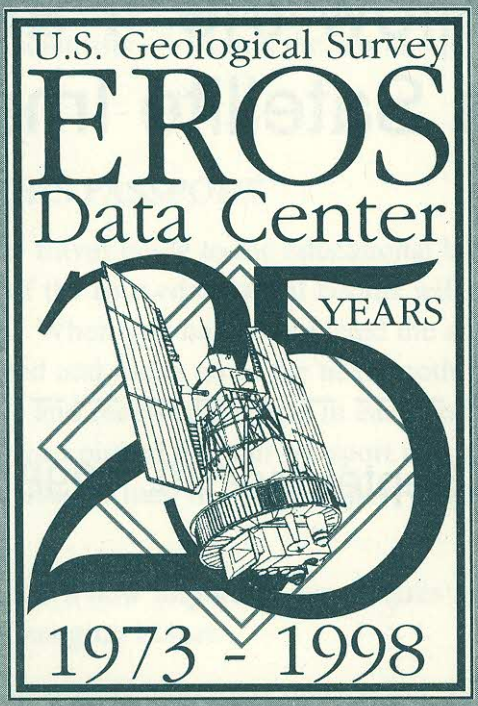
USGS

science for a changing world



PASSPORT

Educational Activities

USGS
science for a changing world

Follow the "Path" of a Satellite Image

Name_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

September 19, 1998

INTRODUCTION

Welcome to the U.S. Geological Survey EROS Data Center and our 25th Anniversary celebration!

For the past 25 years we have been collecting pictures of the United States taken by aircraft and collecting information about the land surface of the planet taken by satellites in space.

Today, we would like you to follow the flow of signals from the satellite and learn how those signals are converted to pictures, then archived, corrected, and used by scientists all around the world who are Exploring Our Changing Planet.

HOW TO USE THIS PASSPORT

This passport is your travel guide to the educational booths at the EROS Data Center. Each of the four educational booths will have an activity for you to complete. When you have completed the activity, you will get your passport stamped and move on to the next booth. When you have visited all the booths and received a stamp in each box, return to the starting table where you picked up your passport and get your 25th Anniversary prize. Use the map in your passport to guide your journey to each booth.

So have fun as you learn how important our pictures and information are for Exploring Our Changing Planet.

Before you start your travels, you must understand, WHAT ARE SATELLITE SIGNALS?

The Landsat satellites provide important information about the land throughout the globe. As the Landsat satellite flies over the planet, it measures the amount of sunlight reflected from the planet's surface. Since the satellite is over 450 miles above the Earth and is moving through space very quickly, the area of each measurement is fairly large, about the size of a basketball court. That is the smallest area the satellite can measure. Since each feature will reflect different amounts of sunlight, the satellite assigns numbers to the amount of light reflected. For

example, a concrete basketball court will reflect a great deal of light, but a lake will absorb a lot of the light and reflect very little light back to the satellite. These units of reflected light are called pixels. Millions of pixels are used to create a single image. As you travel from booth to booth, you will see how the signals from the satellite are changed to pixels and then to useful information.

YOU ARE NOW READY TO START, please proceed to booth #1, DATA RECEPTION

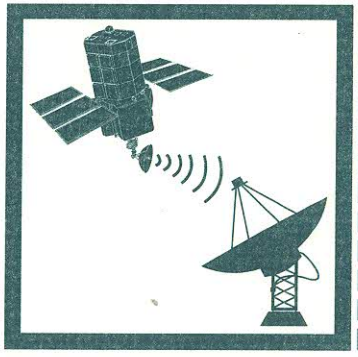
DATA RECEPTION BOOTH: 1

Combining satellite signals into data

At this booth we will focus on what a satellite sees and how we get a picture (image) from a satellite. The smallest area a satellite can measure is called a pixel. The satellite sends these pixels to Earth and the EROS Data Center arranges them into an image.

In the pixel puzzle activity, each piece or pixel represents one small section of an image. Your activity will be to arrange these pixels into an image.

When you have completed the activity, get your passport stamped and move to Booth #2, DATA ARCHIVE



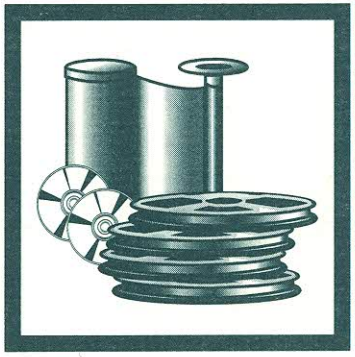
DATA ARCHIVE BOOTH: 2

Where the film and digital data are stored

The archive at the EROS Data Center holds the world's largest collection of satellite and aircraft photographs of the Earth's land surface. The archive holds over 9 million aircraft photographs of the United States, 3 million satellite images from throughout the world, and more than 218,000 computer tapes of satellite images.

Your activity will be a buzzer game where you will gain an understanding of how large the archive collection is and how much data can be stored on film and tapes. Your challenge is to answer the questions without making the buzzer go off.

When you have completed the activity, get your passport stamped and move to Booth #3, DATA CORRECTION

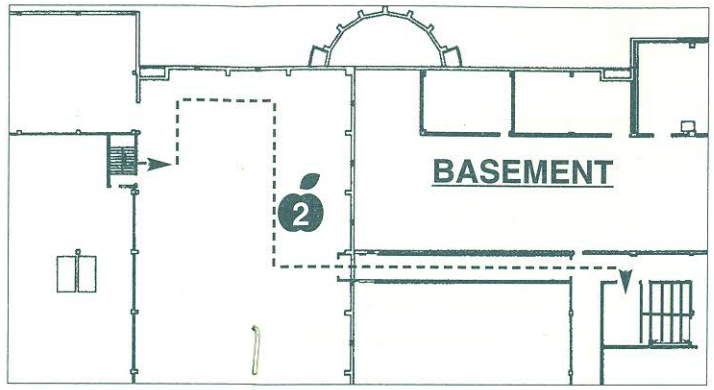


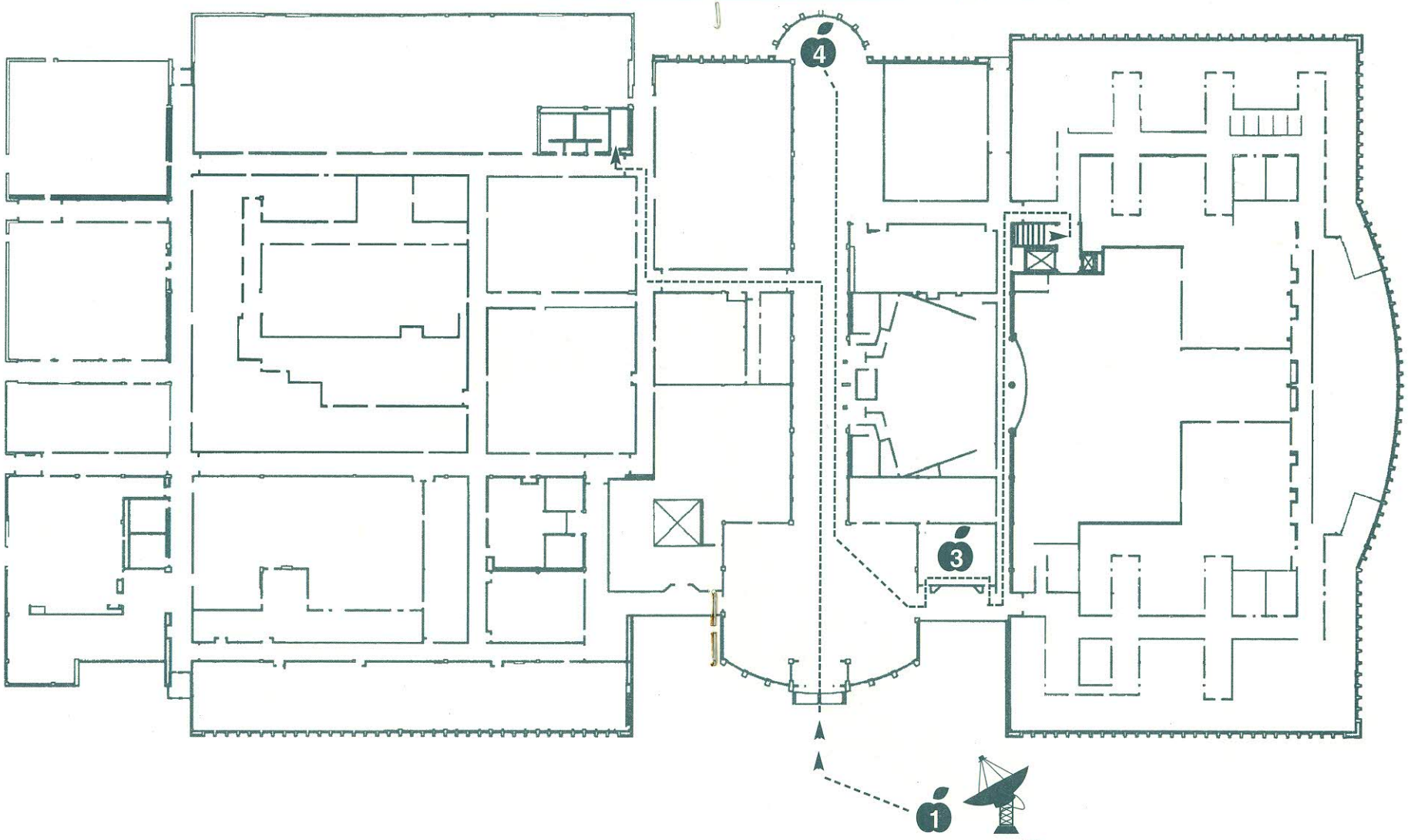
1 Data Reception Booth

2 Data Archive Booth

3 Data Correction

4 Data Analysis





Start at Main Educational Booth
(on grass island outside the front building)

DATA CORRECTION: ❸

Making data usable

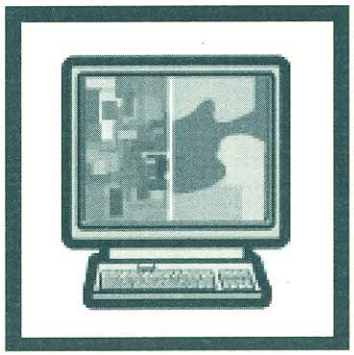
Satellite images are usually stored in digital form. For example, pictures displayed on computer screens are digital images.

Information about the path of the satellite as it orbits the Earth is used to find the location on the Earth of each pixel within an image. Also, the effects of the Earth's atmosphere on the reflected sunlight must be corrected in order to understand the signals. These steps are done with computers and are called image processing. Using computers, the information in a satellite image can be compared with other images. Studying the large amount of information (in the millions of pixels) that make up a satellite image is made much easier using computers.

Your activity, a Before and After exercise, will help you understand what happens to pixels after they are corrected. Try to identify where the pixel was before correction and where it is after correction.

Before After

When you have completed the activity, get your passport stamped and move to Booth #4, DATA ANALYSIS



DATA ANALYSIS: ❹

Using the data

The Landsat satellite takes 16 days to complete a cycle of coverage of the planet. By comparing a series of Landsat images collected over a long period of time, scientists can study changes that are taking place on the Earth. For example, tracking flooding can be done by comparing images from before, during, and after a flood. These images help scientists explain changes and predict where changes may occur.

The following game will give you the opportunity to be a scientist and find features and differences between a 1973 image and a 1997 image. On the images you see arrows with numbers on them. Your job is to figure out what the arrows are pointing to and match up the numbers with the features labeled A through I.

1._____	6._____	A. Sioux Falls Airport	F. Brandon, SD
2._____	7._____	B. Gavins Point Dam	G. Missouri River
3._____	8._____	C. Quarry	H. James River
4._____	9._____	D. EROS Data Center	I. Lake Vermillion
5._____		E. Interstate 29	

You can also try to answer the gold star question:

What is the feature marked on the image with a gold star?

(a) Growth of the city of Sioux Falls (b) Hail damage

(c) Bare rock (d) Flooded land

Once you are done, check your answers using the answer key and get your passport stamped.

CONGRATULATIONS!

You have followed the path of the satellite signal, measured as a series of pixels. You have seen how information on the surface of the Earth is sent through computer systems, stored, corrected, and studied, all for EXPLORING OUR CHANGING PLANET.

Return to the booth where you picked up your passport to claim your special 25th Anniversary prize.

There are many more exciting things to see during our 25th Anniversary celebration, please take in as many of the activities as you can while you are touring the EROS Data Center. Here are just a few additional educational activities that may interest you:

THE DOCTOR IS IN

At this exhibit kids and parents can ask questions about the Earth and the state of the global environment. You can look at photographs and images collected by aircraft and satellite, and talk about what you see.

GOLD PANNING

Learn how to pan for gold and other interesting minerals. Experienced gold panners will tell you where to look for "pay dirt," show you how to fill your pan with the "right stuff," and teach you how to "pan your pan." Then it's your turn. Kids and parents are invited to compete for the best pan full of "nuggets."

RED-BLUE-GREEN: WHAT DO THE COLORS MEAN?

Scientists analyze and interpret satellite and aerial images based on the colors and patterns that represent different features and conditions on the Earth's surface. At this demonstration you learn how the colors (red, green, and blue) are assigned to data and how their mixtures are interpreted.

EROS DATA CENTER ON THE WORLD-WIDE-WEB

EROS Data Center staff demonstrate how to access the Data Center web pages and the types of data and information that are available on-line.

WHAT DO THEY USE THAT THING FOR?

Scientists who use satellite and aerial photographs to study the Earth work with some unusual equipment to analyze the photographs and to collect samples and information about stuff on the ground ("ground truth"). Examples of some of this equipment are displayed. Kids and parents are invited to figure out and match up each piece of equipment with the correct description of what it is used for.

U.S. Department of the Interior
U.S. Geological Survey