

Anastasia Furitsch
Reagan Middle School
Patricia Reiff* and Colin Law
Rice University

In just a few short years the internet has gone from having too few sites of interest in science to too many – in both cases it can be difficult to find the information or activity that is needed to learn (or teach) a specific concept. Museum exhibits have gone from "mausoleums" of dusty science artifacts to vibrant, interactive, hands-on, real-time safe sources of up-to-date information and images. Earth Update and Space Update can provide just the starting point for many a lifetime of exploration, and many activities and games along the way to make the journey fun.

A universe at your fingertips

HOUSTON CHRONICLE
MONDAY, OCT 17, 1994

NASA-Rice collaboration brings space to museum computer

By STEVEN LONG
Houston Chronicle

Visitors to the Houston Museum of Natural Science soon can take a free trip on the information superhighway into outer space.

Their ticket will be paid by an \$800,000 NASA grant to Rice University.

With the touch of a finger, museum patrons will be able to view the wonders that NASA tracks daily, including images of the Earth from space shuttle missions, the Landsat satellite and the Hubble Space Telescope. Images of the sun, weather, space weather and the planets also will be on line.

"NASA wanted to come up with a way to get the beautiful imagery that they are collecting to the people," said Dr. Carolyn Summers, director of astronomy at the museum. "All of the material is on the Internet."

Rice graduate students will capture the NASA images from the Internet – the worldwide web of linked computers used primarily by government, universities and businesses – and transfer them to a Space Kiosk computer in the entry hall of the museum.

"The goal is to transfer as much of that information to direct public access as possible," Summers said. In some cases, images will be accompanied by narrations by a Rice University professor.

Rice students will transfer new NASA images on the Internet daily to the kiosk computer. Not only will their involvement keep the information current, it also will let museum visitors have instant access without wading through the often-labyrinthine Internet system.

NASA spokesman Brian Welch said the grant for electronic public



Houston Museum of Natural Science
NASA's space images can be called up via a computer screen icon like the one above. At right, the Museum of Natural Science's director of astronomy, Dr. Carolyn Summers, and Rice graduate student and programmer Colin Law confer at the Space Kiosk.

access to NASA images is part of an ongoing commitment by the space agency.

"Everyone at NASA, from the very beginning, has always had a deep commitment to providing the widest public access to data collected on our missions," he said.

Welch said technology is reaching a point where almost anyone can access NASA information through the Internet.

"As time goes by, that is only going to increase as we are able to place more and more information in the system," he said.

The first kiosk will be up and running by the end of the week, said museum spokeswoman Terrell Faulk.

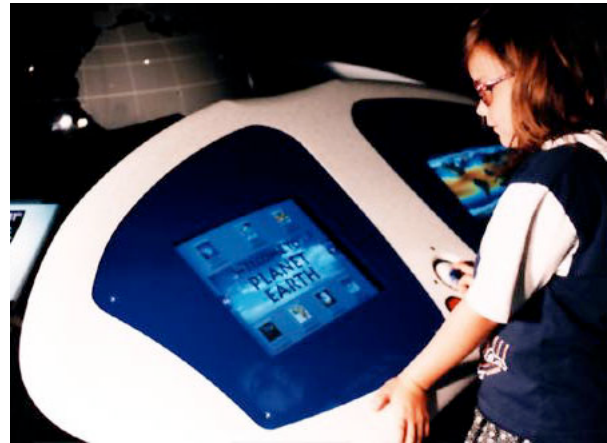
Richard Carlson / Chronicle

The first online interactive realtime computerized exhibit of earth and space science was developed with resources from the Digital Library Technology program: "Space Update", funded by IITA under the "Public Use of the Internet" program. First on display in late 1994 at the Houston Museum of Natural Science, this software was safer than a browser (since it did not allow unlimited access to the web) but yet allowed one-click updating of earth and space science imagery – views of the sun in various wavelengths, weather maps and NOAA satellite images, etc. Our first module "Shoemaker Levy 9" was on display only 6 weeks after the historic

Corresponding author address: Patricia Reiff,
Rice Space Institute, 6100 Main St. MS 108,
Houston TX 77005, reiff@rice.edu

comet hit Jupiter; a full space module opened in October 1994. The earth section "Earth Today" opened in summer of 1995.

The software was the first to attempt to bring the power of the internet to the citizens on the far side of the "digital divide". At that time very few of the public had access to the internet at the office, much less at home, and fear of computers was common. Yet kids were attracted to a display that dynamically changed in response to a touch, and a very popular kiosk was born and has been on display in some version at the museum ever since. This early software (developed prior to Netscape or Internet Explorer) nevertheless was instrumental in bringing earth and space hands-on information to over a million people. (It still doesn't need a keyboard in order to run!)



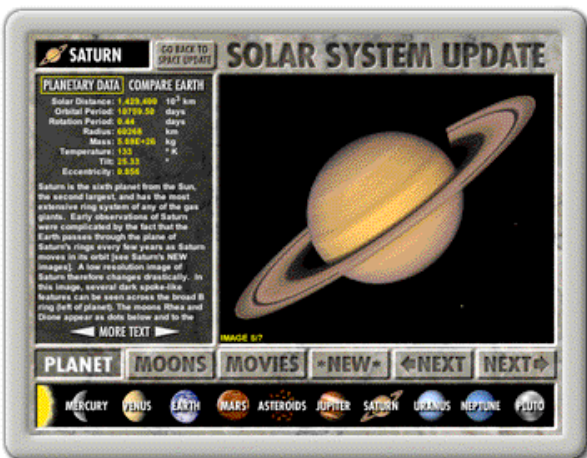
Although the software was developed for use as a museum exhibit, many teachers whose classes came through the museum or who participated in our workshops asked for their own copy of the software, and requested that we develop activities to go with the software. Responding to that plea, we created our first "Space Update" disk, called "Connected", in early 1996.

In 1999, NASA's first Cooperative Agreement Notice for innovative products in Earth science was released, and we were one of the first awardees for the ESIP (Federation of Earth Science Information Partners). As a part of that project, we developed a separate "Earth Update"

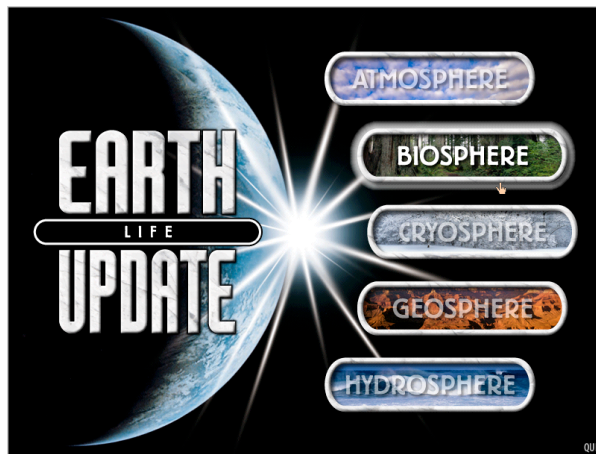
software, a full interactive museum exhibit "Earth Forum" and a series of immersive Earth science shows, including "Powers of Time" (about the cycles of Earth); "Force 5" (about the greatest storms on earth and in space, and "Night of the Titanic", a show that teaches about the conditions on earth and in space that, coupled with human error, caused that tragic sinking. At that time the earth part was removed from Space Update, leaving room to expand Space Update to include a simplified planetarium module plus a "space events" section. Earth Update became its own piece of software, with a consistent look and feel among the Atmosphere, Biosphere, Cryosphere, Geosphere, and Hydrosphere sections.



Space Update is a favorite among museums and schools for its robust design. Its five modules Astronomy, Solar System, Sky Tonight, Space Weather, and Space Events can run as a single linked exhibit, or all except space events can run as a stand-alone exhibit. Space Weather even expanded to become its own CD-rom, with extra activities, movies and sounds highlighting the results from Space Weather missions like IMAGE.



Over 11,000 copies are in the hands of museum and school educators and the public, with the software on permanent display in many fine museums. The software passed the NASA product review, and was recently reviewed in the December 2003 "Sky and Telescope": ... "I was amazed at Space Update's intuitive interface"... a must-have for science teachers" ... "You can bet that Space Update will be on display at our local observatory and my club's future Astronomy Day activities"...



Earth Update also has an intuitive interface, but is much richer, with information in each "sphere" section about **what** (is that field of study, e.g. what is the atmosphere); **who** (studies the atmosphere) **how** (do they study it) and **why** (should we care about the atmosphere). Each sphere has a selection of images that update with a single click – for example, weather maps and hurricane tracking maps in atmosphere; bioactivity and greenness maps in biosphere, snow and ice cover maps in cryosphere, volcano and earthquake maps in geosphere, and wave height and water temperature maps in hydrosphere, some of which



are made at Rice directly from the NASA data sets. it also includes a hotlink with each image for more information that launches a browser (that can be disabled for museum use). All images are external for easy use in other purposes.



Activities in Earth Update and Space Update are organized by student grade level and the science standard(s) addressed, and have been used for students from 2nd grade to Reiff's sophomore non-majors solar system classes at Rice University. Earth Update is on display at the Houston Museum of Natural Science in their exhibit called "Earth Forum". That area has twenty-one computers running different sections of the software (and different games included on the CD), plus twelve hand-on physical exhibits. In addition, it has a survey kiosk where the visitors can let us know which parts of the software they enjoy the most, and which might be difficult to use. Over 80 percent "really enjoy" or "enjoy" using the software!

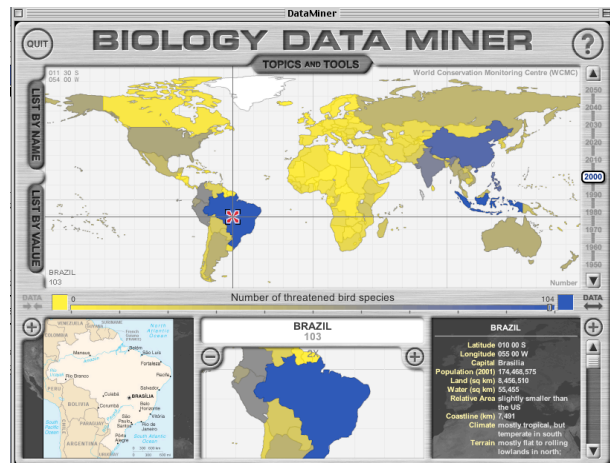


According to the survey, by far the most popular computers in Earth Forum are the ones running "TicTacToe" - a game that lets students test their

knowledge about earth against each other or against the computer.



Kids will play for hours, and then complain that they have seen some of the (nearly 600) questions more than once! Many teachers have expressed gratitude at a learning experience they can do with their class that energizes them to have fun. And a question editor is also included, so that teachers can write their own questions or delete questions that their students haven't covered yet. And they can select a subset of the questions to export as a class quiz.



One amazing tool that we have included is a "Data Miner". We call it a game, but it is a very powerful way to map country-based data from the World Resources Institute. With a single click, visitors can create a color map of the countries with the most species, or most endangered species, or most energy use, or highest population, or most ground water use, and then use a mining tool, to get that same data on a per-person, per-area, or even per-automobile basis! The results can be listed by country or by value, and the color bar

changed or even stretched in case one country's value is far higher than the rest.

So, what can a teacher (AF) who uses Earth Update and Space Update in the classroom say about these teaching tools? Here is her outline:

Earth Update to Teach Earth Science

- Helps to increase interest in the Earth Sciences
- Different presentation of information to help stimulate learning – visual and auditory learning styles are used in the text, pictures, and sound bites
- Tic-Tac-Toe game helps make learning fun and enjoyable as well as giving students an opportunity to review material learned
- Real world application to almost all fields of Earth Science
- Real world answers to “Why do we need to know this?”
- Information is linked in relevant ways to help create the schema needed to retain knowledge
- Helps at-risk students receive the same background and prior knowledge that more affluent students get through text as well as video
- Updatable information gives students a sense of ownership to the event

Space Update to Teach Space Science

- Making the study of space science more “real” for the students by using real images
- Giving many graphic examples for hard to understand concepts to help make information understandable to many different age groups
- Again the variety of presentation types helps reach all learners
- Real world applications to “Why do we need to know this?”
- Giving students new and interesting career ideas

Activities

- Gives relevant application of information presented in Earth/Space Update
- Shows how information would be used in the “real world”

- Activities may be presented in a variety of ways, not just lower level Bloom’s Taxonomy

In Ms. Furitisch's classroom, the most exciting and most rewarding result of using new technology is to turn on the students who are just "marking time" through science. She has several examples of students who routinely failed science very six weeks, who are now actively engaged and considering a science career, coming back to her with their new knowledge of science even after they have gone on to high school. It is examples like those that keep us making interactive exhibits that are educational and fun.



For more info: <http://earth.rice.edu>

Acknowledgments:

This project is supported by NASA's office of Earth science under the ESIP Federation NCC5-311 and by NASA's office of Space Science under the IMAGE mission. Many federal agencies and individuals have participated in providing images and movies for our CD-roms, and many others in the review and improvement process. As a result of federal funding of the development, we are able to provide this software at a price that just allows us to continue the program. We also thank the many teachers who have field tested the software and the activities with many levels of students, and particularly thank the teachers in our experimental "Masters of Science Teaching" degree, who have given many hours late at night and on weekends to improve their skills and this software. Kudos to Katty Furitisch, Lollie Garay, Kevin Robedee, Katrina Miguez and Amy Jackson!...PR