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The Electronic PictureBook and Astronomy's Education Initiative

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Abstract. The Exploration in Education (ExInEd) program at the Space Telescope Science Institute seeks to promote basic teaching and learning by exploiting the connections between astronomy research and education. Our primary product category consists of Electronic Picture-Books (EPBs): educational show-and-tell software allowing astronomers to communicate their ideas and results to a broad audience.

In 1990, the Bahcall committee called for an "educational initiative" associated with its decadal plan for astronomy research (Bahcall 1991). It urged that new resources and innovative partnerships be developed to foster beneficial connections between the exploration of the universe and basic teaching and learning and, in particular, to address the deficit our society faces in the math, science, and technology skills of the next generations.

A study and report entitled An Education Initiative in Astronomy (EIA) (Brown 1990) is an informal appendix to the Bahcall committee report. This work is the product of seventeen professionals in education or astronomy, who deliberated the question of strategies and approaches for connecting astronomy research and basic education. The connection is not obvious, after all: the former activity is the acquisition of advanced knowledge about the universe, which may be understandable in detail by only a few; the latter is aimed at helping all inquirers learn "the basics," that is, information and concepts often long known by past—even ancient—scholars.

The EIA report affirmed manifold opportunities for astronomy research to contribute to education, noting that the astronomy enterprise has many relevant assets, including a broad domain of inquiry, role models, advanced technology, cadres of semi-professionals and amateurs, and interdisciplinary connections. Two prime objectives promoted by EIA were sparking pre-college interest in science and improving the accuracy of astronomical information presented to students and the public. One strategy recommended by EIA was using innovative technologies to disseminate science results, and in particular, using advanced communications networks to facilitate delivery of electronic information to computers in homes and schools.

Today, many new programs are seeking to exploit the connections between astronomy research and education. The Exploration in Education (ExInEd) program at the Space Telescope Science Institute (ST ScI) is one such program. The focus of ExInEd is to enable individual authors in the community to communicate the ideas and results of their activities in the form of computer multimedia software, which is distributed over Internet, via on-line services, and on durable media.

The Electronic PictureBook (EPB) is our primary product category. It is educational software of the show-and-tell variety, consisting of a HyperCard stack that runs on the Macintosh platform. The basic elements of an EPB are picture-caption pairs that are augmented with a structural framework (indices, navigational buttons, overlays) and additional content (an introduction, a glossary, reading lists, credits). The EPB uses an introduction to orient the user in the topic at hand, and provides navigation tools that enable him or her to explore the pictures and captions in either a hierarchical way (via indices and sub indices) or sequentially, as in a slide show.

EPBs have a serious—but unstructured—educational purpose. They are designed to: (1) capture student interest, (2) provide quality information, and (3) construct understanding and skills. We hope that by browsing through their exciting images and informative captions, children and adults will receive the message that science is fun, that learning is a process of exploration and discovery, and that these activities can be enjoyable and rewarding. We are encouraged, based on voluminous, unsolicited correspondence and favorable reviews, that EPBs are being well received by the press and public, by students, and by school teachers in particular.

From the author's standpoint, ExInEd provides a simple and inviting interface. An EPB author has simply to provide ExInEd with pictures and captions along with a brief introduction, and ExInEd does the rest. We have the technical capabilities to accept images and text in a wide variety of forms and formats, which we transform or translate appropriately for the EPB. Editorial responsibilities are shared between the author and ExInEd staff. Once all the edited materials are in-hand, production of an EPB is generally completed in a period of a few weeks.

At the current time, ExInEd has completed and is distributing ten EPB titles over the Internet, through on-line services and bulletin boards, and on diskette and CD-ROM:

- *Gems of Hubble*
  Stephen P. Maran — Published 1994. Version 2.0.
  Gems of Hubble is a collection of recent images obtained by NASA's *Hubble Space Telescope* (*HST*). Topics include the *HST*'s launch and first servicing mission, stars and star clusters, galaxies and black holes, solar system objects, nebulae, and cosmology.

- *The Planetary System*
  Dr. David Morrison with The Astronomical Society of the Pacific
  Published 1994. Version 1.0.1.
  The Planetary System is a pictorial survey of our solar system that includes all nine planets, the Moon, and small bodies. The images it contains were selected for their beauty and for how well they illustrate the wide range of physical and geological features present in the solar system.

- *Endeavour Views the Earth*
  Dr. Jay Apt — Published 1993. Version 1.0.
  Endeavour Views the Earth is a collection of Space Shuttle images of

Earth's northern hemisphere. Image captions by NASA astronaut Jay Apt touch upon timely issues in geography, agronomy, geology, meteorology, and environmental science. Linked to The World Factbook.

- *The World Factbook '92*
  Central Intelligence Agency Published 1993. Version 1.0.
  The World Factbook is a survey of the people, culture, geography, government, economy, political conditions, communications, and defense forces of 261 countries and regions, as well as information on the United Nations and other international organizations. Each of the 261 entries includes a map of that country or region with major population centers highlighted. Can be linked to *Endeavour Views the Earth.*

- *Scientific Results from the Goddard High Resolution Spectrograph*
  James Blackwell, Jennifer Sandoval, Steven Maran, and Steven Shore
  Published 1993. Version 1.2.2.
  Scientific Results from the Goddard High Resolution Spectrograph is a collection of images and the spectra obtained with the Goddard High Resolution Spectrograph (GHRS) during the first years of operation of the *Hubble Space Telescope.* Captions were authored with the assistance of the GHRS science team. Topics include the northern aurora of Jupiter, Beta Pictoris, Chi Lupi, Alpha Tauri, AU Microscopii, AR Lacertae, Nova Cygni 1992, Zeta Ophiuchi, 3C273, R31, and 30 Doradus.

- *Volcanic Features of Hawaii and Other Worlds*
  Peter Mouginis-Mark Published 1993. Version 1.0.
  This EPB describes and compares Hawaiian volcanoes and volcanic features with features believed to have a similar origin on the Moon, Mars, Venus, and the Jovian moon, Io. Accompanying text highlights these comparisons, explains the features, and describes past, current, and planned research by volcanologists. Specific topics include volcanic structures, lava flows, eruption types and resultant land forms, rocks, boulder fields, and radar studies. The glossary is linked to the text.

- *Images of Mars*
  The Planetary Society Published 1993. Version 1.1.4.
  Images of Mars is a collection of re-processed photos of the Martian surface taken during the *Viking* mission. In addition to being an update on U.S. and Russian interest in Mars, the introduction provides a brief look at the broad history of human interest, touching on the early observations of Tycho Brahe, Johann Kepler, Christiaan Huygens, William Herschel, Asaph Hall, and Giovanni Schiaparelli; the imaginative theories of Percival Lowell; and the popular views of science fiction writers Edgar Rice Burroughs, H. G. Wells, and Ray Bradbury.

- *Impact Catastrophe That Ended the Mesozoic Era*
  Dr. William K. Hartmann Published 1993. Version 1.0.
  This series of seven original paintings by artist and planetary scientist William K. Hartmann depicts the impact and resulting effect of a 10 km asteroid believed to have hit the Yucatan Peninsula in Mexico about 65

million years ago. The climatic changes set in motion by the impact are thought to have had a significant role in the extinction of many species at the time, including the dinosaurs.

- *Apollo 11 at Twenty-Five*
  Dr. Roger D. Launius Published 1994. Version 1.0.
  This EPB was published on the occasion of NASA's 25th celebration of the moment when humans first walked on the Moon. It contains an historical survey of the Apollo program for the period from May 1961, with its announcement by President John F. Kennedy, to December 1972, when the program ended with the flight of Apollo 17. Special emphasis on the Apollo 11 mission.

- *Magellan Highlights of Venus*
  Dr. Steve Saunders and Dr. Ellen Stofan Published 1993. Version 1.0.
  This EPB contains images from the *Magellan* spacecraft's first 243-day mapping cycle of Venus. An introduction summarizes the most important science findings. Image captions describe both planetary features—Venusian impact craters, mountains, tessera terrain, coronae, arachnoids, volcanoes, channels, and dunes—and the methods scientists have used to analyze them.

ExInEd has also created its first CD-ROM, entitled Space Science Library of Electronic PictureBooks. It includes all current EPBs plus GIF-format images of 330 individual images in 640x480 pixel format.

In the coming months, we propose to expand our collaborations with at least five new EPB titles:

- *Comparing Earth and Its Planetary Neighbors.* Patricia Barnes-Svarney, an established science writer, has collected 50 images of corresponding features amongst the planets and composed captions for them.

- *The New Solar System.* David Morrison has agreed to select a recent set of planetary images for a new tour of the solar system based on *HST*, Galileo, Clementine, and ground-based observations. He will write the captions, and we will produce the EPB. This will be a valuable update of our current title, The Planetary System.

- *Other Worlds From Earth.* Bill Hartmann will prepare a series of paintings that take perspectives on the solar system from distances 1 AU, 10 AU, 100 AU... out to a planetary system around another star. The purposes of this "powers of ten" sequence are to conceptually connect our solar system with possible others while clarifying the distance scales involved.

- *Comet Strikes Jupiter!* Steve Maran, who edited the images and wrote the captions for Gems of Hubble, has agreed to select SL-9/Jupiter material for an EPB based on the spectacular events of July '94 and to compose an introduction and captions.

- *PlanetQuest.* Daniel Glover, a NASA engineer based at Lewis Research Center, is compiling a history of NASA's planetary spacecraft.

ExInEd plans to produce additional multimedia products for both the Macintosh and the Windows PC platforms. As noted, EPBs are currently based on the HyperCard engine and are thus available only for the Macintosh computer. In the future, we will be using the Apple Media Tool (AMT) authoring system in addition to HyperCard, and will be producing runtime executable software for Windows also. The content will be derived from EPBs, which we will continue to produce. This will expand ten-fold the installed base of computers that can use our products.

ExInEd is also exploring new products specifically for Internet distribution. The Electronic InfoCapsule (EIC), for example, will be small cross-platform interactive computer presentation incorporating images, sound, text, and video. Authored with Apple Media Tool, EICs will run identically on the Macintosh and Windows PC platforms.

All ExInEd titles currently available can be obtained by downloading them from any one of several electronic sources, including SSO's electronic bulletin board system (bbs) at 410-516-4880 using user ID "guest" and password "guest", then searching under the heading "Conferences"; via anonymous ftp over the Internet at host address *stsci.edu* in directory */ExInEd*; through America Online using the search term "ExInEd" in the Macintosh software library; and from ExInEd's Mosaic/WWW Home Page[1].

ExInEd EPB's can also be purchased on durable media, diskette or CD-ROM, by contacting The Astronomical Society of the Pacific (415-337-2624) between 9 a.m. and 3 p.m. Pacific Time or writing to: The Astronomical Society of the Pacific, 390 Ashton Ave., San Francisco, California 94112. They may also be purchased from NASA's Central Operation of Resources for Educators (CORE) by calling 216-774-1051, ext. 293 or writing to NASA CORE, Lorain County Joint Vocational School, 15181 Route 58 South, Oberlin, OH 44074.

To receive a copy of An Education Initiative in Astronomy, to obtain more information on the ExInEd program, or to provide comments or suggestions on the EPB concept, please write to: ExInEd, Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218. FAX: 410-516-7450. Internet: *ExInEd@stsci.edu*.

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References

Bahcall, J. N., ed. 1991, The Decade of Discovery in Astronomy and Astrophysics (Washington, D.C., National Academy Press)

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[1] http://www.stsci.edu/exined-html/exined.home.html