SCIENCE INFORMATION SYSTEMS NEWSLETTER

A PUBLICATION OF NASA'S OFFICE OF SPACE SCIENCE SIS PROGRAM

MARCH 2002

The Science Information Systems Newsletter is a vehicle for sharing research and development within NASA's information systems community and for sharing information with the outside community.

NASA's Science Information Systems Program sponsors, evaluates, and infuses new technologies into NASA's science data environment and is the focus for all data systems activities within the Office of Space Science.

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EAST Language and Tools

By John Garrett, Betty Brinker, and Don Sawyer

EAST is a data description language that supplies complete and non-ambiguous information about the format of the described data. An intrinsic need when describing data is the need to specify the representation of the interchanged data, including the logical structure of the data and the physical representation of the individual data items. When allowing for the wide diversity of variables such as the operating systems and the machine representations for numerics, a full understanding of data can only be reached by using a rigorous notation/language that provides a complete, non-ambiguous logical and physical description. EAST is used for this purpose.

EAST is designed for building descriptions of data to be contained separately from the data itself. Note that it is a data description language and is not itself a data format. Users of EAST maintain and use their data in whatever formats are most useful to them. EAST is used to describe those various formats without any requirement to change the actual data. EAST was designed with three overriding concerns: data description capabilities, human readability, and computer interpretability.

All data have a life cycle. Many people only think about data descriptions once data are already on media and when they are attempting to access or use the data. However, the data life cycle concerns data not only during access and during use, but also as the data are conceived, designed, described, produced, exchanged, migrated, converted, and archived. The EAST language, and its associated tools, is used to support the use of data throughout its entire life cycle.

The EAST data description language is applicable to nearly all science and engineering data exchanges where data descriptions are desired and where these descriptions must provide a complete, precise, and unambiguous description of the record structure of the data down to the bit level. Thus, EAST becomes applicable throughout the entire data life cycle and the greatest benefits accrue when it is used this way. In this way, it can serve to aid the understanding of the data as it passes between interested parties. Current tools support the visual creation of EAST descriptions and make use of such descriptions to generate documentation useful at interfaces and throughout the data life cycle.

A typical use of EAST could be a description of some raw telemetry science data. However, perhaps the user community for the science data wishes to make use of the telemetry data in a widely accepted format such as CDF or HDF. In this case, the EAST description provides excellent documentation of the source format, and the EAST library routines or other EAST tools could be used to access the telemetry data to support automated transfer into the other formats.

The EAST specification document (http://www.ccsds.org/all_books.html#ccsds-644.0-b-2) provides the syntax and semantic rules for EAST itself. The EAST specification has been endorsed as an International

Standard by the International Organization for Standardization (ISO) and as a Recommendation for Space Data Standards by the Consultative Committee for Space Data Systems (CCSDS). While tools enable users to avoid learning the EAST language syntax, those who wish to do so can because the language avoids the use of cryptic forms in favor of more English-like constructs. EAST is a formal language and not a natural language: it is a machine compatible (or interpretable) language. The formal nature of EAST allows the control of data descriptions and the interpretation of data in an automated fashion.

EAST is designed to focus primarily on the physical components and the layout or structure of data while being able to interact with complementary standards and tools that have a stronger emphasis on the semantics, or meaning, of the data. One such complementary standard is the Data Entity Description Specification Language (DEDSL) defined by the Consultative Committee for Space Data Systems (CCSDS). Tools have been designed to incorporate both EAST and DEDSL to fully describe data.

Although EAST is designed to be human readable, truly complete and unambiguous descriptions of complex data record structures can become lengthy and repetitive. This complication provides another motivation to have tools that provide users with several different graphical and text views of the complete set of information carried within EAST and as supplemented by DEDSL information.

An EAST unit is called a package and consists of a logical description that includes a syntactic and partial semantic description of the data, and a physical description. The physical description makes possible the interpretation of the actual bit patterns encountered on the medium.

The logical part of an EAST description includes:

> a logical description of all components of the exchanged data, their size in bits, and their location within the set of the described data

The physical part of an EAST description includes:

> the representation of some basic data types (enumeration, integer, and real) defined in the logical description and dependent on the machine that has generated the data. the array organization (first-index-first or last-index-first) used by the generating machine, and the octet and bit organization on the medium (high-order-first or low-order-first).

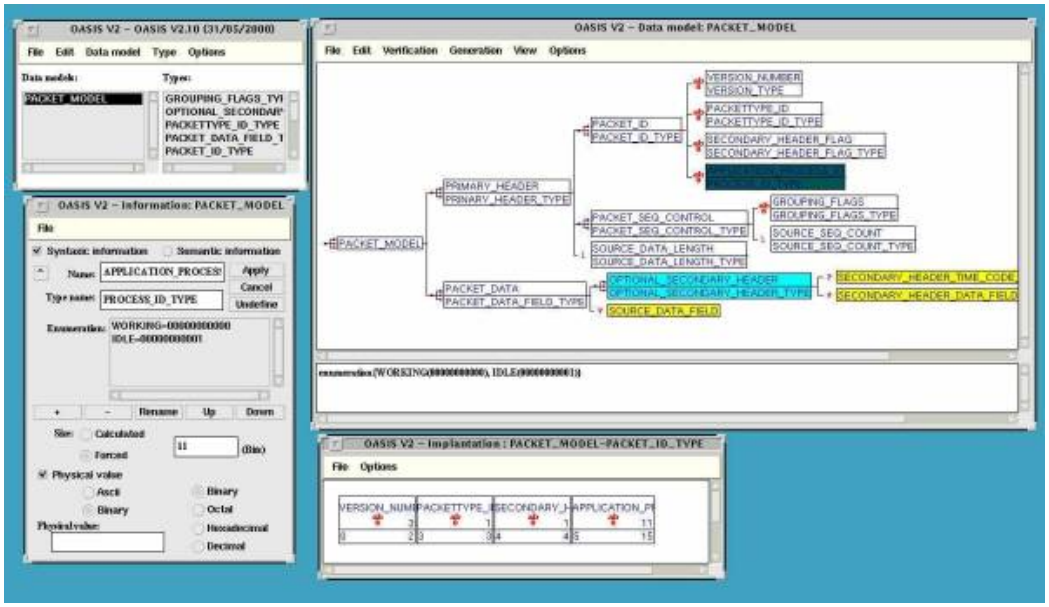
The typical EAST user would use tools that interpret the EAST code and provide an alternate form of display. This is the same model employed by the typical WWW user who uses his or her browser to display information and rarely actually deals with the underlying HTML code.

The French Space Agency, CNES, has put together a growing suite of tools that support or make use of EAST. The Data Entity Dictionary Specification

Language (DEDSL) is another CCSDS and ISO standard that complements EAST by providing the semantic equivalent to the syntactic descriptions that EAST provides. Currently the DEDSL standard is available in an Abstract Syntax (http://www.ccsds.org/all_books.html#ccsds-647.1-b-1), PVL Syntax (http://www.ccsds.org/all_books.html#ccsds-647.2-b-1), and a draft XML/DTD Syntax (http://www.ccsds.org/all_books.html#ccsds-647.3-r-1).

The *Outil D'Aide à la Structuration d'Informations Spatiales* (OASIS) tool is a graphical tool built on top of EAST and DEDSL that is used to visualize and design data. OASIS can be used to describe all kinds of data. The graphical interface is used to define their organization (tree structure), to provide their syntax (enumerative, ASCII, binary, etc.), and finally, for each field (node or leaf), to define their semantic attributes (meaning, units, range of validity, etc.)

The following figure, a screen snapshot from the OASIS tool, which uses EAST and DEDSL as an underlying constructs, demonstrates modeling of a data structure in EAST. The EAST logical description provides enough bit level representation to show placement of data in the record. In cases where changing machines would not change the data format, a description may be complete without a physical description being required. Such is the case in this description of a CCSDS data packet, as shown in the figure.



EAST related data access and viewing tools include the EAST interpreter, ASCII dumper, the ESA's Product Access Environment (PAE), the EAST Data Generator, and the Data Update Wizard. Several of these applications make use of the EAST library to interact with the EAST descriptions. The EAST library is also available to users who wish to build their own applications.

Currently EAST is being used by several significant French and European space domain projects and EAST usage overseas is continuing its rapid growth. As the CNES created tools now support English language capabilities, we hope to also see EAST use within the US. ESA is now also developing and using tools incorporating EAST.

The suite of tools supporting EAST is available at: http://east.cnes.fr/ . Check the website for applicability of these tools to any particular Operating System. Most are targeted at Windows NT and some UNIX versions.

Additional information and support are available through the authors at John.Garrett@gsfc.nasa.gov, Don.Sawyer@gsfc.nasa.gov, or bbrinker@pop500.gsfc.nasa.gov. Information may also be available from your local CCSDS Panel 2 members or directly from the CNES EAST Team who may be contacted at east@cnes.fr.

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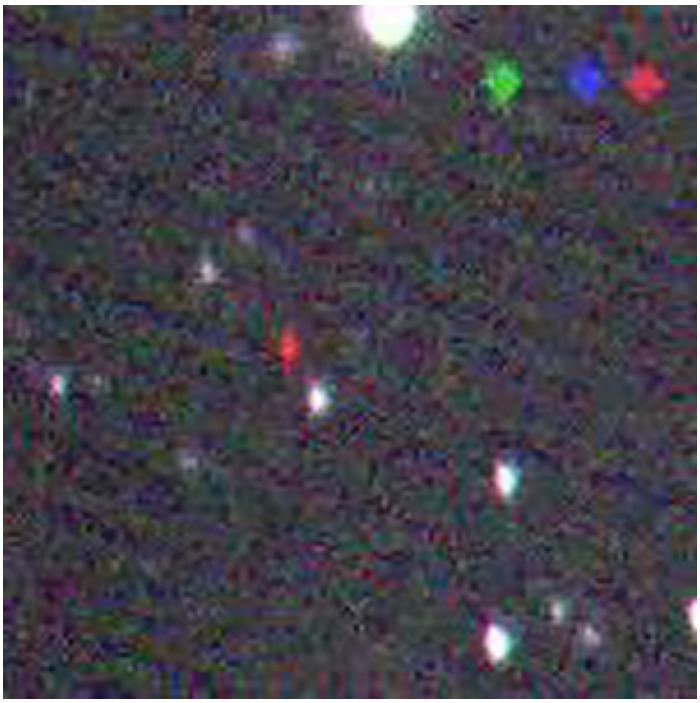
SkyMorph: An Archive of the Living Sky

An activity called SkyMorph has enabled hundreds of science discoveries of Near-Earth objects and a Trans-Neptunian object. 1000s of nearby proper-motion stars have been detected by a new research project using the SkyMorph archive and will contribute to the question of mass contribution of a hitherto unknown white dwarf component. Research is also ongoing on supernova discoveries as part of the Supernova Cosmology Project, and on binary degenerate dwarfs.

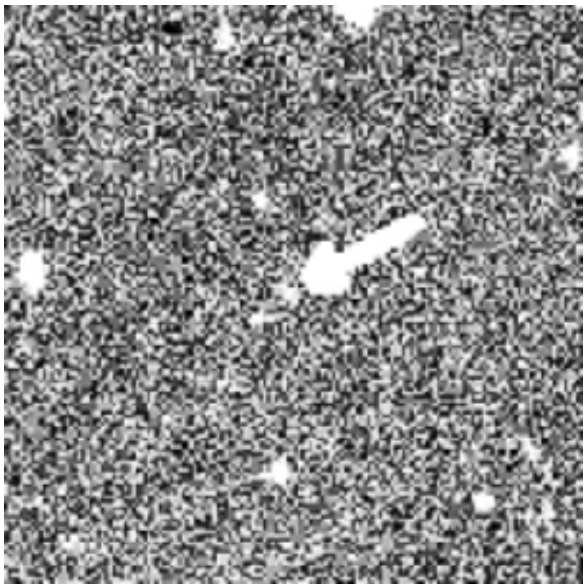
SkyMorph develops hardware and software to create, maintain, and extend a multi-terabyte web-accessible archive of Near-Earth Asteroid Tracking (NEAT) and other celestial images and data. NEAT operates on both the Maui Space Surveillance Site (MSSS) and the Palomar Oschin telescopes.

An output image from SkyMorph's on-line Moving Target Detection utility.

The red, blue, and green images across the upper right are the three views that were used to discover asteroid 2002 AA2 on January 7, 2002.



SkyMorph enables searches for variable, moving or transient objects. Moving object searches use ephemerides generated dynamically using NASA's Horizons project. The archived data are CCD-visible images of the sky with 15 minute interval sampling. Skymorph also develops algorithms to allow scientific exploitation of the archive.



SkyMorph moving target observation of 2001 RJ_{34}

As much as 25 GBytes per night is received by Skymorph from both MSSS and Palomar. The archive now consists of ~300,000 images and contains more than 2 TBytes of data. A new state-of-the-art processor and disk raid arrays enable SkyMorph to keep up with ever-increasing data volumes.

The SkyMorph program is sponsored by the Applied Information Systems Research Program and is led by investigators Dr. Steven H. Pravdo at JPL and Dr. T. A. McGlynn at GSFC.

Common Data Format (CDF) Releases Perl APIs and Embraces XML

By David Han

The CDF office realizes that scientific progress is often impeded by the lack of, or excessive multiplicity of, available standards for data formats and structures and/or data format translators. In a bid to facilitate and promote data sharing with other data formats, the CDF Office has recently decided to adopt eXtensible Markup Language (XML) as the basis for establishing interoperability with other scientific data formats. XML is a language defined by the World Wide Web Consortium (W3C), and it is an emerging technology for describing digital information (i.e. see, for example, http://www.xml.com/pub/a/98/10/guide0.html). XML is a method for putting structured data in a text file, and it is gaining support from a wide spectrum of users including academia, various government organizations, various technical committees, and commercial software companies such as Sun Microsystems and Microsoft.

The CDF office has developed an XML-based markup language called CDF Markup Language (CDFML) to describe CDF data and metadata. The CDFML employs some of the basic building blocks/objects defined in eXtensible Data Format (XDF) within CDF tags to describe CDF data and metadata. The use of these XDF objects allowed the CDF Office to capitalize on the existing infrastructure code already developed by the Astronomical Data Center (ADC) at NSSDC. XDF is an XML-based scientific data format and is considered by many to be the most mature Web-based scientific data format available today. As of this writing, software has been developed and tested to convert CDF data and metadata stored in CDFML into XDF. The CDF Office plans to develop software to export the contents of a CDF file into the CDFML format and vice versa in the near future.

The CDFML-to-XDF translation software mentioned above brings an unanticipated side benefit to the space physics user community. The XDF Office located at ADC has developed a program that converts a Flexible Image Transport System (FITS) file to the XDF format (using a markup language called FITSML). This means that since CDF understands how to interpret an XDF file, the interoperability between CDF and FITS can be achieved by defining a mapping relationship between the FITS objects and the CDF objects.

Reprinted by permission of NSSDC News, from the December 2001 issue. See also "CDF Office Making CDF XML-Ready" by David Han in the March 2002 issue.

NSSDC News Goes All Electronic

After publishing a paper version of NSSDC News since April 1985, and an electronic version since September 1994, NSSDC News is switching to solely electronic distribution. The December 2001 newsletter was the last paper version.

NSSDC News is published quarterly by NASA's National Space Science Data Center. To receive the notification of new online issue, please send your e-mail address to patross@nssdca.gsfc.nasa.gov. The online newsletter is located at:

http://nssdc.gsfc.nasa.gov/nssdc_news/.

Magnetospheric magnetic field modeling pages moved to NSSDC

By Joe King and Kolya Tsygananko

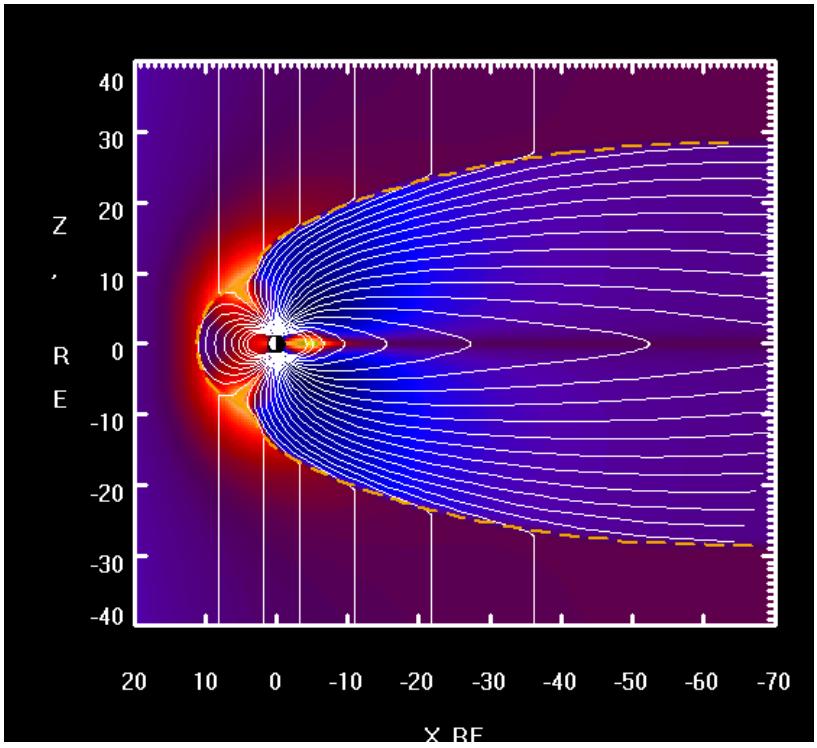
Over the years, the National Space Science Data Center has provided access to a rich array of empirical geophysical models at http://nssdc.gsfc.nasa.gov/space/model/models_home.html. Several models are user-executable on NSSDC's computers.

The most popular external-source magnetospheric magnetic field models of recent years have been those developed by Nikolai Tsyganenko, originally of St. Petersburg University (Russia) and for many years now at Goddard Space Flight Center. For a long time, NSSDC's model web pages provided a link to the Tsyganenko models and related material on a computer associated with the International Solar-Terrestrial Physics (ISTP) program.

With the termination of the ISTP program as such, and uncertainties about the related computers, Tsyganenko suggested that NSSDC should host his models and related material directly on an NSSDC machine. Recognizing the importance of continuing availability of the models to the space physics community, NSSDC was pleased to comply.

These pages are now available at

http://nssdc.gsfc.nasa.gov/space/model/magnetos/data-based/modeling.html.



Animations on the web site demonstrate magnetospheric changes.

The content of these pages is quite tutorial in nature, helping even non-

experts understand via words and dynamic graphics the changing interaction between the solar wind (with its embedded magnetic field) and the geomagnetic field. That the Earth's dipole axis is offset from the Earth's spin vector by ~11 degrees and presents a changing orientation to the oncoming solar wind with a daily periodicity is well illustrated in the visuals. Additional graphics illustrate concepts of magnetic field line reconnection and magnetospheric substorms.

In addition to these web pages, NSSDC also has newly included in its ftp distribution area many of the magnetospheric magnetic field model codes previously accessible from the ISTP computers.

Other community-important services previously hosted on the ISTP computers and now moving to the NSSDC computer environment will be further discussed in the next NSSDC Newsletter.

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NSSDC Annual Highlights and Statistics for 2001 Available

By Joe King

The annual report on NSSDC's 2001 highlights and statistics has recently been made web accessible at http://nssdc.gsfc.nasa.gov/nssdc/annual/2001/.

This report lists 96 peer-reviewed papers published in 2001 which cite use of NSSDC-provided data or services. These articles were found mainly by the NSSDC staff perusing the pages of the Journal of Geophysical Research and the Geophysical Research Letters and as such represent a lower limit on the count of 2001 papers benefiting from NSSDC's services.

The report characterizes the nature and size of the NSSDC archive as of the end of 2001 and the data inflow and outflow during 2001. There were 4,359 distinct data sets from 1,301 experiments flown on 373 different spacecraft. The 2,318 digital data sets contained 22.5 Terabytes.

3.5 million files were downloaded from NSSDC during 2001 including 2.9 million from the popular photo gallery. 116 thousand plots and 71 thousand digital files were downloaded from NSSDC's special space physics interfaces, with a significant majority from the CDAWeb interface of the Space Physics Data Facility. 99 thousand executions of geophysical models and 47 thousand plots or lists from NSSDC's orbit information interfaces were also realized in 2002.

NSSDC's web pages averaged over one million hits per month. 919 requests were handled via the mailing of CD-ROMs or photoprints. In addition, about 8,700 Milky Way and COBE posters were mailed.

CALENDAR

March 2002

IEEE Aerospace Conference

Big Sky, Montana
March 9-16, 2002
Further info: http://aeroconf.org

33rd Lunar and Planetary Science Conference

Houston, Texas
March 11-15, 2002
Further info: http://www.lpi.usra.edu/meetings/lpsc2002/

April 2002

IEEE Symposium on Mass Storage Systems/ NASA Goddard Conference on Mass Storage Systems and Technologies

April 15-18, 2002
Inn and Conference Center
University of Maryland
Adelphi, Maryland
Further info: http://storageconference.org/2002

International Parallel and Distributed Processing Symposium

April 15-19, 2002
Marriott Marina
Ft. Lauderdale, Florida
Further info: http://ipdps.org

July 2002

Siggraph 2002

Henry B. Gonzalez Convention Center
San Antonio, Texas
July 21 - 26, 2002
Further info: http://www.siggraph.org/s2002

ITCom 2002

Showcasing Communication, Networking, Computing, and Storage Technologies and Applications

Boston Marriott Copley Place
Boston, Massachusetts
July 29 - August 2, 2002
Further info: http://spie.org/conferences/calls/02/itcom/

August 2002

Astronomical Telescopes and Instrumentation

22 - 28 August 2002
Waikoloa, Hawai'i USA
Further info: http://spie.org/Conferences/calls/02/as/

Meeting Calendars

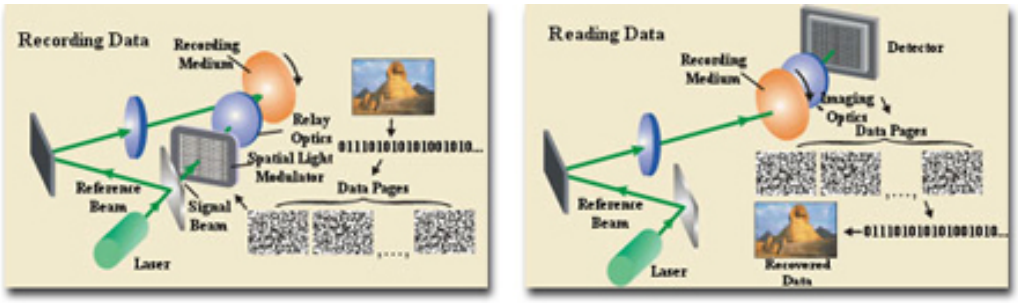
International Astronomy Meetings

http://cadcwww.dao.nrc.ca/meetings/meetings.html

Optical Storage Special Interest Group and Knowledge Base near release

The Optical Storage Special Interest Group (SIG) and Knowledge Base will be available shortly as a new resource for archive technologists, provided by the Data Distribution Laboratory (DDL). This web-based service will include basic technology information about optical storage, answers to frequently asked questions (FAQs), the latest prices for hardware and media for use in project planning, advice and recommendations, links to other resources, and a discussion forum for SIG members.

Deploying DVD technology is becoming both more affordable and more complex, as "DVD General" and "DVD Authoring" standards have emerged, and DVD-9 enters the mainstream as an archive media. A major challenge remains—the rising volume of data that needs to be safely archived. At high volumes, a DVD solution is no longer viable; and a higher-capacity archive media must be found.



The OSSIG web site will report on new technologies such as holographic storage.

In looking to the future, the DDL is researching new archive storage solutions for multi-terabyte data sets. Through this website, the DDL will provide an online knowledge base of the results of these research efforts and provide a discussion forum for organizations struggling with these same issues/concerns.

Membership in the SIG will be open to interested parties from NASA agencies and other government institutions, and educational institutions. Readers interested in being notified when the site is operational should contact Cynthia Hall-Atkinson (Cynthia.H.Atkinson@jpl.nasa.gov).

Last Issue of SISN

At the present time, we do not plan any further issues of the Science Information Systems Newsletter in its current form. Future budgeting and program decisions may result in the SISN being reintroduced, but no plans are currently underway. This marks the end of eight years of on-line publication, after many years of hardcopy publication. Thank you for your readership, interest and support. I have enjoyed being the editor of SISN for the past year.

Betty J.
Sword

To stay informed about NASA's space science information systems programs, be sure to check the following links:

NSSDC News - a quarterly publication by the National Space Science Data Center.

Gridpoints - Ames Research Center's Numerical Aerospace Simulation (NAS) Systems Division's publication on High Performance Computing technologies.

NASA News - A directory of NASA news publications.

NASA Tech Briefs - a design and engineering technology digest.

Space Science News - MSFC's weekly newsletter on NASA science news.

ADC News - Quarterly electronic newsletter of the Astronomical Data Center.

Project AstroData: Value-Added Educational Tutorials for HST Data at NSSDC's Astronomical Data Center

By Kirk Borne and Beth Brown

As part of a NASA-funded Hubble Space Telescope (HST) research project, staff at the Astronomical Data Center (ADC) received an augmentation grant to support Education and Public Outreach (E&PO) activities. To carry out this project, the E&PO team Principal Investigator, Kirk Borne, is collaborating with NSSDC scientist Dr. Beth Brown, with ADC staff members Jim Gass and Jim Blackwell, as well as with several external collaborators (Sue Higley, summer teacher at NSSDC; Dr. David Patton of Trent University; plus two other educators).

The goal of the project, dubbed Project AstroData, is to develop a pilot series of on-line science education tutorials and exercises for K-12 students. These products are intended to demonstrate the connections between new HST observations and existing astronomical data that students can easily access. Some of the student lessons focus specifically on the subject of the parent HST observing program: a study of colliding and merging galaxies within the context of an evolving universe. The connections between new data and previously catalogued astronomical data will show the students how new scientific results can be derived and how new research programs can be created for future missions of astronomical discovery.

The project's educational resources are universally available on-line via the WWW on the new Project AstroData Web site.

These resources include the Project AstroData activities, lesson plans, HST images, and related tutorials. There are tutorials explaining the Astronomical Data Center archive and astronomical tabular data catalogs; an image collection showing some of the finest HST images of colliding galaxies; a large list of related links that connect to other sites that illustrate the science of colliding galaxies; a tutorial and set of links describing the HST itself. Finally, of course, there are lesson plans and class exercises, and specific lesson plans for various grade levels and separately for math and astronomy/science.

A comprehensive compilation of external links are provided to educators,

including more lesson plans, national and state education standards, and topics in assessment and evaluation. The lesson plans that we have developed address very specific national and state standards. In addition to the formal lesson plans, there are four "missions" for the students to carry out. These Web-based activities are geared toward classroom participation in groups, though they can be assigned on an individual student basis as well. An innovative and comprehensive graphical interface to several on-line astronomical glossaries and dictionaries is provided. If you have any questions or need additional information regarding this project, then check out the Project AstroData Web site at http://adc.gsfc.nasa.gov/adc/education/astrodata/ or contact the author by e-mail at Kirk.Borne@gsfc.nasa.gov.

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26-Oct-2005
Research Home

Opportunity Definitions

Search

Proposal Site
- *Subscribe for email notification*
- *Submit Notice of Intent to Propose*
- *Submit Proposal Information*

NASA Links
- ***HQ's CBD Notices***

Helpful References

Research Task Books

Help

Research Opportunities Online

This page only contains data on solicitations issued prior to January 1, 2005. For solicitations released after December 31, 2004, please visit: NSPIRES Web site at http://nspires.nasaprs.com

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Welcome to the National Aeronautics and Space Administration (NASA) Headquarters Research Opportunities Web site. This web site allows immediate access to Research Opportunities currently being offered by the NASA Offices listed below at NASA Headquarters. (Note: Solicitations issued from NASA field Centers are not included)

As of August, 2004, NASA has streamlined the agency's structure in order to better implement the Vision for Space Exploration. This transformation fundamentally restructures the former Strategic Enterprises into Mission Directorates to better align with the Vision. Below are the directorates listed with the former code names.

- **Science Mission Directorate**
  - Former Office of Earth Science (Code Y)
  - Former Office of Space Science (Code S)
- **Exploration Systems Mission Directorate**
  - Former Office of Biological and Physical Research (Code U)
  - Former Office of Space Flight (Code M)
- **Office of the Chief Education Officer**
  - Former Office of Education (Code N)
    - Former Office of Equal Opportunity Programs (Code E)
    - Former Office of Human Resources (Code F)
- **Aeronautics Research Mission Directorate**
  - Former Office of Aerospace Technology (Code R)
- Research Announcements for all of the above organizations
- Small Business Innovation Research (SBIR) and Technology Transfer (STTR) Programs

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*Alert: As of February 2004, all Code N, Office of Education solicitations can be accessed by clicking on the Office of Education (Code N) link. Minority Programs and Education Division solicitations released on this site prior to February 2004 can be found under the appropriate links to Code E and Code F, respectively.

*Alert regarding obtaining DUNS Number for potential applicants applying for NASA Research Grants.

Curator: NASA Peer Review Services
Responsible NASA Official: Greg Lindsay
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