The Earth Science Enterprise (ESE) continues to strive to better understand how the global environment is changing, predict change and understand how these changes affect the human and economic condition. In this Topic, the ESE wants innovative companies to propose technology and techniques to accomplish two goals.

1. Goal 1: Accelerate the deployment of NASA science data and understanding into existing decision support tools used by managers concerned with stewardship of the Earth’s resources. This goal addresses the development of innovative technology solutions that allow the routine use of Earth science results in automated decision support tools already in use by a broad user community. Management decision support tools of interest are used daily in the management of land and biota, air, water, education, and emergency issues.

2. Goal 2: Inspire and motivate students to pursue careers in science, technology, engineering, and mathematics.

**Subtopics**

**E4.01 Innovative Tools and Techniques Supporting the Practical Uses of Earth Science Observations**

Lead Center: SSC
Participating Center(s): MSFC

Technical innovation and unique approaches are solicited for the development of new technologies and technical methods that make Earth science observations both useful and easy to use by practitioners. This subtopic seeks proposals that support the development of operational decision support tools that produce information for management or policy decision makers. Proposed applications must use NASA Earth Observations (see [http://gaia.hq.nasa.gov/ese_missions/](http://gaia.hq.nasa.gov/ese_missions/)) Other remote sensing data and geospatial technologies may also be employed in the solution.
This subtopic focuses on the systems engineering aspect of application development rather than fundamental research. Offerors are, therefore, expected to have the documented proof-of-concept project in hand. Topics of current interest to the Earth Science Applications Directorate may be found at http://www.esa.ssc.nasa.gov.

Innovation in processing techniques, include, but are not limited to, automated feature extraction, data fusion, and parallel and distributed computing which are desired for the purpose of facilitating the use of Earth science data by the nonspecialist. Ease of use, fault tolerance, and statistical rigor and robustness are required for confidence in the product by the nonspecialist end user.

Promotion of interoperability is also a goal of the subtopic, so Federal data standards, communication standards, Open Geographic Information Systems (GIS) standards, and industry-standard tools and techniques will be strongly favored over proprietary 'black-box' solutions. Endorsement by the end user of both system requirements and the proposed solution concept is desirable. While the proposed application system may be specific to a particular end user or market, techniques and tools that have broad potential applicability will be favored. An objective assessment of market value or benefit/cost will help reviewers assess the relative potential of proposed projects.

E4.02 Advanced Educational Processes and Tools

Lead Center: GSFC

This subtopic focuses on innovation in effective applications related to classroom- or museum-ready software tools for display and/or analysis of Earth science information for learners in both formal and informal settings, and tools for organization and dissemination of NASA's Earth science educational materials to a wide array of educational audiences. The Earth science educational program covers a wide range of audiences from students to adults in both classroom settings, such as public schools or continuing education venues, to all matter of informal learning settings such as radio, television, museums, parks, scouts, and the Internet. In these venues, the learning focuses on the scientific discoveries by the ESE, the technology innovations and the applied use of these discoveries and technologies for improved decision making by all.

The areas of interest (described below) cross-cut the three programmatic areas within the ESE program (formal, informal, and professional development) and hence, are anticipated to have utility in at least two of these areas and most likely in all three areas.

The first area of interest focuses on innovation in the application of digital library technologies to educational materials and audiences. NASA's Earth Science Education Program currently collaborates with the Digital Library for Earth System Education (DLESE). The successful proposal must be able to integrate with, or be integrated into, existing educational digital library efforts within NASA and/or make contributions to DLESE. These proposals will advance the use and usability of globally distributed, networked information resources, and encourage existing and new communities to focus on innovative applications areas. Collaboration between Earth scientists, formal or informal education community professionals, and computer scientists is required for these proposals to demonstrate useful results. Areas of interest include:
• Extend the current Joined Digital Library (JOIN) effort by developing additional Jini applications. (JOIN is a collection of tools based on Sun's Jini technology used to implement efficient, decentralized, and distributed computing systems and follows "the network is the computer" philosophy.)

• Development of formal and informal education audience-specific interfaces (e.g., specific interfaces for students, park interpreters, TV producers, curriculum developers, etc.).

• Development of interfaces to promote diversity within educational audiences (e.g., age, ethnicity, cultural, urban/rural, etc.).

• Development of accessibility tools for disabled users to interact and search digital libraries.

• Development and access to educational materials including new resources for science, mathematics, and engineering education at all levels.

• Development of interoperability tools to integrate dissimilar library archives.

• Development of tools to administer and manage end-user expectations and satisfaction.

• Develop applications that enhance the general functionality of existing digital libraries by providing new general-purpose tools for archive management, metadata ingestion, intelligent search, and retrieval.

• Tools to support online community interaction, which could include new means for gathering, interacting, and communicating with other library users.

The second area of interest focuses on innovation in effective software and related development techniques, and in highly practical methods for maintaining and disseminating software for use by educational audiences engaged in teaching or learning about Earth science. The specific areas of greatest interest are highly-portable, classroom-ready software for analysis, visualization, and processing of Earth science satellite data, and methods to provide long-term support and viability for educational software. Collaboration between Earth scientists, educators, computer scientists, and "business" model experts is required for these proposals to demonstrate useful results. Areas of interest include:

• Extend the current Image 2000 effort by developing additional plug-in applications and modifying core software if necessary. Image 2000 is a Java/Java Advanced Imaging (JAI)-based image processing package being developed at GSFC.

• User-friendly, extensible, Earth science satellite image processing software for multiple operating systems, for educational use in K–12, undergraduate and continuing education venues.

• Techniques and software for integrating vector and raster data for the visualization and analysis of geo-spatial Earth science data.

• Tutorials geared toward the use of image processing software for visualization and analysis of Earth science related satellite imagery.

• Infrastructure and startup of an Internet based user-supported support and development network, in the spirit of "Open-Source," to ensure continued maintenance and development of Earth science satellite image processing software and tutorials for educational audiences.
Technical innovation is solicited for the development of wireless technologies for field personnel and robotic platforms to send and receive digital and analog data from sensors such as photography cameras, spectrometers, infrared and thermal scanners, and other sensor systems to collection hubs. The intent of this new innovation is to rapidly, in real time, ingest data sequentially from a variety of input sensors, provide initial field verification of data, and distribute the data to various nodes and servers at collection, processing, and decision hub sites. Data distribution should utilize state-of-the-art wireless, satellite, land carriers, and local area communication networks. The technologies’ operating system should be compatible with commonly available systems. The operating system should not be proprietary to the offeror. The innovation should include biometric capability for password protection and relational tracking of data to the field personnel inputting the data and/or sensors and platforms sending information. The innovation should contain technologies that recognize multiple personnel and other sources (robotics) so that several personnel and platforms can use the same unit in the field. Biometric identification can be fingerprint, retina scans, facial, or other methods. The innovation should include geospatial technologies to use digital imagery and have Global Positioning System (GPS) location capabilities. The innovation should be able to display with sufficient size and resolution the rendering of vector and raster data and other sensor data for easy understanding. The field capability of the innovation must be fully integrated end to end with computing capabilities that range from mobile computers to servers at distant locations. Field personnel and robotic platforms providing information and support to science investigations, resource managers, and community planners will use the innovative wireless technology. First responders to natural, human-made disasters and emergencies will also be users of this innovation.