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A Public-Private Partnership Opportunity for NSF Earth Cube to Serve Stakeholders and Decision Makers

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10/17/11

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Introduction

To effectively predict and prepare for the impacts of global environmental changes on population, infrastructure and economy, we need to take a quantum leap forward in enhancing access and expanding scope of support to end users. Stakeholders who must make near term decisions for investments and planning for security and sustainability need access to the best available science information and analysis. The information must be credible, robust, unbiased, and based on research results that are broadly accepted by the earth science community. The process for delivery of information must be tailored to the users' needs and practices. As the past is not a good predictor of the future, these needs will become all the more pressing as predictive analyses are used in real world decisions involving the commitment of large resources coupled with potential liability and litigation. User requirements will be based on very specific questions that a decision maker must address in planning for the future. A public-private partnership is needed for understanding both the science user requirements and the stakeholder requirements. An effective public-private partnership will result in an EarthCube that represents the common needs across government, academia and industry and that can be used by each sector in meeting their specific end-use requirements, including development of robust, collaborative solutions that can be relied upon for making decisions.

Bringing Science to Society

Today, much of the available earth science data is available in information systems oriented toward the "scientific user domain" of researchers in universities and government labs. There is a need to bridge the gap between scientists and decision making organizations via a *systematic approach* driven by user requirements for sharing earth science research and analysis beyond the communities that generate that information. How can we enable climate adaptation and mitigation decisions based on validated scientific data? The challenge, in this case, is that the climate science information now broadly available to concerned agencies, institutions, and individuals is by and large dispersed, difficult to obtain, appears to be inconsistent from one source to another, and is often incomprehensible to all but the most knowledgeable. Moreover, the best information is rarely in a form usable by decision makers in categories of need, such as businesses who seek information differently than what is provided for science users. The experience industry has in working on solutions for military and related applications can be harnessed to contribute to the Earth Cube.

To meet these challenges, there is a distinct need to improve earth science data acquisition and management, climate modeling and projections with uncertainty quantification based on this data, climate change impact assessments, and interfaces with users. Gap analysis will help determine what new data, from satellites, airborne, and ground sensors, are needed to meet end user needs. The results from a synthesis of models, data and uncertainty quantification must be refined to create knowledge or information that the end users can apply to make decisions and take action. This involves further integration with end-user mission-

specific data on population, agriculture, land use, energy consumption, water resources, and many other inputs necessary to provide localized decision support.

When implemented with a systematic approach, the NSF Earth Cube can play a central role as a source of access to necessary data and information needed to protect and empower the general public, impart knowledge to stimulate adaptation and inspire solutions for security and sustainable economic growth, while shaping and leveraging existing investments.

Roles and Responsibilities

A successful EarthCube requires contributions from and coordination across government, academia, and industry. The systematic approach outlined above should also drive the roles and responsibilities in public-private partnerships. Each sector has an important role to play. While government must facilitate building, deployment and maintenance of observational platforms requiring large investments, continued research in the universities and national labs is needed to push the envelope and develop models and methodologies to simulate complex environmental systems and enhance predictive analysis capabilities. Industry can take a leading role in understanding expanded end user requirements, executing systems integration and delivering reliable decision support to stakeholders and end users across economic sectors. When security and sustainability are at stake, operational quality and reliability are critical for decision support systems and industry is well equipped to meet that challenge. Many universities have established industry partnership programs for technology transfer and enabling research to operations.

An approach to facilitating the coordination across government, academia, and industry is to have EarthCube organizations identify their common interests, technologies, and capabilities. In essence, EarthCube represents this common area of data, tools, analytics and their underlying cyberinfrastructure. Many, if not most, contributors to the creation of EarthCube have an inherent interest in ultimately using EarthCube to enhance their own mission, research, or business. Each of the EarthCube contributors will represent their end interests in the design of EarthCube but EarthCube should not be designed to specifically support a particular end-use. Each contributing member has a responsibility to represent their “end-user community” in the creation of EarthCube and then build upon EarthCube by adding value tailored toward their particular end-use. This approach would help EarthCube result in a flexible and reusable system that can be extended by future organizations who were not necessary involved in its design. With public-private partnership, NSF Earth Cube will be able to serve national, regional, and local decision makers and their respective organizations, the private sector, and the general public in the most effective manner.

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