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ON THE
GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS (GEOSS)

BEFORE THE
COMMITTEE ON ENERGY AND COMMERCE
SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS
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Chairman Whitfield, Mr. Stupack, and Members of the Subcommittee, I am very happy to be here today to speak to you about the Global Earth Observation System of Systems (GEOSS). I have personally championed this program both at the National Oceanic and Atmospheric Administration (NOAA) and within our interagency community because I strongly believe it has tremendous potential benefits for the United States and the world.

GEOSS is an excellent example of science serving society. Over time, GEOSS will provide an important scientific basis for sound policy and decision making in every sector of our society including energy, public health, agriculture, transportation and numerous other areas that shape the quality of everyday life. In addition, it will enhance our capability to address natural disasters in the United States and throughout the world.

As you know, I have recently returned from the Third Earth Observation Summit in Brussels, Belgium, where nearly 60 countries and the European Commission adopted a plan that, over the next 10 years, will revolutionize our understanding of the Earth and how it works.

Support is growing around the world for this project. In just 18 months, since the Bush Administration hosted the first-ever Earth Observation Summit in July 2003, the number of participating countries has nearly doubled, and interest has grown since the recent tsunami tragedy. Nearly 40 international organizations also support the emerging global network. In the coming months, more countries and global organizations are expected to join the historic initiative.

I would like to acknowledge the active involvement of Commerce Secretary Carlos M. Gutierrez, who led the U.S. Delegation to Earth Observation Summit III in his first international travel as Secretary.

Development of the Global Earth Observation System of Systems (GEOSS)

Nearly three years ago, I had the pleasure of addressing the World Summit on Sustainable Development (WSSD) event on the Global Information for Sustainable

Development (GISD) project. After my presentation, I heard about the different applications for the data and information provided by the GISD, and the international collaboration taking place to make scientifically sound public policy decisions.

As you may know, at this event the participating countries decided to foster strengthened cooperation and coordination among global observing systems and research programs for integrated global observations. In the following year, the G8 ministers at Evian also issued a Science and Technology Action Plan calling on the nations of the G8 to strengthen cooperation on global observations.

Earth Observation Summit I

Heeding that call, in July 2003, the United States hosted 34 countries and 20 international organizations at the first-ever Earth Observation Summit in Washington, D.C. This meeting marked an important first step in bringing the nations of the world together for the purpose of establishing a comprehensive Earth observation system. The heads of national delegations participating in the summit adopted a declaration that announced their commitment to developing a comprehensive, coordinated Earth observation system built on existing systems.

This declaration reaffirmed the need for Earth systems data and information for sound decision-making, set forth principles for long-term cooperation, and committed participants to improving Earth observation systems and scientific support in developing countries. It also established the *ad hoc* Group on Earth Observations (GEO), which was tasked with preparing a ten-year implementation plan for a comprehensive, coordinated Earth observation system. I have been privileged to co-chair GEO, along with representatives from the European Commission, South Africa and Japan.

One of the defining characteristics of GEO is that membership is open to any country that expresses an interest and designates a point of contact. Participating countries are not bound by geographic characteristics, population, or wealth – only by a desire to be a part of the future. This philosophy has led to the growth and expansion of GEO. A growing number of international organizations with observations and/or an Earth science focus are also participating in GEO.

At this first summit, there was a sense of cooperation and goodwill, which is critical when working with such a large and diverse group of international partners. As an excellent example of the goodwill present in the room, Canada's Environment Minister, David Anderson, announced the commitment of his nation to make its climate data – dating back to 1840 – freely available to all nations.

Earth Observation Summit II

Earth Observation Summit II in Tokyo in April 2004 welcomed 44 ministers and heads of national delegations, along with 26 international organizations. The convening of the Tokyo summit delivered on the charge from the initial Washington meeting to have a Framework for the 10-Year Plan agreed to by the spring of 2004.

In preparation for this summit the GEO held a series of four meetings and worked diligently to develop this Framework. Specifically, at GEO 1**,** in Washington, we approved the Terms of Reference and established five working subgroups to address the Architecture, Data Utilization, User Requirements & Outreach, Capacity Building and

International Cooperation components of the Plan. At GEO 2, in Baveno, we received initial reports from those subgroups, and reached consensus on a societal benefit/user focus for the Plan. We also began discussing an international cooperation mechanism for post-GEO implementation of the Plan. At GEO 3, in Cape Town, the Framework document and accompanying Communiqué were fully negotiated and prepared for distribution to countries for comments and clearance. And finally at GEO 4, in Tokyo, we held final discussions on the negotiated text of the Framework and Communiqué to be presented to ministers at the second summit, and received the first reports of the Implementation Plan Task Team. The group discussed a governance structure for a successor mechanism to GEO, and decided to hold a special session this summer (2005) to come to agreement on that issue.

The Framework for the GEOSS, which emerged from this summit, focuses on the benefits of a global system, noting current key areas of observations and pointing out the shortcomings of our existing systems. The Framework also offers a picture of what GEOSS will look like.

GEOSS will be:

- **Comprehensive**, by including observations and products gathered from all components required to serve the needs of participating members;
- **Coordinated***,* in terms of leveraging resources of individual contributing members to accomplish this system, whose total capacity is greater than the sum of its parts; and
- **Sustained**, by the collective and individual will and capacity of participating members.

The Framework declares that the GEOSS will be a distributed system of systems, addressing data utilization challenges, as well as facilitating current and new capacity building efforts. Specific outcomes of an operational GEOSS are identified in the Framework including enabling global, multi-system information capabilities for:

- Weather Forecasting
- Disaster Reduction
- Oceans
- Climate
- Human Health and Well-being
- Ecosystems/Biodiversity
- Agriculture
- Water
- Energy

Earth Observation Summit III

In preparation for the final summit, GEO convened two critical meetings. At GEO 5, in Ottawa, we continued the forward progress, with delegates negotiating the 10-Year Implementation Plan. Although governance issues proved to be challenging, once again the strong will to see this initiative through prevailed. At GEO 6, in Brussels, final negotiations were held, and transition issues were discussed in anticipation of the third summit, and the establishment of the new GEO.

At the third Earth Observation Summit, recently hosted by the European Commission in Brussels, participants endorsed the 10-Year Implementation Plan as the basis for further development of the GEOSS. By adopting this implementation plan for the GEOSS, we have accomplished the first phase of realizing our goal of developing a comprehensive, integrated and sustained Earth observation system. In addition, the summit participants agreed to establish an intergovernmental Group on Earth Observations (GEO), and to take steps necessary to implement GEOSS in accordance with the 10-Year Implementation Plan. This new Group on Earth Observations replaces the *ad hoc* GEO, which officially ended with the completion of its task to develop the 10-Year Plan.

The governments of all UN member states are encouraged to participate in GEO. In addition, the governing bodies of the UN Specialized Agencies and Programs, as well as other relevant international and regional organizations, are invited to endorse the implementation of GEOSS and assist GEO in its work.

Summit participants also directed GEO to consult with the sponsors of the component systems of GEOSS to request progress reports on implementation as well as affirmation of their intention to provide the support necessary to execute the GEOSS 10-Year Implementation Plan.

The participants resolved to meet before the end of 2007 to evaluate our progress and provide further guidance towards the successful implementation of GEOSS. They also resolved to conduct a mid-term assessment of GEO by 2010.

Environmental, Societal and Economic Benefits of a Comprehensive Earth Observation System

We have generated a great deal of political will in support of GEOSS and it is imperative to this process that we maintain it. Highlighting the human dimension and the benefits to society from a comprehensive system has been and will continue to be the key. Here are a few examples:

Agriculture

A comprehensive system of Earth observations will supply critical information, allowing us to predict and plan for droughts and other phenomena affecting our agricultural outputs. Estimates of costs associated with drought in the United States range from $6 to $8 billion annually. However, if we knew years in advance that these patterns would be occurring, we could take the necessary precautions to mitigate the impacts.

Understanding the El Nino/La Nina patterns have allowed us to save millions of dollars in the United States alone. Crop planting decisions, seed selection, and fertilizer application can be adjusted to reduce vulnerability to abnormal weather conditions. It also may be possible to adjust storage of crop inventories in anticipation of changed yields due to El Nino. Worldwide benefits to agriculture due to El Nino forecasts are at least $450 to $550 million per year.

Health

The health of our citizens will also benefit from an integrated system of observations that will be used for novel applications such as disease tracking and prediction. While still in their infancy, these projects have already begun.

Malaria killed more than one million people last year, primarily in the developing world. Weather patterns – temperature, soil moisture and rainfall patterns – often set the stage for optimal conditions for the spread of diseases like malaria. Earlier this year, the National Aeronautics and Space Administration (NASA) and the University of Alabama-Huntsville announced a program for using satellite-based monitoring to alert at-risk communities when the conditions are right for malaria outbreaks. By utilizing information such as soil-type and recurring standing puddles, as well as satellite-based information, such as temperature and rainfall, a computer simulation may be used to estimate the risk of disease outbreak. The combination of satellite and land observations gives us a glimpse of the power of a truly integrated and comprehensive observation system. While malaria no longer plagues our citizens in this country, understanding the environmental factors that contribute to similarly spread diseases could help us predict, and possibly control or prevent their occurrence.

Another exciting new health-based initiative was announced last year in the U.S. Northeast. NOAA and our colleagues from other government agencies, academia, and the international science community announced plans to conduct the largest ever air quality study in New England this summer. Data is collected by a variety of methods such as ground-based sensors measuring ozone, ships and aircraft monitoring the flow and transformation of air pollution, and satellites collecting data on climate and atmospheric changes. These data are very important for making policy and business decisions at the local level, but what if we could make global air quality forecasts in the same way we currently make weather forecasts? The real benefit comes by integrating this data with similar information collected all over the globe. Air quality monitoring systems will provide real-time information, as well as accurate forecasts days in advance.

Energy – Resource Management

Utility companies typically use weather forecasts to determine the mix of coal, hydroelectric, nuclear, wind, natural gas and oil plants that will be used to meet consumer needs. In June 2001, USA Today reported that annual costs of electricity could decrease by an estimated $1 billion if we could improve the accuracy of weather forecasts by one degree Fahrenheit. This difference in just one degree of accuracy could impact the decision a utility company will make in determining whether to buy electricity from the wholesale market or fire-up an expensive natural gas facility to meet increased demand.

Likewise, more accurate 5-day forecasts for hurricanes can save the offshore oil and gas industry significant amounts of money by notifying them when and if a facility must go offline for a storm. Not only is this a direct benefit to the company operating the platform, it's an indirect benefit that extends to the entire globe, preventing a ripple in the world energy market that can take weeks or months to recover from.

A February 15, 2005 report issued by the U.S. Minerals Management Service (MMS) on oil and gas production in the Gulf of Mexico clearly demonstrates the disruptive effect of extreme weather. MMS states that the cumulative shut-in oil production for the period between September 11, 2004 and February 14, 2005 (which includes the height of the 2004 hurricane season) was 43.8 million barrels, which is equivalent to 7.2% of the average yearly production of oil in the Gulf of Mexico, which is approximately 605 million barrels. Cumulative shut-in gas production during the same period was 172.3 billion cubic feet, which is equivalent to 3.9% of the average yearly production of gas in the Gulf of Mexico, which is approximately 4.45 trillion cubic feet.

From an energy exploration perspective, Earth observations are also playing innovative roles. New techniques allow us to get a better picture of what is beneath the sea floor. By the introduction of three-dimensional seismic data, we can better understand whether an area has potential for energy resources. Using this "seismic cube" to interpret geophysical, geological, petrophysical and paleontological data, geoscientists can collaborate more efficiently and develop more accurate analyses. Better pictures and evaluations result in cost-savings and the prevention of wasteful drilling and mining. Directed drilling and mining efforts would reduce strain on the oceanic environment and ecosystems.

GEOSS and the United States Plan: Principles and Governance

At Earth Observation Summit III, Secretary Gutierrez presented the *Strategic Plan for the U.S. Integrated Earth Observation System* as the U.S. contribution to GEOSS. This strategic plan was prepared by the U.S. Interagency Working Group on Earth Observations, which is made up of 15 federal agencies and 3 White House offices, and reports to the National Science and Technology Council's Committee on Environment and Natural Resources. The U.S. effort involves a wide variety of federal agencies that are both providers and users of Earth observations and information.

The U.S. *Strategic Plan* identifies the same nine societal benefit areas outlined in the implementation plan for GEOSS, and outlines a core set of principles for the U.S. system:

- The U.S. effort will be multi-disciplinary. It will take into consideration the interaction among multiple science disciplines, including physical, life and social sciences.

- The U.S. effort will be interagency. It will build upon existing systems and strategies to develop a framework for identifying gaps and priorities.

- The U.S. effort will link across all levels of government. The stakeholder capacity to use assessment and decision support tools for decision-making will be supported through education, training, research, and outreach. Building domestic user capacity is a key consideration.

- The U.S. effort will be international. Environmental observations and science are international in scope and international cooperation is imperative both to the U.S. and global plans.

- The U.S. effort will encourage broad participation. Many entities (public, private, and international) acquire and use Earth observations. The scope of the integrated Earth observation system will encompass the needs of these entities including the commercial Earth observation data providers, value-added intermediaries, and commercial users.

The U.S. *Strategic Plan* also recommends a governance structure. A standing Earth Observation Subcommittee will be established within the National Science and Technology Council's Committee on Environment and Natural Resources. This Subcommittee will have responsibility for periodic assessment of the multi-year U.S. plan, as well as annual reports to the Committee on Environment and Natural Resources on progress.

Consistent with the President's Management Agenda, federal research and development investments for an integrated and sustained system of Earth observations will be managed as a portfolio of interconnected interagency activities, taking into account the quality, relevance and performance of each project. Working with the external stakeholder community (consistent with the Federal Advisory Committee Act), this strategy will not only address planning, management and prospective assessment, but will also seek retrospective assessment of whether investments have been well directed, efficient and productive.

The agencies, through the Earth Observation Subcommittee, will recommend priorities for investment for near-term, mid-term and long-term activities. In addition, the Subcommittee will, over time, assemble its own benchmarks and metrics as tools to assess the U.S. *Strategic Plan's* relevance, quality and performance across societal benefits areas. The Subcommittee will continue to formulate U.S. positions and inputs into the Global Earth Observation System of Systems, taking into account the full range of U.S. policies and interests.

Challenges Ahead

The Third Earth Observation Summit was a milestone in our effort to establish a comprehensive global system of systems, and could not have occurred without the high-level political commitment of all of the participating nations. For years, our science and technical communities have discussed and understood that we must link our individual observation systems in order to understand Earth's complex processes. As we move forward with implementing the strategic plan, we have many important tasks in front of us. The technology available is not our challenge because we can and already have made our machines and computers talk to each other. The real challenge has been overcoming the political boundaries that our Earth systems do not recognize. That is what is unique about this initiative.

While progress in Earth observations will come in part from new capabilities and information, it is imperative that existing capabilities be maintained and improved. Without the simple maintenance or enhancement of existing systems – for example, stream flow gauges for water monitoring and continuity of weather and climate data sets – progress will be spotty at best.

Another critical issue is the maintenance of observational records at all levels to allow scientists to evaluate the effects of change in, for example, air quality and/or drinking water quality.

In addition, the U.S. *Strategic Plan* stresses that in order to assess the efficacy of existing systems and identify gaps and future needs, we first must understand who the critical users are – in the context of society as a whole – and identify their needs. In the context of the nine societal benefits areas, these groups are:

- **End users,** which includes the general public, the commercial sector and authorities with responsibility, for example, for managing the distribution and quality assurance of resources.

- **Scientists, managers, and policy makers in advisory, service and regulatory agencies** who need to make informed decisions on predictions of future conditions, respond to environmental changes and disasters in real time, develop accurate assessments and simulation tools to support decision-making, and run operational forecast and modeling centers.

- **Research scientists** whose research is directed toward improving our understanding of the physical, chemical, biological, and ecological relationships that define our Earth system.

The most immediate challenge ahead, however, will be in the development of a plan to manage and communicate Earth observation data. New observation systems will lead to a 100-fold increase in Earth observation data. Our individual agencies' current data management systems are already challenged to process current data streams.

Domestically, our interagency effort is currently examining technological solutions that will maximize our ability to manage data, including methods for standardizing vocabularies across agencies and developing browsing and visualization systems. By agreeing to standards and protocols among our agencies, we will achieve interoperability of our individual systems, enabling users to effectively locate data and information relevant to their needs.

The GEO members also recognize data management as a necessary component in the international context. The 10-Year Implementation Plan adopted in Brussels noted that GEOSS "will facilitate, within 2 years, the development and availability of shared data, metadata, and products commonly required across diverse societal benefit areas."

As was tragically evident in the Indian Ocean region in December, having the information is simply not enough. We need systems in place to manage this information and deliver it to our citizens in an accessible and useable format.

Conclusion

Over the next decade, I believe we will look back at this period and recognize what an enormous turning point it represents in the scientific understanding of our planet. The goal of the United States, and every country participating in GEOSS, is to ensure that this understanding leads to improved operational capabilities that will be put to work for the benefit of people throughout the world and the economies they depend on.

Thank you very much. I look forward to your questions.